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**Analysis on operation of
Chinese cocoon silk industry
in 2020 and prospect in 2021**

**Key works of International Silk Union (ISU)
for 2020-2021**

The actions for silk community to Higg MSI Index

**The fallout of Higg Index on silk
and the way forward**

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Topic selection direction of *Journal of Silk* for 2022

Raw silk production in major silk producing countries from 2015 to 2020

International Sericultural Commission



Silk originated in China and spreads throughout the world along the Silk Road. Today, the world's mulberry silk production mainly comes from China, India, Uzbekistan, Brazil, Japan, South Korea, Thailand, Vietnam, North Korea, Iran, etc. China, India and Uzbekistan are the world's three largest producers of raw silk, accounting for about 98% of the mulberry silk production among these major producers of raw silk (Tab.1).

Tab.1 Global mulberry silk production (2015 – 2020)

Serial No.	Countries	2015	2016	2017	2018	2019	2020
1	Bangladesh	44.00	44.00	41.00	41.00	41.00	41.00
2	Brazil	600.00	650.00	600.00	650.00	469.00	377.00
3	Bulgaria	8.00	9.00	10.00	10.00	10.00	10.00
4	China	170,000.00	158,400.00	142,000.00	120,000.00	68,600.00	53,359.00
5	Colombia	0.50	—	—	—	0.50	0.50
6	Egypt	0.83	1.20	1.10	1.25	1.50	1.50
7	India	28,523.00	30,348.00	31,906.00	35,261.00	35,820.00	33,770.00
8	Indonesia	8.00	4.00	2.50	2.50	2.50	2.50
9	Iran	120.00	125.00	120.00	110.00	227.00	270.00
10	Japan	30.00	32.00	20.00	20.00	16.00	16.00
11	Madagascar	5.00	6.00	7.00	7.00	7.50	7.50
12	North Korea	350.00	365.00	365.00	350.00	370.00	370.00
13	Romania	—	—	—	—	0.50	0.50
14	Philippines	1.20	1.82	1.50	2.00	2.00	2.00
15	South Korea	1.00	1.00	1.00	1.00	1.00	1.00
16	Syria	0.30	0.25	0.25	0.25	0.50	0.50
17	Thailand	698.00	712.00	680.00	680.00	700.00	700.00
18	Tunisia	3.00	2.00	2.00	2.00	2.00	2.00
19	Turkey	30.00	32.00	30.00	30.00	5.00	5.00
20	Uganda	—	—	—	—	3.10	3.00
21	Uzbekistan	1,200.00	1,256.00	1,200.00	1,800.00	2,037.00	2,037.00
22	Vietnam	450.00	523.00	520.00	680.00	795.00	969.00
Total		202,073.00	192,512.00	177,507.00	159,648.00	109,111.00	91,945.00

Source: International Sericultural Commission (ISC)

Analysis on operation of Chinese cocoon silk industry in 2020 and prospect in 2021

China Silk Association

Affected by the COVID-19 epidemic, the economic operation of China's cocoon and silk industry witnessed dramatic decline in 2020. Benefiting from the effective domestic epidemic prevention and control and improvement of the epidemic situation in foreign countries, the industry revenue and profit indicators began to rebound at the end of 2020. Nevertheless, the deterioration of international trade environment in recent years has brought adverse impacts on China's cocoon and silk industry. China Silk Association has published a series of reports entitled "Analysis of Economic Operation of Cocoon and Silk Industry and Prospect" every year since 2005. It is judged from the industry analysis and experience that in 2021, China's cocoon and silk industry needs actively responding to domestic and international market risks and challenges in the post-epidemic era, remaining committed to the general principle of pursuing progress while ensuring stability, working to the supply-side structural reform of the industry, positively adapting to the new development pattern which gives priority to domestic circulation and promotes positive interplay between domestic circulation and international circulation, and accelerating the adjustment of enterprise product mix and innovation of sales model.

1 Industry performance in 2020

1.1 Production status

1.1.1 Roughly stable cocoon production

According to statistics, the area of mulberry orchards in China reached 80.78 hm² in 2020, representing a year-on-year decrease of 0.04% and an increase of 1.48 hm² compared with 2016. The seeding quantity totaled 16,719,100, posting a year-on-year decline of 4.51% and rise of 8% compared with 2016. The yield of silkworm cocoon amounted to 687,200 tons, falling by 4.44% year on year and rising by 10.76% against 2016. The average purchase price of silk worm cocoon was 35.28 yuan/kg, dropping

by 22.09% year on year and by 8.02% against 2016. The silkworm cocoon production of China in 2020 is as shown in Tab. 1.

Tab. 1 Silkworm cocoon production of China in 2020

Serial No.	Regions	Seeding quantity/ 10,000 pieces	Year-on- year/%	Output/t	Year-on- year/%
1	Guangxi	820.00	-0.38	376,500	-0.58
2	Sichuan	215.01	-6.67	83,000	-5.68
3	Yunnan	161.29	-12.50	56,000	-12.50
4	Jiangsu	95.60	-14.89	38,300	-11.14
5	Guangdong	69.75	-14.29	25,000	-16.67
6	Anhui	41.36	10.50	18,200	13.75
7	Zhejiang	45.32	-12.39	17,700	-11.94
8	Shandong	32.59	-11.11	14,900	-23.20
9	Chongqing	38.92	-10.22	12,500	-8.09
10	Shaanxi	30.00	-8.69	11,700	-6.40
11	Jiangxi	24.18	3.17	8,900	2.30
12	Hubei	19.60	-7.41	8,100	2.12
13	Henan	20.30	-0.76	5,700	-3.39
14	Guizhou	14.13	4.70	5,316	5.08
15	Hunan	8.32	-3.27	2,930	-0.68
16	Hainan	2.62	-7.77	1,300	-14.47
17	Shanxi	2.09	-28.17	913	-34.36
18	Gansu	1.33	0.00	219	0.00
Total		1,671.91	-4.51	687,178	-4.44

Note: The above-mentioned data is sourced from the Ministry of Agriculture and Rural Affairs of the People's Republic of China.

Judging from the silkworm cocoon production of China from 2010 to 2020 (Fig. 1), although the output in 2020 was lower than that of 2019, the output in the past five years basically remained at around 660,000 tons, the national cocoon output did not show great fluctuation and the overall scale was relatively stable. As inflected by the national average price of silkworm cocoon purchase from 2010 to 2020 (Fig. 2), the highest purchase price of silkworm cocoon in China reached 2,369 yuan/50 kg in 2017, yet it saw a decline for three consecutive years in 2018, 2019 and 2020.

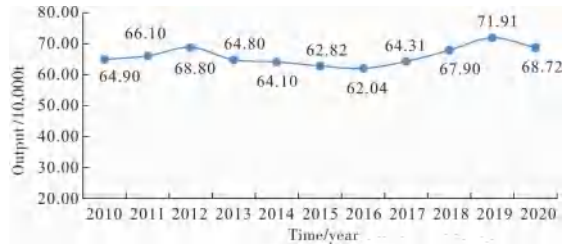


Fig. 1 National output of silkworm cocoons from 2010 to 2020

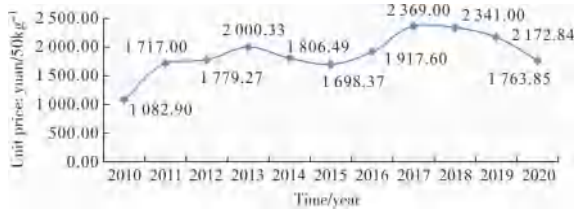


Fig. 2 National average purchase price of silkworm cocoons from 2010 to 2020

Affected by such factors as accelerated process of industrialization in China, the rising cost in breeding and rearing, and labor shortage, the output presented a significant downward trend in the eastern coastal areas of Jiangsu, Zhejiang and Guangdong. Instead, the production of silkworm cocoons in Anhui, Jiangxi, Hubei, Guizhou and other central and western regions rose steadily, effectively offsetting the impact of the reduction in production in the eastern coastal areas. On the whole, the production scale of silkworm cocoons in China remained stable.

1.1.2 Decline in output of major products

As indicated by the statistics of the National Bureau of Statistics of China, the output of major products from enterprises above designated sized declined to varying degrees in 2020, as shown in Tab. 2. Among them, silk output totaled 53,400 tons, down 16.21% year on year and 66.29% compared with 2016; the output of silks and satin amounted to 383.5 million m, declining by 18.29% year on year and 42.55% against 2016. The output of silk quilts was 9.24 million pieces, decreasing by 20.89% year on year and 55.45% from 2016. As indicated by

the data released by the National Bureau of Statistics of China, the output of raw silk, satin and silk quilts in 2020 dropped by 66.29%, 42.55% and 55.45% respectively against 2016. But according to the China National Silk Association, the artificially high output of major silk products in the past and the widened decline of silk production in 2020 was partly due to the limitation of the statistic scope. In fact, the production data of major products in the past two years were close to the actual output of the industry.

Tab. 2 The output of national silk enterprises above the designated size in 2020

Major products	Unit	2020	Year-on-year/%	% against 2016
Silk	t	53,358	-16.21	-66.29
Spun silk	t	3,132	-32.63	-65.15
Satin	10,000 m	38,350	-18.29	-42.55
Silk quilt	10,000 pieces	924	-20.89	-55.45

Note: The above-mentioned data is sourced from the National Bureau of Statistics of China.

The output of major products in various provinces and cities in 2020 (Tab. 3) indicates that the low overall operating rate of enterprises and the slow recovery of consumer market led to a significant decline in the output of major products in the sector under the impact of COVID-19 at home and abroad. Though the production of raw silk in Guangxi and Sichuan decreased slightly by 14.39% and 0.23% respectively, the two provinces still held a leading position in cocoon silk production. The yield of raw silk in Anhui, Chongqing and Shanxi decreased by less than 10%, and even registered a positive increase in Yunnan, Guizhou and Hubei. Chongqing's satin output increased by 16.31% year on year and the production of silk quilt in Guangdong, Anhui, Guangxi, Xinjiang, Yunnan, Jiangxi and Shanghai even reported a positive increase, with the increase in Guangdong and Guangxi being 105.45% and 82.27% respectively mainly as a result of the increase of domestic home consumption during the outbreaks of the epidemic.

Tab. 3 The output of main silk products in various provinces and cities in 2020

Raw silk (including spun silk)				Silk quilt				Pure silk satin			
Serial No.	Areas	Output/t	Year-on-year/%	Serial No.	Areas	Output/10,000 pieces	Year-on-year/%	Serial No.	Areas	Output/10,000 m	Year-on-year/%
1	Guangxi	19,150	-14.39	1	Jiangsu	261	-8.46	1	Sichuan	17,906	-10.03
2	Sichuan	9,422	-0.23	2	Zhejiang	215	-8.59	2	Zhejiang	10,747	-23.32
3	Jiangsu	5,601	-18.93	3	Shaanxi	99	-13.40	3	Chongqing	2,295	16.31
4	Zhejiang	4,073	-27.83	4	Hunan	73	-6.64	4	Anhui	2,037	-47.91
5	Yunnan	3,127	2.11	5	Shandong	56	-55.01	5	Jiangsu	1,885	-33.26
6	Anhui	3,046	-7.84	6	Henan	56	-10.57	6	Guangxi	1,797	-13.16
7	Jiangxi	2,131	-48.33	7	Guangdong	38	105.45	7	Shandong	1,084	-22.41
8	Chongqing	1,711	-4.14	8	Anhui	32	29.82	8	Yunnan	335	-3.71
9	Henan	1,187	-14.89	9	Hubei	30	-79.17	9	Shaanxi	190	-21.60

Continued Tab. 3

Raw silk (including spun silk)				Silk quilt				Pure silk satin			
Serial No.	Areas	Output/t	Year-on-year/%	Serial No.	Areas	Output/ 10,000 pieces	Year-on-year/%	Serial No.	Areas	Output/ 10,000 m	Year-on-year/%
10	Shaanxi	1,041	-49.80	10	Guangxi	19	82.27	10	Guangdong	23	-32.26
11	Guizhou	1,022	15.74	11	Sichuan	19	-56.79	11	Liaoning	21	-57.40
12	Liaoning	565	-50.96	12	Xinjiang	5	11.11	12	Qinghai	20	-75.59
13	Shandong	527	-10.30	13	Yunnan	5	9.93				
14	Guangdong	396	-32.87	14	Jiangxi	4	29.66				
15	Hubei	275	1.67	15	Liaoning	4	-5.04				
16	Shanxi	85	-0.34	16	Shanghai	4	46.69				

Note: The above-mentioned data is sourced from the National Bureau of Statistics of China.

According to the data analysis of the National Bureau of Statistics of China, the output changes of main products in major producing areas from 2016 to 2020 show that with the decrease of silk output in Jiangsu, Zhejiang and other eastern coastal areas year by year, the scale advantage of raw silk output in Guangxi and Sichuan became increasingly prominent. In 2020, Jiangsu's silk and satin output totaled 18.85 million m, down 82.01% against 2016, while Chongqing's silk and satin output amounted to 22.95 million m, up 9.31% compared with 2016. In 2020, the output of silk quilt in Shandong totaled 560,000 pieces, decreasing by 81.24% from 2016, while that in Shaanxi and Hunan respectively increased by 116.87% and 19.85%. With the cancellation of the qualification certification system for fresh cocoon purchase since the issuing of the 13th Five-Year Plan, all links of cocoon silk industry chain were completely marketized, regional cooperation and specialized division of labor were formed among major producing provinces (regions and cities) in the eastern, central and western regions, accelerating the continuous concentration of cocoon silk production to dominant regions. The East-to-West layout was basically formed in domestic cocoon and silk industry, enhancing the industry's agglomeration level and cluster effect.

The latest data sourced from the National Bureau of Statistics of China indicates that from January to March, 2021, the silk output of enterprises above designated size in the entire industry totaled 10,555 t, representing a year-on-year decrease of 1.45%. The output of silk and satin was 87.55 million m, registering a year-on-year decrease of 3.41%. The output of silk quilts amounted to 5.56 million pieces, up 29.78% year on year. As the situation of epidemic prevention and control at home and abroad continued to improve, market demand was released, plenty of spring cocoons were available on the market, silk reeling and weaving enterprises resumed normal operation. Thus, it is expected that the production of major products will witness a

steady increase in the first half of 2021, and will basically return to the normal level before the COVID-19 struck in the second half of 2021.

1.2 Industrial economic situation

According to the National Bureau of Statistics of China in 2020, the national silk enterprises above designated size (excluding silk garments and products) achieved operating income of 60.79 billion yuan, decreasing by 12.53% year on year and by 52.28% from 2016. The total profit amounted to 1.646 billion yuan, down 37.65% year on year and 76.31% from 2016. As shown in Tab. 4 and Tab. 5, these enterprises reported a profit of 339 million yuan, 1.136 billion yuan and 170 million yuan in 2020 respectively with regard to silk reeling, silk weaving and silk printing and dyeing, posting a respective year-on-year decline of 62.24%, 24.95% and 24.91%.

Tab. 4 Operating income of enterprises above the designated size in 2016 – 2020

Main business	Operating income/100 million yuan				
	2020	2019	2018	2017	2016
Silk and finishing	607.90	694.99	805.92	1,203.57	1,273.91
Silk reeling	237.83	291.33	419.66	692.53	774.94
Silk weaving	312.58	335.60	329.11	428.01	419.79
Silk printing and dyeing	57.49	68.06	57.15	83.02	79.18

Note: The above-mentioned data is sourced from the National Bureau of Statistics of China.

Tab. 5 Profits of enterprises above the designated size in 2016 – 2020

Main business	Profits/100 million yuan				
	2020	2019	2018	2017	2016
Silk and finishing	16.46	26.39	35.44	64.83	69.47
Silk reeling	3.39	8.99	16.59	35.24	41.41
Silk weaving	11.36	15.14	17.19	23.13	23.44
Silk printing and dyeing	1.70	2.27	1.66	6.46	4.62

Note: The above-mentioned data is sourced from the National Bureau of Statistics of China.

Seen from the overall operating conditions of the industry, most cocoon and silk enterprises were faced with difficulties such as poor domestic sales, blocked exports, insufficient production orders, shortage of liquidity and so on, and the downward

pressure on the industry economy was increasing under the impact of the epidemic situation at home and abroad since 2020. The comparison of major economic indicators of the industry in 2020 is as shown in Tab.6.

Tab.6 Changes in the main economic indicators of the industry in 2020

Main economic indicators	2020 year-on-year increase/%	2019 year-on-year increase/%	Growth rate/%
Total profit	-37.65	-12.18	-25.47
Operating income	-12.53	-4.49	-8.04
Operating cost	-12.23	-4.52	-7.71
Sales expenses, management expenses and financial expenses	-5.70	-10.69	4.99
Deficits	36.66	20.30	16.36
Total liabilities	-0.19	3.94	-4.13
Total loss of loss-making enterprises	97.36	44.72	52.64

Note: The above-mentioned data is sourced from the National Bureau of Statistics of China.

1.3 Export

1.3.1 Sharp decline in export of silk goods

According to the statistics of the General Administration of Customs, export of China's silk goods totaled US \$1.071 billion in 2020, posting a year-on-year decrease of 50.62%. Among them, the export of silk goods amounted to US \$244 million, 36.23% lower than the previous year; the export of silk and satin totaled US \$271 million, dropping by 54.66% year on year; the export of silk garments and products totaled US \$557 million, decreasing by 52.46% year on year. Seen from the month-on-month exports, the export of real silk goods declined rapidly in the first quarter, reaching the lowest level in February, being US \$38.15 million. After a slight rebound in March, it continued to fall slightly, and gradually picked up from June. In December, the export value amounted to US \$103.15 million and began to rebound steadily.

1.3.2 Overall decline in exports to major markets

According to the data analysis of the General Administration of Customs, China's export of real silk goods to major export markets in 2020 all witnessed negative growth year on year (Tab.7). In terms of export ranking, the EU and the USA remained the main export markets of China's silk goods, with exports of US \$307,886,900 and US \$207,337,400, decreasing by 32.38% and 34.88% respectively. The sum of exports of the EU and the USA accounted for 48.1% of the total exports. Hong Kong of China, Japan and India respectively ranked the third, fourth and fifth, with export value of US \$89,451,100, US \$77,752,000 and US \$69,212,300 respectively, all posting a year-on-year decrease of over 30%.

Tab.7 Export to the main market in 2020

Ranking	Countries and regions	Export/ US \$ 10,000	Year-on-year increase/%	Proportion/%
1	27 EU countries	30,788.69	-32.38	28.74
2	The USA	20,733.74	-34.88	19.36
3	Hong Kong of China	8,945.11	-36.18	8.35
4	Japan	7,775.20	-37.81	7.26
5	India	6,921.23	-57.18	6.46
6	The UK	3,922.26	-34.47	3.66
7	Pakistan	3,670.47	-57.76	3.43
8	South Korea	3,597.84	-40.07	3.36
9	Australia	2,569.45	-19.62	2.40
10	Vietnam	2,129.87	-57.22	1.99

Note: The above-mentioned data is sourced from the General Administration of Customs.

In terms of products for export, the EU, India, Japan, Vietnam and Madagascar ranked the top five in terms of silk products and the export of the top four countries and regions decreased by 21.44%, 56.11%, 47.5% and 61.77%, respectively, while that of Madagascar rose by 310.14% instead. As for satin products, the top five export markets were the EU, Hong Kong of China, Pakistan, India and South Korea, with an respective year-on-year decrease of 47.31% and 38.48% for the EU and Hong Kong of China and over 50% for the other three countries. In terms of clothing and related products, the export to the top five markets including USA, the EU, Hong Kong of China, Japan and the UK declined by 33.48%, 28.94%, 35.06%, 28.14% and 30.68%, respectively.

As indicated by the export to major markets from 2016 to 2020 (Tab.8), with the rapid rise of the domestic market, the proportion of domestic demand for silk goods witnessed a year-on-year

increase, while that of export decreased year by year since 2016. In 2020, China's top five exports markets (the USA, Italy, Hong Kong of China, Japan and India) concerning silk goods dropped by 51.05%, 45.22%, 54.97%, 51.25% and 76.5%, respectively against 2016.

Tab. 8 Export value to the main markets in 2016–2020

Countries and regions	Export/US \$ 10,000				
	2020	2019	2018	2017	2016
The USA	20,733.74	47,279.93	52,561.20	39,665.82	42,357.16
Italy	11,634.63	52,974.35	25,613.40	21,460.20	21,240.56
Hong Kong of China	8,945.11	48,243.01	14,630.70	17,184.77	19,863.12
Japan	7,775.20	49,507.46	14,043.10	16,857.85	15,948.07
India	6,921.23	71,902.59	18,513.90	31,042.19	29,448.20

Note: The above-mentioned data is sourced from the General Administration of Customs.

As indicated by the proportion of export to major markets from 2016 to 2020 (Tab. 9), the export to the USA and Italy claimed a respective proportion of 19.36% and 10.86% in total exports of silk goods in 2020, rising by 4.93 percentage points and 3.63 percentage points respectively against 2016. The proportion of export to Hong Kong of China and Japan remained basically unchanged, while that to India decreased by 3.57 percentage points.

Tab. 9 The proportion of the main markets in 2020 and 2016

Countries and regions	2020		2016	
	Amount/US \$ 10,000	Proportion/%	Amount/US \$ 10,000	Proportion/%
The USA	20,733.74	19.36	42,357.16	14.42
Italy	11,634.63	10.86	21,240.56	7.23
Hong Kong of China	8,945.11	8.35	19,863.12	6.76
Japan	7,775.20	7.26	15,948.07	5.43
India	6,921.23	6.46	29,448.20	10.03

Note: The above-mentioned data is sourced from the General Administration of Customs.

Due to the deterioration of international trade environment and the rising of "anti-globalization" in recent years, countries were constantly being stimulated to implement trade protection measures, which led to export enterprises to strengthen their export channels to emerging markets in Southeast Asia, countries along the "the Belt and Road Initiative" and Africa. For instance, in 2016, the export to Nigeria increased by 310.97% year on year. In 2017, the export to Ethiopia, Saudi Arabia and Nigeria grew by 256.5%, 198.4% and 135.64% respectively against the previous year. In 2018, the export to Nigeria read US \$ 284,513,000, which claimed a proportion of 9.62% of total exports, second only to 17.77% of the USA. While export to the

major markets such as the USA, Italy and India fell across the board in 2019, the export to Egypt and Ethiopia posted an respective increase of 654.81% and 125.22% year on year.

1.4 Cocoon silk market situation

In the first quarter of 2020, the market panic was exacerbated under the impact of COVID-19, which led to the irrational and rapid decline of the prices related to dried cocoons and raw silk, with the largest drop exceeding 30% compared with the beginning of the year and hitting a new low in the past five years. With the continuous issuance of multiple rescue policies around the country since April 2020, enterprises resumed orderly work and production, and the operating rate of reeling and weaving enterprises grew in Guangxi, Zhejiang, Jiangsu, Sichuan, etc. What's more important, as the domestic cocoon silk circulation and consumer market recovered gradually, the cocoon silk price bottomed out and rose at the end of the second quarter. By the end of 2020, the domestic prices of dried cocoons and 3A grade raw silk were 108,400 yuan/t and 328,500 yuan/t, respectively, which decreased by 6.71% and 11.76% year on year, as shown in Fig. 3 and Fig. 4.

In 2021, the domestic cocoon silk market continued to rebound and the prices appeared to climb steadily. As of March 31, 2021, the domestic price of dried cocoon and 3A raw silk reached 128,700 yuan/t and 399,900 yuan/t respectively, increasing by 52.85% and 49.44% compared with the lowest price in 2020. Besides, the price of raw silk basically recovered to the highest level since 2019.

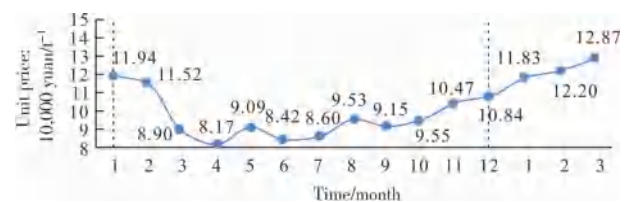


Fig. 3 The price trend of dry cocoons from January to December 2020

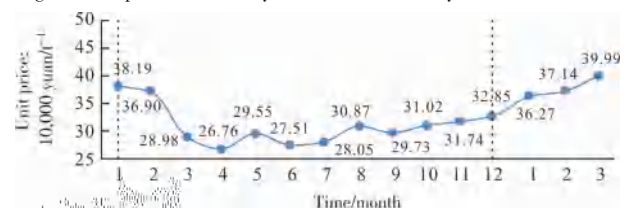


Fig. 4 The price trend of grade 3A raw silk from January to December 2020

2 Global silk trade in 2020

China, India, Turkey, Brazil, the USA, Japan, Malaysia, Australia, Thailand and the European Union (27 EU countries) as the most important players in the world silk trade accounted for about 85% of global trade. According to the GTA data, the global

trade volume of silk goods in 2020 registered US \$ 22.782 billion, dropping by 21.17% year on year. Among them, the export totaled US \$ 11.051 billion, down 21.18% year on year while imports amounted to US \$ 11.731 billion, down 20.59% year on year.

2.1 Export

As reflected by the export value of the major export markets in 2020 (Tab. 10), China suffered the biggest decline of 50.26%. The EU, India and Turkey saw similar declines of 16.63%, 16.44% and 13.45%, respectively. It can be seen that silk trade in all countries were affected to varying degrees by the global COVID-19 pandemic.

Tab. 10 The export value of major export markets in 2020

Countries/regions	Export/US \$ 10,000	Year-on-year/%	Proportion/%
The EU	441,575.54	-16.63	39.96
India	278,135.39	-16.44	25.17
Turkey	165,669.00	-13.45	14.99
China	107,118.71	-50.62	9.69
The USA	45,232.70	-22.60	4.09
Thailand	32,746.07	-24.77	2.96
Japan	17,135.62	-14.00	1.55
Malaysia	9,611.77	-4.46	0.87
Brazil	4,602.32	-26.79	0.42
Australia	3,231.08	-8.56	0.29
Total	1,105,058.21	-21.18	100.00

Note: The above-mentioned data is sourced from the China Chamber of Commerce for Import and Export of Textiles.

Judging from the proportions of export value from major export markets in 2020, the export of the EU, India and Turkey increased by 2.47, 1.61 and 1.44 percentage points respectively against 2019. Only China's proportion continued to decline, by 5.67 percentage points year on year. On the whole, the sum of export of the EU, India, Turkey and China reached US \$ 9.925 billion, accounting for 89.81% of the total export, which was roughly the same as last year.

2.2 Import

According to the import of major import markets in 2020 (Tab. 11), the most important consumption markets of silk commodities remained the EU, the USA and Japan, whose import summed to US \$ 9.922 billion, accounting for 84.57% of the total, roughly the same as in previous years. However, the three major markets, namely, the EU, the USA and Japan all saw their imports drop by more than 15%, being 17.6%, 25.45% and 15.8% respectively. Among the emerging markets, only Australia witnessed a decline of less than 10%, at 6.26% in terms of import, while all the rest markets saw declines of more than 18%. Moreover, only China posted a growth as big as 9.24% in regard to silk imports.

Tab. 11 Import value of major import markets in 2020

Countries/regions	Imports/US \$ 10,000	Year-on-year/%	Proportion/%
The EU	481,572.67	-17.60	41.05
The USA	349,848.69	-25.45	29.82
Japan	160,768.29	-15.80	13.70
Australia	51,086.34	-6.26	4.35
India	27,072.48	-42.92	2.31
Thailand	27,122.22	-18.59	2.31
China	26,138.53	9.24	2.23
Malaysia	18,022.08	-36.05	1.54
Turkey	20,257.60	-26.60	1.73
Brazil	11,256.05	-36.12	0.96
Total	1,173,144.96	-20.59	100.00

Note: The above-mentioned data is sourced from the China Chamber of Commerce for Import and Export of Textiles.

3 Prospect of industry development situation in 2021

The political and economic environment at home and abroad has undergone profound and complex changes since the beginning of 2021. The prospect of COVID-19 epidemic is uncertain, and the global economic and trade environment is unstable and uncertain. The risks and challenges facing the industry cannot be ignored.

The current international situation is highly uncertain. The COVID-19 epidemic has yet to be fully brought under control, geopolitical risks, unilateralism and protectionism are on the rise, which has led to the downgraded world economic growth forecasts. According to relevant reports of United Nations Conference on Trade and Development (UNCTAD) and World Trade Organization (WTO), global trade in goods decreased by 5.6% year on year in 2020, marking the biggest year-on-year decline in trade in goods since the international financial crisis in 2008. What's worse, the COVID-19 coupled with the protectionism has seriously disrupted the normal operation of the global economy. Although overseas orders returned to China since the second half of 2020 due to severe outbreaks of COVID-19 in some countries, the tendency to spread international orders outside China would become more apparent as the global industrial chain restructures. In 2021, since the epidemic abroad has yet to be effectively brought under control, the international political landscape is undergoing profound adjustments and economic globalization is facing countercurrents, sluggish consumer demand may become the norm, competition in the international market will inevitably intensify, and risks to economic security and trade environment will persist.

(Please refer to P1-8, Issue 7 of *Journal of Silk* in 2021 for details.)

Report on world silk trade (2020)

China Chamber of Commerce for Import and Export of Textiles

The year 2020 is a special year. Affected by the COVID-19 epidemic, the data of world silk trade experienced a significant decline across the board. China, India, Turkey, Brazil, the United States, Japan, Malaysia, Australia, Thailand and the EU (referred to as the EU-27's trade with non-EU countries and regions, similarly hereinafter) (hereinafter referred to as the "nine countries and the EU"), are the world's most important participants in silk trade, whose silk trade accounts for about 85% of the world's total silk trade. Keeping abreast of the trade situation of the nine countries and the EU will provide great reference for government sectors to make decisions and guide enterprises to explore the international market. Based on the data of statistical departments of countries (regions) released by America-based Global Trade Atlas (hereinafter referred to as GTA), the silk trade situation in 2020 is analyzed for reference.

Overall condition: As released by GTA, the trade of the nine countries and the EU totaled US \$22.782 billion, posting a year-on-year decline of 21.17%. Exports and imports read US \$11.051 billion and US \$11.731 billion respectively, registering a respective decrease of 21.18% and 20.59% year on year. The trade of silk, satins and finished goods amounted to US \$633 million, US \$3.432 billion and US \$18.717 billion respectively, representing a year-on-year decrease of 33.41%, 22.28% and 20.46%.

1 Exports

1.1 Overall export structure of silk goods in the nine countries and the EU

In terms of exports of silk goods from the nine countries and the EU for 2020, the proportion of silk and satins decreased, while that of manufactured goods increased. According to the data released by GTA, the exports of silk, satins and finished goods amounted to US \$311 million, US \$2.051 billion and US \$7.863 billion respectively, posting a respective year-on-year decline of 34.79%, 23.14% and 20.87%. The export proportion of satins

and finished goods respectively read 2.81% and 18.56%, marking a respective decrease of 0.56% and 0.33%. Instead, the export proportion of finished goods read 78.63%, posting a year-on-year increase of 0.89%.

1.2 Quarterly exports of the nine countries and the EU

Judging from the quarterly export statistics, the exports of silk goods in the nine countries and the EU declined in the four quarters throughout the year. Exports in the four quarters read US \$3.1 billion, US \$1.7 billion, US \$3 billion and US \$3.1 billion, respectively. Among them, the second quarter saw the biggest drop of 49.17%, while the other three quarters witnessed a decline of 14.01%, 9.02% and 14.69%, respectively.

1.3 Major exporters in the nine countries and the EU

In 2020, the exports of silk goods from nine countries and the EU all declined and the exports from major suppliers all dropped by more than 10%. Among them, China suffered the biggest decline of 50.26% and the export declines of the EU, India and Turkey were close, being 16.63%, 16.44% and 13.45% respectively.

Compared with 2019, the export share of the EU, India and Turkey further increased by 2.47%, 1.61% and 1.44% respectively. Only China's share continued to fall, by 5.67% year on year.

The exports of the EU, India, Turkey and China summed to US \$9.925 billion, accounting for 89.81% of the total, which was roughly the same as last year. (See Tab.1 for details).

Tab.1 Statistical table of exports of silk goods from the nine countries and the EU in 2020

Countries/Regions	Exports/ US \$ 10,000	Year-on-year/%	Proportion/%
Total	1,105,058.21	-21.18	100.00
The EU (trade outside the EU)	441,575.54	-16.63	39.96
India	278,135.39	-16.44	25.17
Turkey	165,669.00	-13.45	14.99
China	107,118.71	-50.62	9.69
The USA	45,232.70	-22.60	4.09

Continued Tab. 1

Countries/Regions	Exports/ US \$ 10,000	Year-on-year/%	Proportion/%
Thailand	32,746.07	-24.77	2.96
Japan	17,135.62	-14.00	1.55
Malaysia	9,611.77	-4.46	0.87
Brazil	4,602.32	-26.79	0.42
Australia	3,231.08	-8.56	0.29

Source: GTA

1.4 Silk exports of the nine countries and the EU

1.4.1 Amount

In 2020, the exports from China and Brazil, the main filament suppliers, fell sharply by 39.23% and 29.88% respectively. The EU's exports of imported filament after processing decreased by 9.63% while exports from India, a major supplier of staple fiber, saw a big rise of 25.59%.

As indicated by the proportions, only that of China fell by about 7%, while that of Brazil, the EU and India all increased, and the proportion of India nearly doubled (see Tab. 2) over the previous year.

Tab. 2 Statistical table of exports of silks from the nine countries and the EU in 2020

Countries/Regions	Exports/ US \$ 10,000	Year-on-year/%	Proportion/%
Total	31,079.96	-34.79	100.00
China	24,372.44	-39.23	78.42
India	2,175.25	25.59	7.00
Brazil	2,011.75	-29.88	6.47
The EU (trade outside the EU)	1,697.23	-9.63	5.46
Thailand	344.91	-35.38	1.11
Japan	305.41	-6.23	0.98
The USA	120.80	-37.08	0.39
Turkey	51.65	91.10	0.17
Malaysia	0.17	-82.95	0.00
Australia	0.34	3,227.09	0.00

Source: GTA

1.4.2 Quantity and unit price

In 2020, the nine countries and the EU exported 9,859.59 tons of silk, posting a year-on-year decrease of 22.32%. China, India, Brazil and the EU as the major suppliers reported a sum of export of 9,457 tons, accounting for 95.92% in total. Among them, only India's exports increased by 38.6%, while the export volume China, Brazil and the EU decreased by 37.79%, 21.44% and 16.98% respectively.

The proportion of China's exports decreased by 14% while that of India increased by about 14% and other countries witnessed an insignificant change.

Among the major silk suppliers in terms of the average unit price, only the EU saw its export price increase by 8.91% year on year, while China, India and Brazil all saw their export price decrease by 2.31%, 9.39% and 10.74%. (See Tab. 3 for details).

Tab. 3 Statistical table of the quantity and unit price of exported silk goods of the nine countries and the EU in 2020

Countries/ Regions	Export volume/t	Year-on- year/%	Proportion/%	Unit price/ US \$ /kg	Year-on- year/%
Total	9,859.59	-22.32	100.00	—	—
China	5,550.07	-37.79	56.29	43.91	-2.31
India	3,206.12	38.60	32.52	6.78	-9.39
Brazil	437.20	-21.44	4.43	46.01	-10.74
The EU (trade outside the EU)	264.00	-16.98	2.68	64.36	8.91
Thailand	193.56	-33.79	1.96	17.82	-2.39
The USA	74.88	-61.47	0.76	16.13	63.30
Turkey	97.51	74.89	0.99	5.30	9.27
Japan	35.70	-7.85	0.36	85.54	1.76
Malaysia	0.45	-66.37	0.00	3.82	-49.31
Australia	0.09	8,854.00	0.00	38.30	-62.84

Source: GTA

1.5 Satin exports of the nine countries and the EU

Among the nine countries and the EU in 2020, only Turkey witnessed an export increased by 6.54%, and the rest countries and regions all witnessed a decline by more than 15%, with China seeing the biggest decline of 54.66%.

Compared with 2019, the share of China's and the USA's exports decreased by 9.18% and 1.12% respectively, while that of the EU and Turkey increased by 2.21% and 7.66% respectively. On the whole, the increase or decrease of the rest of the exports did not exceed 1% (see Tab. 4 for details).

Tab. 4 Statistical table of the exports of satins from the nine countries and the EU in 2020

Countries/Regions	Exports/ US \$ 10,000	Year-on-year/%	Proportion/%
Total	205,071.00	-23.14	100.00
The EU (trade outside the EU)	65,500.97	-17.41	31.94
Turkey	56,415.37	6.54	27.51
China	27,089.15	-54.66	13.21
India	17,610.86	-21.71	8.59
The USA	14,924.64	-33.41	7.28
Japan	14,933.42	-16.54	7.28
Thailand	5,313.68	-28.20	2.59
Brazil	1,962.36	-18.93	0.96
Malaysia	1,149.30	-37.41	0.56
Australia	171.26	-49.75	0.08

Source: GTA

1.6 Export of ready-made silk goods of the nine countries and the EU in 2020

In 2020, exports of major suppliers of silk finished goods fell by over 15%, with China seeing the biggest drop of 52.46%. The EU, Turkey and India saw similar declines of 16.52%, 16.29% and 21.12% respectively.

In terms of market share, China's export share further decreased to 6.41%, down 4.25% year on year. That of the EU and India increased by 2.25% and 1.6% respectively. The export share of other countries and regions changed slightly, with no increase or decrease surpassing 0.25% (see Tab. 5 for details).

Tab.5 Statistical table of the exports of satin finished goods from the nine countries and the EU in 2020

Countries/Regions	Exports/ US \$ 10,000	Year-on-year/%	Proportion/%
Total	868,907.25	-20.88	100.00
The EU (trade outside the EU)	374,377.34	-16.52	43.09
India	258,349.28	-16.29	29.73
Turkey	109,201.97	-21.12	12.57
China	55,657.13	-52.46	6.41
The USA	30,187.26	-15.76	3.47
Thailand	27,087.49	-23.89	3.12
Malaysia	8,462.30	2.90	0.97
Australia	3,059.47	-4.17	0.35
Japan	1,896.79	11.17	0.22
Brazil	628.21	-37.00	0.07

Source: GTA

1.7 Conclusion

1) Exports of silk commodities fell by 21.18%, the biggest drop in recent years.

2) As indicated by of the quarterly exports, the decline of silk exports roughly corresponded to the COVID-19 outbreak in various countries, with the decline in the second quarter being the largest, while the decline in the other three quarters being relatively small.

3) Silk export value fell much more than export volume mainly because China's filament export value fell by 39.23% and the volume of exports fell by 37.79%, while India's staple silk

export value increased by 25.59% and the export volume increased by 38.6%. The decline in exports of higher-priced filament was partly offset by an increase in exports of lower-priced staple yarn.

4) The export volume of silk decreased by 22.32%, which was close to the decrease of 23.14% for satins and 20.87% for finished products. It can be said that the three categories of commodities declined simultaneously.

5) Although the overall export structure of silk commodities did not change greatly, it was still absolutely dominated by finished products, but the silk exports merely claimed a proportion of 2.81%, falling below 3% for the first time.

6) China's exports decreased by 50.62%, among which exports of silk, satins and finished goods all saw the largest declines in the nine countries and the EU. It was mainly due to the fact that China's silk export was affected by multiple adverse factors such as COVID-19, Sino-US economic and trade tensions and China-India border conflicts.

7) Among the major suppliers of finished goods except China, all exports saw similar declines, ranging from 15% to 24%.

2 Import

2.1 Overall import structure of silk goods of the nine countries and the EU

In 2020, silk imports of the nine countries and the EU reached US \$ 321 million, down 32.01% year on year. Imports of satins and finished goods amounted to US \$ 1.382 billion and US \$ 10.028 billion respectively, posting a respective year-on-year decline 20.96% and 20.11%.

Compared with 2019, the proportion of silk decreased by 0.47%, that of satins was basically the same, with a decrease of only 0.05% while that of finished goods rose by 0.52%.

2.2 Quarterly import from the nine countries and the EU

The imports of silk goods for the four quarters of 2020 from nine countries and the EU declined, with the imports being US \$3.7 billion, US \$2.2 billion, US \$3 billion and US \$2.8 billion respectively. In terms of decline, the second quarter saw the largest decline of 41.53%, while the other three quarters showed similar declines of 11.01%, 14.79% and 11.65% respectively.

2.3 Imports of the major markets in the nine countries and the EU

The EU, the USA and Japan remained the main consumer markets of silk goods, with a total import value of US \$9.922 billion, accounting for 84.57% of the total, which was equivalent to that of previous years.

Imports in the three major markets of the EU, the USA and Japan all fell by more than 15%, being 17.6%, 25.45% and 15.8% respectively. Among the emerging markets, only Australia saw a decline of less than 10%, at 6.26%, while all other markets saw declines of more than 18% in terms of imports.

Significantly, among the nine countries and the EU, only China delivered a growth of 9.24% concerning imported silk goods.

In terms of the proportion of imports, the changes of all parties were relatively stable, with the increase or decrease of less than 2% compared with the previous year (see Tab. 6 for details).

Tab. 6 Statistical table of the imports of satin goods from the nine countries and the EU in 2020

Countries/Regions	Imports/ US \$ 10,000	Year-on-year/%	Proportion/%
Total	1,173,144.96	-20.59	100.00
The EU (trade outside the EU)	481,572.67	-17.60	41.05
The USA	349,848.69	-25.45	29.82
Japan	160,768.29	-15.80	13.70
Australia	51,086.34	-6.26	4.35
India	27,072.48	-42.92	2.31
Thailand	27,122.22	-18.59	2.31
China	26,138.53	9.24	2.23
Malaysia	18,022.08	-36.05	1.54
Turkey	20,257.60	-26.60	1.73
Brazil	11,256.05	-36.12	0.96

Source: GTA

2.4 Import of silks from the nine countries and the EU

2.4.1 Amount

In 2020, the EU regained its status to be the largest silk

import market, with India relegated to second place and Japan remaining third. Imports fell sharply in all the three traditional major markets, among which, the import of India and Japan dropped by over 40%, being 47.23% and 40.17% respectively, and that of the EU fell by 19.61% as well. The total amount read US \$273 million, claiming a proportion of 84.91%, dropping by 3.95% from the previous year.

The proportion of India and Japan decreased correspondingly by 29.43% and 13.83% respectively as a result of slump in imports, 8.49 and 1.89 percentage point lower than the previous year. The proportion of the EU was further raised to 41.65%, with an increase of 6.43%.

China was the only major market in which silk imports grew, rising by 17.47% year on year and accounting for 9.56%, with an increase of 4% from the previous year. (See Tab. 7 for details).

Tab. 7 Statistical table of the imports of silks from the nine countries and the EU in 2020

Countries/Regions	Imports/ US \$ 10,000	Year-on-year/%	Proportion/%
Total	32,193.52	-32.01	100.00
The EU (trade outside the EU)	13,408.78	-19.61	41.65
India	9,475.94	-47.23	29.43
Japan	4,452.81	-40.17	13.83
China	3,079.19	17.47	9.56
The USA	750.15	-16.21	2.33
Thailand	362.20	-54.91	1.13
Turkey	383.63	-35.92	1.19
Brazil	243.28	-24.63	0.76
Malaysia	18.50	-24.00	0.06
Australia	19.04	91.53	0.06

Source: GTA

2.4.2 Quantity and unit price

Quantity: In 2020, the nine countries and the EU imported 12,100 t of silk, posting a year-on-year decline of 15.15%. China became the largest silk import market for the second year in a row, and it was the only major market that kept growing, with an increase of 18.42% year on year. It claimed a proportion of 46.65%, posting an increase of 13.16% over the previous year.

Although the imports of the EU decreased by 15.7% year on year, it overtook India to become the second largest silk import market, accounting for 22.69% and dropping by merely 0.16 percentage point. India's imports saw the biggest drop of 43.78%, accounting for 18% and declining by 9.17 percentage point from the previous year. Japan remained the fourth largest import market with a drop of 36.29%, or 2.47 percentage point, to 7.46%. Most of the rest markets saw declines in imports, but their share changes were all below 1%.

China, the EU, India and Japan together imported 11,400 t, claiming a proportion of 94.5% of the total.

Unit price: The average unit price of imports in major markets fell throughout the year. China's import unit price decreased slightly by 0.72%, while that of the EU, India and Japan fell by 4.64%, 6.14% and 6.09%, respectively (see Tab. 8 for details).

Tab. 8 Statistical table of the quantity and average unit price of imported silk of the nine countries and the EU in 2020

Countries/ Regions	Import volume/t	Year-on- year/%	Proportion/%	Unit price/ US \$ /kg	Year-on- year/%
Total	12,082.24	-15.15	100.00	—	—
China	5,612.64	18.42	46.45	5.49	-0.72
The EU (trade outside the EU)	2,742.00	-15.70	22.69	48.90	-4.64
India	2,175.35	-43.78	18.00	43.56	-6.14
Japan	900.81	-36.29	7.46	49.43	-6.09
Thailand	300.47	-36.34	2.49	12.05	-29.17
The USA	157.09	-24.55	1.30	47.75	11.04
Turkey	140.91	-8.56	1.17	27.23	-29.92
Malaysia	27.91	-69.20	0.23	6.63	146.80
Brazil	20.39	-43.87	0.17	119.34	34.28
Australia	4.67	100.38	0.04	40.74	-4.41

Source: GTA

2.5 Imports of satins from the nine countries and the EU in 2020

In 2020, satin imports of nine countries and the EU all declined, with China seeing the biggest drop of 40.5%. The EU and the USA, the two largest markets, saw similar drops in imports of 18.22% and 21.82% respectively. Turkey, India,

Brazil and Malaysia all saw declines of more than 30%.

Compared with 2019, the share of imports of the nine countries and the EU changed little, with neither increase nor decrease exceeding 1.5% (see Tab. 9 for details).

Tab. 9 Statistical table of satin imports of the nine countries and the EU in 2020

Countries/Regions	Imports/ US \$ 10,000	Year-on-year/%	Proportion/%
Total	138,154.10	-20.96	100.00
The EU (trade outside the EU)	61,985.88	-18.22	44.87
The USA	21,320.30	-21.82	15.43
Thailand	13,482.68	-13.46	9.76
Japan	11,794.25	-2.89	8.54
Turkey	10,542.19	-31.25	7.63
India	8,871.64	-33.36	6.42
Brazil	4,204.32	-37.62	3.04
Malaysia	2,284.35	-36.52	1.65
Australia	1,843.81	-5.45	1.33
China	1,824.68	-40.50	1.32

Source: GTA

2.6 Imports of silk finished goods from the nine countries and the EU in 2020

In 2020, China was the only country among the nine countries and the EU with an increase of 16.41%, accounting for 2.12% of the total.

Imports in the three main traditional markets of the EU, the USA and Japan all fell by more than 15%, being 17.44%, 25.7% and 15.66% respectively. The imports of the three traditional major markets summed to US \$8.785 billion, accounting for 87.6% with a slight decrease of about 1% compared with the previous year.

Among the emerging markets, only Australia saw a slight drop of 6.31% while the decline of other markets in terms of import all surpassed 15%.

In terms of the share of imports, the USA saw the biggest change, with a 2.46% decrease from 2019. The imports of the EU increased by 1.3%, and Japan, Australia and China all increased by about 0.7%. The rest of the market changed slightly (see Tab. 10 for details).

Tab. 10 Statistical table of imports of silk finished goods from the nine countries and the EU in 2020

Countries/Regions	Imports/ US \$ 10,000	Year-on-year/%	Proportion/%
Total	1,002,797.34	-20.11	100.00
The EU (trade outside the EU)	406,178.02	-17.44	40.50
The USA	327,778.24	-25.70	32.69
Japan	144,521.24	-15.66	14.41
Australia	49,223.49	-6.31	4.91
China	21,234.66	16.41	2.12
Malaysia	15,719.24	-35.99	1.57
Thailand	13,277.34	-21.58	1.32
India	8,724.89	-46.00	0.87
Turkey	9,331.78	-20.00	0.93
Brazil	6,808.45	-35.51	0.68

Source: GTA

2.7 Conclusion

1) Imports fell in all markets except China. Among them, the decline of imported silk goods in the three traditional major markets of the EU, the USA and Japan all exceeded 15%, the highest in recent years.

2) The import situation was roughly consistent with the export situation, import volume saw the largest decline in the second quarter, while the decline in the other three quarters was similar.

3) China was the only country that saw an increase in terms of imports of silk goods, of which the import of silk and finished goods increased by 17.47% and 16.41% respectively, while the import of satins decreased by 40.5%.

4) In general, silk imports witnessed the largest decrease of 32.01%, while imports of satin and finished products saw a similar decline of 20.96% and 20.11% respectively. Imports of silk fell by 15.15%, less than those of satin and finished goods thanks mainly to a 18.42% increase in imports of Chinese staple fibre.

5) China became the largest market for silk imports for the second year in a row, with imports exceeding exports by 62 t. Moreover, the import volume exceeded the sum of the second EU and third India by 695 t. China's imported silk mainly came from India (2,753 t, up by 32%), Uzbekistan (1,294 t, up by 26%), Vietnam (837 t, up by 27%) and Myanmar (252 t, up by 27%).

6) The average unit price of silk imported from major markets, whether short or long, declined somewhat, but the decline was relatively small.

7) The import of satins increased in none of the markets in China and the EU, but all declined. The import volume of the EU and the USA summed to 60%, with a drop of around 20%.

8) As the most important markets for silk products, the EU, the USA and Japan all saw a decline in imports of above 15%. China was the only growing market for imports of finished goods.

Key works of International Silk Union (ISU) for 2020 – 2021

International Silk Union



1 The ISU carried out the survey of Impact of COVID-19 on International Silk Industry and Consumer Market Trends

The global spread of COVID-19 since 2020 has severely impacted the international silk industry and consumer market, impeding international exchanges in the silk industry. In order to study the future trends of international silk industry and consumer market, ISU secretariat carried out the survey of Impact of COVID-19 on International Silk Industry and Consumer Market Trends among silk enterprises and related institutes in more than 10 silk producing and consuming countries including China,

Italy, Japan, Brazil, India, Thailand, Vietnam, Cambodia, Laos, Indonesia, etc. The questionnaire covers the basic information of the enterprises, and the impact of COVID-19 on the enterprises and international silk industry. Through the analysis and summary of the silk production/consumption data, response measures, and expert opinions of participating countries and regions, the 41 pages of bilingual research report in Chinese and English was formed, which was released on the World Silk Website, and submitted to relevant government departments and industry organizations. On May 19, ISU survey report was published on the official website of Union of International Associations (UIA), gaining further recognition and spread on the international authoritative platform.



2 ISU was included in the Yearbook of International Organizations of UIA

In May 2020, ISU was identified as a Type C intercontinental membership organization by Yearbook of International Organizations of UIA, making it the first silk international organization in the yearbook with the secretariat located in China, and one of the most active international silk

industry organizations in UIA. Department of Commerce of Zhejiang Province, Hangzhou Municipal Government and relevant departments spoke highly of the further improvement of ISU international influence, "the event has greatly enhanced the international influence of Hangzhou silk industry and the city, which should be fully affirmed", said HU Wei, Deputy Mayor of Hangzhou Municipal Government.



3 ISU co-sponsored the International Silk Art Exhibition Hall

Silk Road Week 2020 was jointly organized by National Cultural Heritage Administration and the People's Government of Zhejiang Province, organized by China National Silk Museum (NSM), etc. and co-organized by ISU, etc. On June 19, 2020, the Silk Road Week 2020 kicked off at NSM. During the period, ISU and NSM jointly set up the International Silk Art Exhibition Hall, aiming to promote communication in the field of silk culture in various countries and regions of the world through a series of theme exhibitions. For instance, the display of silk road brand boutiques reflected the broad and profound silk culture. At the first exhibition dubbed Splendid Silk Road: International Silk Boutique Exhibition, more than 50 silk products from Laos, Cambodia and China with brand and regional features were exhibited; at the second exhibition themed with Jingluntang Peach Blossom Land, Chinese high-end silk culture products under the brand co-founded by the chairman unit of ISU, Zhejiang Cathaya Group and the vice-chairman unit, NSM were exhibited. On June 18, 2021, the Silk Road Week 2021 co-organized by ISU kicked off at NSM. During the event, the exhibition entitled Square Silk Goods: Silk Road of Silk Scarves was held, and 13 museums and silk enterprises nationwide were invited to attend the exhibition.



4 Silk City Lounge and International Silk Boutique Store were set up

On November 19, 2020, the opening ceremony of Hangzhou Leisure and Shopping Festival & the Provincial High-quality Pedestrian Street in 2020 entitled New Consumption & Intoxicating Hangzhou was held in Hangzhou China Silk Town. City Lounge at Hangzhou China Silk Town, the first silk city lounge in Hangzhou co-built by ISU secretariat, Hangzhou City Brand Promotion Association, Hangzhou Oriental Silk Culture and Brand Research Center and Hangzhou China Silk Town was set up. At the opening ceremony, the high-end Silk Boutique Store jointly built by ISU, the chairman unit Zhejiang Cathaya Group and the City Investment Group of Xiacheng District, was also opened ceremoniously, which features Cathaya's high-end silk products and also displays multiple international silk brand products from Italy, Brazil, Cambodia, Laos, Bangladesh, etc.



5 2021 ISU Chairman Meeting & International Think Tank Forum on Silk Sustainable Development were held

To fulfill the principle of "Communication & Cooperation, Development with Concerted Efforts", discuss the current situation and future of the silk industry, and advance the sustainable and healthy development of the silk industry, 2021 ISU Chairman Meeting & International Think Tank Forum on Silk Sustainable Development was held on June 10, 2021. At the meeting, the work reports of ISU and its professional committees for 2020 were deliberated, such papers as Amendment to the Constitution of the International Silk Union and Working Mechanism of the International Silk Union were passed and International Think Tank Forum on Silk Sustainable Development was held. Guests from 22 countries and regions attended the conference, with more than 100 people offline and 60 people online. A total of 3,000 odd people watched the video online.

Besides, ISU and International Sericultural Commission signed memorandum of understanding, and the Proposal for the Comprehensive and Objective Assessment of Life Cycle of Silk Products was jointly released by ISU, International Sericultural Commission, Ufficio Italiano Seta (UIS), INTERSOIE France and Brazilian Silk Association (ABRASEDA). To enhance publicity, a special column of www.worldsilk.com.cn, the official website of the union, was launched to release the achievements of the meeting in both English and Chinese, and related information was also released on convergence media matrixes such as Sohu, Penguin, Toutiao and Baijiahao. In the meanwhile, over 60 reports regarding the outcomes of the meeting were released in over 200 countries and regions by domestic and foreign mass media and professional media such as the official website of the UIA, icitynews.com, Radio Mandarin d'Europe, CHMB and Prague Chinese Times.



6 ISU provided support for the First International Conference of Brazilian Silk Association

On July 22, 2021, the 37th Palana National Sericulture Conference, the 4th Sao Paulo Sericulture Technology Day and the First International Conference of the Brazilian Silk Association were held in Brazil. Leaders of government departments from the Ministry of Agriculture, Livestock, and Food Supply (MAPA), Parana State, Bastos City of Sao Paulo State, and representatives of industry organizations and enterprises such as ISU, Brazilian Silk Association, INTERSOIE France and Bratac attended the meeting. ZHANG Guoqiang, chairman of International Silk Union, was invited to deliver a video speech at the conference. At the same time, entrusted by the Brazilian Silk Association, the union invited ZHU Xinrong, a Chinese expert and researcher of Zhejiang Cathaya Sericulture

Research Institute Co., Ltd. to make a special report on Breeding of Male Silkworm and Development of the Full Industrial Chain.



7 ISU joined MOU entitled Make the Label Count for Founding Members and advocated sustainable international silk

In 2021, with the rise of the ISU's international clout, it gradually established contact with the International Wool Textile Organization (IWTO) and was invited to join the MOU named Make the Label Count for Founding Members. On September 30, the video conference for the MOU Members Meet & Greet entitled Make the Label Count initiated by the International Wool Textile Organization (IWTO) and Australian Wool Innovation (AWI) was held as scheduled. At the conference, views on the sustainability of natural fibers, Product Environmental Footprint (PEF), the formulation of EU natural fiber policies and the launch plan of the Make the Label Count campaign were exchanged. Later, the launch of the Make the Label Count campaign was held on October 13 when more than 100 participants including policy makers of the European Commission, experts in the field of sustainability, representatives of international organizations and industries took part in the event. As an international organization representing the silk industry, ISU has been vigorously participating in natural fiber initiatives and advocating green production, consumption and sustainability of silk to maintain the international image of silk.



8 ISU provided support for organizing "2021 China International Silk Expo"

From October 15 to 17, 2021, the 21st China International Silk Expo, supported by ISU, was successfully held in Hangzhou, China. At the opening ceremony, Stefano Vitali, Vice President of the union and President of the Italian Silk Office, Xavier Lepingle, Vice President of the union and President of the INTERSOIE France, and Renata Amano, Vice President of the union and President of the Brazilian Silk Association were invited to address the expo. ZHANG Guoqiang, Chairman of the union, read the 2021 China International Silk Expo Proposal together with other industry leaders. During the opening ceremony, the "Third Expert Meeting and Symposium on the Theme of the Think Tank of the Hushan Gala" was held. ZHANG Guoqiang, the president of the union, was invited to discuss in depth with representatives and experts of the silk industry on how to facilitate the upgrading, transformation and innovation development of the silk fair in the context of global digital trade.



9 ISU provided support for "the video conference of International Network of Silk Cities and Metropolises"

Hosted by Municipality of Lyon, the Metropolis of Lyon and INTERSOIE France, "the video conference of International Network of Silk Cities and Metropolises" was jointly held in Lyon by many institutions including ISU, chairman unit of the union Italian Silk Office and vice chairman unit Brazilian Silk Association in November 2020 and November 2021. Given to the epidemic, representatives from industry organizations and silk cities from China, Italy, France, Brazil, Spain, Japan, Uzbekistan, India and Georgia were invited to attend the conference online or offline. The participants exchanged information on the development of various silk cities and industries. At the 2021

conference, ZHANG Guoqiang, Chairman of ISU, was invited to address the conference, introducing the annual work of the International Silk Union and its support for the construction of the International Network of Silk Cities and Metropolises. In the meanwhile, the network members were determined, the Statutes of the International Silk Cities Network and the scheme of membership fees were deliberated, and the Chairman, Vice Chairman, Secretary-General, Deputy Secretary-General and Chief Financial Officer of the standing council were elected.



10 ISU developed 14 new members of the ISU from eight countries and regions

To further enhance the cohesion of the international silk industry, facilitate international exchanges and cooperation, and increase the global influence of ISU, the secretariat stepped forward to attract superior international silk enterprises and organizations to join the union. In 2020 – 2021, a total of 14 institutions from Chinese Mainland, Switzerland, Turkey, Iran, Pakistan, Romania, Cambodia, Hong Kong (China) and other countries and regions joined the union. At present, the union boasts 137 members from 24 countries and regions such as China, France, Italy, Brazil, Japan, India and Uzbekistan, which include national industry associations from Italy, France, Brazil, Vietnam, Cambodia, etc.



List of international silk industry organizations

World Silk Website

1 International Silk Union (ISU)

International Silk Union (ISU) is an international and specialized non-profit social organization in which enterprises and related organizations from the silk producing and consuming countries participate voluntarily. The secretariat is located in Hangzhou, China. Since the convening of the founding Members' conference in October 2015, more than 130 enterprises and organizations from 24 countries and regions have joined ISU, including China, Italy, France, Switzerland, Brazil, Poland, Japan, Thailand, India, Vietnam, Cambodia, Myanmar, Indonesia, Singapore, the USA, Australia, Uzbekistan, Bangladesh, Laos, Turkey, Pakistan, Romania, Iran and Hong Kong (China), and six professional committees in silk field including History & Culture, Fashion Design, Education Research, Technical Innovation, Intelligent Manufacture and Sustainable Development have been set up. At present, the union comprises 11 vice chairmen and 46 executive members. The joining of national level industry organizations such as Ufficio Italiano Seta, INTERSOIE France, Brazilian Silk Association, Vietnam Sericulture Association, and Cambodia Silk Sector Promotion and Development Commission has further enhanced the union's influence on hundreds of enterprises. In 2020, ISU was included in the "Yearbook of International Organizations" of Union of International Associations (UIA), making it the first silk international organization in the UIA with the secretariat located in China.

2 International Sericultural Commission (ISC)

International Sericultural Commission (ISC) is an intergovernmental organization dedicated to the development of sericulture and silk industry with the office located in Bengaluru, India. The commission has 35 associate members from 21 member countries. ISC aims to encourage and promote the development of sericulture industry in existing and new areas through coordinated actions and convergence of programmes extended by different countries, international organizations and other agencies and to organize specialized programmes and activities in capacity building, volunteer expert services, establishing linkages among the sectors, and enhancing facilities for common use.

3 China Silk Association (CSA)

Founded in 1986, China Silk Association is a national industry organization integrating trade, industry and agriculture based on manufacturing enterprises. Now, it comprises 400 members including silk companies from major silk producing areas such as Zhejiang, Jiangsu, Shanghai, Sichuan, Shandong, Anhui, Chongqing, Guangdong, Guangxi and Liaoning, multiple national key and major enterprises regarding cocoon purchasing and drying, silk reeling, silk spinning, silk weaving, silk printing and dyeing, silk knitting, silk garment, silk machinery, etc. and academic institutions. Its competent department is the State-owned Assets Supervision and Administration Commission of the State Council.

4 Ufficio Italiano Seta (UIS)

Ufficio Italiano Seta (UIS) was settled in 1951. Today it comprises 100 Italian silk producers, representing each ring of the textile chain of silk in Italy. The core of Italian textile industry for silk is embodied in UIS; 900 million Euro of silk fabrics, scarves, ties and garments are exported every year towards the most important markets all over the world, with a preponderant role in France, the USA, Switzerland, Germany, the UK and China, especially for luxury products. Italian silk industry represents 75% of industrial silk activities in Europe. UIS deals with the specific problems of silk and represents Italian silk industry in international Associations, such as AIUFFASS (The Association of European users of silk and man-made filament yarns) and International Silk Union.

5 INTERSOIE France

INTERSOIE France is a French professional association, gathering all companies involved in the production, the use and the trade of silk. Its mission is to promote and defend the interests of the French silk industry across the world. INTERSOIE France comprises 30 members gathering all the professions from silk yarn to the silk fabric, including dyeing, printing and finishing. INTERSOIE is made up of prestigious Lyon-based companies and small and medium-sized industrial enterprises. Characteristic events such as the International Network of Silk Cities and Metropoles Silk in Lyon are held every year.

6 Brazilian Silk Association (ABRASEDA)

Brazilian Silk Association (ABRASEDA) was initiated by local manufacturers of raw silk in 1971, aiming to strengthen the development of the silk spinning industry in Brazil. In 2017, ABRASEDA enlarged its coverage based on new market opportunities in order to represent the entire silk production chain in Brazil. ABRASEDA combines ancient art and innovative techniques, making Brazilian silk the most valuable product across the globe. Besides, it works to innovate the sustainable and circular economy worldwide by embracing participants from all stages of production and promoting responsible production and conscious consumption.

7 The Dainippon Silk Foundation (DSF)

The Dainippon Silk Foundation (DSF) was established in the 25th year of Meiji (1892) as a voluntary association and evolved into a corporation in the 38th year of Meiji (1905). In 2021, Silk Science Research Institute and Institute of Sericulture were merged into Silk Science and Technology Research Institute, a comprehensive research institute dedicated to studying sericulture and silk making. The Dainippon Silk Foundation works to carry out research and development on silk-related basic sciences and applies technology to boost the development of related science and technology and silk industry, which will make further contribution to the improvement and development of social culture with regard to silk.

8 Vietnam Sericulture Association (VISERIA)

Vietnam Sericulture Association (VISERIA) is a non-governmental, non-profit and spontaneous organization which consists of legal individuals, companies dealing with sericulture and silk production & business, scientists and social activity persons countrywide. The Association is the prime organ connecting and protecting the legal benefits of its members in sericulture and silk field. It also makes proposals on policies and solutions for developing silk production and business to enhance the competitiveness of the silk sector. Vietnam Sericulture Association

actively joins the international organization such as ISU to strengthen the connection with potential partners by means of production investment, commercial connection and cooperation negotiation.

9 Cambodia Silk Sector Promotion and Development Commission (SDC)

Established in 2013, Cambodia Silk Sector Promotion and Development Commission (SDC) seeks to reverse the backward situation of Cambodia's silk industry and improve silk production technology so as to enhance the international competitiveness of Cambodia's silk. The commission, under the direct jurisdiction of Ministry of Commerce of Cambodia, works to offer help concerning domestic market supply and export market seeking from mulberry growing and silkworm raising to silk production. The commission has been taking active steps to facilitate the establishment of Cambodia Golden Silk Producers Association and organize experts to provide technical training, so as to improve the production quality and standard of Cambodian golden silk.

10 SS Bursa Koza Agricultural Sales Cooperatives Union (KOZABİRLİK)

SS Bursa Koza Agricultural Sales Cooperatives Union (KOZABİRLİK) is a union of cooperatives, formed by Silkworm Cocoon Producers. The first cooperatives were established in Bursa, Bilecik and Adapazari in 1940 in order to protect and increase the production of cocoon in Turkey. Guided by the principle that union is strength, these cooperatives jointly established the SS Bursa Koza Agricultural Sales Cooperatives Union—KOZABİRLİK on May 11, 1940. KOZABİRLİK, which tried to develop nationwide after its first establishment years, opened cooperatives in Edirne in 1944, Mihalgazi in 1951 and Alanya in 1984, and purchased cotton, olives, olive oil and sunflowers grown in cooperative regions in addition to cocoons. Later, it gave up on them and only dealt with the purchase of cocoons.



www.worldsilk.com.cn



ISU WeChat Official Account

International silk industry news for 2021

National Silk Information Center

1 The Technical Requirements for Fresh Cocoon Purchase, one of the China trade industry standards, was released

On January 6, the Ministry of Commerce of the People's Republic of China released No. 1 Announcement for 2021, in which seven domestic trade industry standards were established. Among them, the Technical Requirements for Fresh Cocoon Purchase (Serial No. : SB/T 11225 – 2021) took effect on May 1, 2021.

2 The Development Achievements of Zhejiang Silk Industry during the 13th Five-Year Period were released

On January 11, the Development Achievements of Zhejiang Silk Industry during the 13th Five-Year Period were released by Economy and Information Technology Department of Zhejiang. The main achievements are shown in six aspects: (1) the ability of innovative design has been gradually improved; (2) the construction of renowned enterprises and branded products has been gradually enhanced; (3) new breakthroughs have been made in industrialization of sericulture; (4) marketing methods have seen continuous innovation; (5) the application of intelligent manufacturing has been stepped up; (6) standardization has been gradually promoted.

3 India's budget for 2021 rendered full support to its textile industry concerning cocoon silk

On February 1, India's budget for the fiscal year of 2021 (April 1, 2021-March 31, 2022) was released. To boost the development of India's cocoon silk industry, the tariff on silk products and satins imported from China was raised from 10% to 15% and from 15% to 20% respectively.

4 Four cocoon silk standards were included in the plan on the first industry standards and foreign language edition projects of China in 2021

On February 8, the Ministry of Industry and Information Technology of the People's Republic of China completed the plan on the first industry standards and foreign language edition projects of China in 2021. Among them, four cocoon silk standards including FZ/T 0898 – 2019 Testing Method for Sericin Content in Silk, FZ/T 40006 – 2018 Testing Method for Oil Content of Silk, FZ/T 44005 – 2018 Silk Paintings and FZ/T 44007 – 2019 Raised Silk Scarf and Shawl were included in the plan.

5 Shanghai Tech University developed the thermochromic yarns based on natural silk that can be mass-produced

On February 14, the research team of ShanghaiTech University School of Physical Science and Technology developed the thermochromic yarns based on natural silk that can be mass-produced and they were processed into intelligent wearable dynamic display fabric. Related research findings have been published in the international journal *Nano Micro Letters*.

6 South Korean investors planned to establish silk processing enterprises in Tajikistan

On February 16, the relevant departments of Tajikistan negotiated with foreign investors to establish silk processing enterprises there.

7 A number of cocoon and silk geographical indication products were selected into the EU-China GIs Agreement

On March 1, the Agreement between the Government of the

People's Republic of China and the European Union Cooperation on, and Protection of, Geographical Indications officially came into force. A number of cocoon silk geographical indication products such as Yizhou bombyx mori cocoon, Zhenhu embroidery, gambiered Guangdong gauze, Sichuan figured satin, Sichuan embroidery and Shiquan silk were included in the agreement.

8 Two new silkworm varieties were approved in Sichuan, China

On March 5, the 11th Session of the Sixth Sichuan Silkworm Variety Approval Committee was held in Chengdu, at which two new silkworm varieties, Chuankang No. 1 and Suying × Xiyang were approved.

9 China National Silk Museum and Dunhuang Academy signed a strategic cooperation agreement

On March 8, China National Silk Museum and the Dunhuang Academy planned to carry out comprehensive strategic cooperation in various aspects, including Dunhuang silk research, preservation of Dunhuang cultural relics, digital regression and promotion of Dunhuang silk and Silk Road culture for resource sharing and mutual benefits.

10 Silk remains were first discovered in Sanxingdui sacrificial pits in Sichuan, China

Two kinds of silk traces found in the sacrificial pits of Sanxingdui site were announced at the progress meeting of the "Archaeological China" project on March 20: Numerous traces of silk in the ash layer of sacrificial pits and traces of silk wrapped around the bronze ware.

11 The Fifth Cross-strait Lei Zu Cultural Exchange Activity was held in Yanting, Sichuan, China

On March 22, the fifth Cross-strait Cultural Exchange Activity with the theme of "Paying homage to the Mother of China to Find the Origin of Silk" was held in Yanting County, Mianyang City, Sichuan Province, the birthplace of Lei Zu culture. A series of activities including cross-Straits theme seminars, cooperation talks and art shows were also held.

12 China Silk & Silkworm Brand Cluster Working Conference was held in Beijing, China

On March 23, China Silk & Silkworm Brand Cluster Working Conference was held in Beijing. At the meeting, ZHU Baocheng, chairman of China Silk & Silkworm Brand Cluster said that it was necessary to support mulberry and silkworm scientific basic research and transformation of achievements, aggregate key technological breakthroughs and support industrial innovation.

13 The Inaugural Meeting of the Third Session of National Technical Committee on Silk of Standardization Administration and Standard Approval Conference were held in Hangzhou, China

From March 25 to 26, the Inaugural Meeting of the Third Session of National Technical Committee on Silk of Standardization Administration and Standard Approval Conference were held in Hangzhou, China. At the meeting, the work report of the Second Session of National Technical Committee on Silk of Standardization Administration was deliberated, the plan for changing the National Technical Committee on Silk of Standardization Administration approved by Standardization Administration of China and building the third session was announced, and advanced work organizations and advanced individuals were commended.

14 Yashilin Changsha (International) Sericulture & Silk Intelligent Manufacturing Industry Project kicked off

On March 28, Yashilin Changsha (International) Sericulture & Silk Intelligent Manufacturing Industry Project kicked off at Liuyang Economic Development Zone, Changsha City. With a total investment of 7 billion yuan, the project covers a land area of about 408,667 m² and a building area of around 900,000 m². It was estimated that the annual output value would reach 30 billion yuan and the annual foreign exchange would exceed US \$500 million. It aims to occupy more than 50% of the international silk raw material market, provide impetus to the cultivation of 43,333 hm² of mulberry orchards, and build the silk capital and rural revitalization demonstration area of the world.

15 Uzbekistan's sericulture and silk industry kept expanding, making Uzbekistan the world's third largest producer of silk products

It's reported on April 2 that Uzbekistan's sericulture and silk manufacturing kept expanding. With the support of the government, seven silkworm raising & silk making enterprises were established in the state of Samarkand in 2021 mainly to produce raw silk and carpets for export, creating 65,000 jobs.

16 National Cocoon & Silk Industry Production and Marketing Situation Analysis Meeting for 2021 was Held in Jiaxing, Zhejiang, China

On April 27, National Cocoon & Silk Industry Production and Marketing Situation Analysis Meeting for 2021 was held in Jiaxing, Zhejiang, China, at which the economic operation of national cocoon & silk industry for 2020 was released, production and sales situation of cocoon silk industry for 2021 was analyzed and the industry development trend for the rest of 2021 was predicted.

17 Asian envoys visited Jiangxi Sericulture and Tea Research Institute

On 28 April, Asian envoys from Laos, Brunei, Myanmar, Thailand, Afghanistan, Nepal, Mongolia, Singapore, Malaysia, Maldives, Vietnam and other countries visited Jiangxi Sericulture and Tea Research Institute of Department affiliated to Agriculture and Rural Affairs of Jiangxi Province, and visited the Tea Sea, Tea Culture Park, Farmhouse and Sericulture & Silk Ecological Museum.

18 The research team of Tufts University in the United States developed silk leather that can be recycled and printed in 3D

On May 7, the research team of Tufts University in the United States developed a new material similar to leather with silk, which can be printed in 3D. The material is tough, sturdy, durable and elastic. Its appearance and performance are comparable to those of leather, and it has recyclable and biodegradable characteristics.

19 The Ministry of Commerce of the People's Republic of China decided to put the filature silk it reserved on the market in an open manner

On May 31, in order to stabilize the market price of raw silk, the Ministry of Commerce of the People's Republic of China

issued the Announcement on Putting Filature Silk It Reserved on the Market. After the on-site electronic bid evaluation system calculation and sorting and examination of the Price Review Committee, a total of 62 enterprises succeeded in bidding for 150 bales of raw silk (about 6 tons per bale).

20 Silk Suzhou 2021 Exhibition kicked off in Suzhou, China

From June 4 to 6, Silk Suzhou 2021 Exhibition themed with "Innovative Exploration and High-quality Development" was held in Suzhou, covering an area of 10,000 m², with 350 standard booths and seven exhibition areas. The exhibition aimed to better present the beauty of traditional silk and stived to building a service platform for the silk industry through digital empowerment and live broadcasting platforms.

21 The Sino-foreign Cultural Exchange Research Institute of Textile and Garment (Silk) Industry was established in Jiaxing Vocational & Technical College

On June 8, Sino-foreign Cultural Exchange Center of the Ministry of Education of the People's Republic of China and Jiaxing Vocational & Technical College decided to jointly set up The Sino-foreign Cultural Exchange Research Institute of Textile and Garment (Silk) Industry so as to build an open and high-end international platform integrating talent cultivation, academic research, skills training, decision-making consultation, technical services and people-to-people exchanges.

22 2021 ISU Chairman Meeting & International Think Tank Forum on Silk Sustainable Development were convened in Hangzhou, China

On June 10, 2021 ISU Chairman Meeting & International Think Tank Forum on Silk Sustainable Development were convened in Hangzhou, China and guests from 22 countries and regions attended the meeting online or offline, at which the work reports of ISU and its professional committees were deliberated, regulations and working mechanism of the ISU were passed, Memorandum of Understanding was signed and Proposal for the Comprehensive and Objective Assessment of Life Cycle of Silk Products was released.

23 Embroidered Pieces of Literature-Special Exhibition on Spinning, Dyeing and Embroidery Technology opened at Baopu Art Museum, Shanghai, China

On June 12, Embroidered pieces of literature-Special Exhibition on Spinning, Dyeing and Embroidery Technology opened at Baopu Art Museum, Shanghai, China. As one of the sub-venues of the Chinese Traditional Craft Invitation Exhibition themed with "Hundred Years of Arts and Crafts being Passed down from Generation to Generation", this special exhibition systematically analyzed the development history and revitalization achievements of China's traditional crafts in a comprehensive way.

24 The Silk Road Week 2021 special exhibition kicked off at China National Silk Museum

On June 18, the special exhibition of Silk Road Week 2021 and Creation from Creature: Plants and Animals on the Silk Road kicked off at China National Silk Museum. At the opening ceremony, the Annual Report of Silk Road Cultural Heritage for 2020 and Time Travel: The Cultural and Creative Silk Scarf co-developed by Dunhuang Academy, China National Silk Museum were released, and the Silk Road Online Museum and Creation from Creature: Plants and Animals on the Silk Road were launched.

25 The research team of Beihang University developed reduced graphene oxide functionalized silk

On June 22, the research team of Beihang University developed the silk (GS) coated by reduced graphene oxide (rGO) through hydrogen bonding to enhance interfacial interactions. The GS has outstanding tensile strength and toughness and related research findings entitled Strong Reduced Graphene Oxide Coated Bombyx mori Silk have been published in *Advanced Functional Materials*.

26 Harbin Silk Garment Fair for 2021 kicked off at Harbin international Conference & Exhibition Center, China

On June 24, Harbin Silk Garment Fair for 2021 kicked off at

Harbin International Conference & Exhibition Center. The two-week fair covered an exhibition area of 12,000 m² holding 600 standard exhibition booths. Well-known silk brands such as Cathaya, Wensli, Hentoonlon and Su-Hang Cheongsam appeared at the exhibition.

27 Degradable medical silk screws were used in human bone fixation

On June 25, Xijing Hospital and Shanghai Institute of Microsystem and Information Technology of Chinese Academy of Sciences jointly developed the degradable silk screws, which is the world's first degradable medical silk bone nail applied in human body, marking the opening of a new era of silk application in the field of human body fixation.

28 China industrial standards such as Silk Knitted Garment were released

On July 1, 563 industrial standards released by Ministry of Industry and Information Technology of the People's Republic of China officially took effect. Among them, six ones including FZ/T 43015 – 2021 Silk knitted Garment, FZ/T 42007 – 2021 Test Method for Mulberry Spun Silk Yarn, FZ/T 42002 – 2021 Mulberry Spun Silk Yarn and FZ/T 42007 – 2021 Raw Silk/Spandex Wrapped Silk were under centralized management of National Technical Committee of Standardization Administration for Silk.

29 Hunan University of Technology signed a contract with the Sericulture Research Institute of Hunan Province to boost upgrading of Miao Embroidery

On July 5, School of Packaging Design & Art, Hunan University of Technology signed a contract with Sericulture Research Institute of Hunan Province. The two sides would carry out comprehensive and in-depth cooperation in the formulation of Hunan provincial standard Miao Embroidery, the development of relevant production equipment, the development of cultural and creative products of Miao Embroidery, the compilation of teaching

materials for Hunan Miao Embroidery and the cultural inheritance of Miao Embroidery.

30 The second (enlarged) meeting of directors of the first session of National Innovation Association for Mulberry Industry was convened in Chongqing, China

On July 10, the second (enlarged) meeting of directors of the first session of National Innovation Association for Mulberry Industry was convened in Southwest University and more than 70 representatives from member units and specially invited units attended the meeting. At the meeting, a special report was made, related documents were studied and the Revised Regulations of National Innovation Association for Mulberry Industry were discussed.

31 2021 National Tussah Cocoon & Silk Work Conference was held in Dandong, Liaoning, China

On July 13, 2021 National Tussah Cocoon & Silk Work Conference and the Third General Meeting of Liaoning Cocoon & Silk Industry Association were convened in Dandong. During this period, a report on the work of the second council of the association was made, the third council members were elected, and the draft of the 14th Five-Year Plan of Liaoning cocoon & silk industry was studied.

32 2021 Guangxi Special Funds for Foreign Trade and Economy Development of the Central Government were issued to mainly support three types of cocoon & silk projects

On July 20, the Ministry of Finance of the People's Republic of China issued 2021 Guangxi Special Fund for Foreign Trade and Economy Development of the Central Government to boost structural optimization and industrial upgrading of cocoon & silk in Guangxi and accelerate high-quality development of the cocoon & silk industry. The special fund focuses on boosting scientific research and development, cocoon silk quality improvement and brand cultivation.

33 Intangible heritage projects regarding Song brocades and brocade of Dai nationality were selected into the pool of the 2021 National Cultural and Tourism Science and Technology Innovation Project

On August 3, Department of Science and Technology Education, Ministry of Culture and Tourism of the People's Republic of China released the list of 2021 National Cultural and Tourism Science and Technology Innovation Project reserve, among which four intangible heritage projects including Research and Application Demonstration on Key Technologies of Functional Song Brocade Design, Research on Color System, Institution Digitization and Industry Practice of Dai Brocade, Research and Innovation Practice of Yi Embroidery Living Inheritance Based on Artificial Intelligence and Semiotics, and Digital Innovation Application Demonstration of Pillow Embroidery of Manchu Nationality in Changbai Mountain were included.

34 A number of cocoon silk enterprises were selected into the list of China's Top 100 Garment Enterprises for 2020

On August 4, three indicators of China's top 100 garment enterprises were announced, with 127 enterprises nationwide being on the list. Among them, Xinyuan Cocoon Silk Group Co., Ltd., Zhejiang Babei Necktie Co., Ltd. and other five cocoon silk enterprises were selected as the top 100 enterprises regarding business income in garment industry in 2020; three cocoon silk enterprises such as High Fashion (China) Co., Ltd. and Jiangsu Huajia Holding Group Co., Ltd. were selected as the top 100 enterprises regarding total profit and operating profit ratio in garment industry in 2020.

35 The cocoon & silk development projects in Chongqing, China for 2021 were publicized

On August 10, Chongqing Commission of Commerce organized experts to conduct a special evaluation on the cocoon and silk development project in Chongqing in 2021, and planned to fund 30 projects, including Construction Project of Large-scale Intensive Sericulture Demonstration Base in Tianqi Village, Shima Town, Jiangjin District.

36 The special fund project for silk development of Guangxi in 2021 was publicized

On August 11, Industry and Information Technology Department of Guangxi Zhuang Autonomous Region and Department of Finance of Guangxi Zhuang Autonomous Region organized experts to evaluate the projects and publicized 32 silk projects of foreign economic and trade development funds in 2021, such as Construction of Electronic System for Raw Silk Spot Purchase and Sale of Bulk Silk International Trade Center.

37 20 pieces handed down by the royal family of the Qing Dynasty including the Cixi Dharani quilt were successfully restored

On August 14, 20 pieces handed down by the royal family of the Qing Dynasty made by Jiangning Imperial Silk Manufacturing were successfully restored. The Dharani quilt, female dragon robe with the characters "佛 (Buddhism)" and lotus mattress unearthed from Cixi mausoleum underground palace represented the highest level of textile technology at that time and reflected the characteristics of royal funeral customs.

38 Ministry of Commerce of Thailand strived to develop the silk industry in Thailand

On August 23, Ministry of Commerce of Thailand indicated that it would strive to improve the quality and value of Thai silk to meet the rising market demands and boost the export of Thai silk. The Ministry of Commerce suggested that all related enterprises should improve the silk weaving technology, increase the promotion of Thai silk and expand the export to overseas markets.

39 The Ministry of Commerce of the People's Republic of China issued instructions on the development of cocoon & silk industry during the 14th Five-Year Plan period

On September 9, the Ministry of Commerce of the People's Republic of China issued instructions on the development of cocoon & silk industry during the 14th Five-Year Plan period from three major aspects: General requirements, key tasks and

safeguard measures.

40 Multiple Chinese silk enterprises were included in list of the second batch of "specialized, refined, special and new" SMEs in textile industry

On September 13, the list of the second batch of "specialized, refined, special and new" SMEs in textile industry was officially unveiled, with 76 enterprises such as Hangzhou Wensli Silk Digital Printing Co., Ltd., Zibo Daranfeng Silk Group Co., Ltd. and Dehong Zhengxin Industrial Co., Ltd. being included in the list.

41 The new book launch of the Art of Chinese Silk Series was held in Beijing, China

On September 14, the new book launch of the Art of Chinese Silk Series appeared at the 28th Beijing International Book Fair. The series consist of ten volumes, each of which comprehensively, systematically and scientifically collates and studies the artistic development of Chinese silks from the Han Dynasty to the early 20th century, and describes the artistic style of silk patterns at that time and the cultural connotation behind them.

42 Wensli Silk was successfully listed in China's A-share market

On September 22, Wensli, A well-known silk brand with leading silk cultural creativity, made an initial public offering and was listed on Shenzhen Stock Exchange A-share GEM. As a listed enterprise with silk cultural creativity and silk technology as its core competitiveness, Wensli became the first veritable stock of Chinese silk cultural innovation.

43 The founding members' meeting of Make the Label Count campaign was successfully held, and the International Silk Union actively advocated sustainable silk

On September 30, the founding members' videoconferencing of Make the Label Count campaign initiated by International Wool Textile Organisation was successfully convened. Participants exchanged views on the sustainability of natural fibers, the environmental footprint of EU products, the formulation of EU

policies on natural fibers, and the launching plan that "Make the Label Count". At the conference, the International Silk Union actively advocated silk sustainability.

44 2021 China International Textile Fabric & Accessories (Autumn & Winter) Expo kicked off in Shanghai

From October 10 to 12, 2021 China International Textile Fabric & Accessories (Autumn & Winter) Expo kicked off at the National Convention and Exhibition Center (Shanghai), with an exhibition of nearly 200,000 m². It coordinated with the four major exhibitions, opened up all links from the perspective of the whole industrial chain and worked together to promote the "double circulation" of the industry.

45 The 130th Session of China Import and Export Fair was held in Guangzhou, China

From October 14 to 19, the 130th China Import and Export Fair (Canton Fair) was held in Guangzhou. It is the first fair adopting online-merge-offline mode and the first time to take promoting domestic and international double circulation as the theme. Most domestic purchasers were invited and the offline exhibition area was 400,000 m².

46 2021 China International Silk Expo was held in Hangzhou, China

During October 15 and October 17, the 21th China International Silk Expo was held in Hangzhou, China. At the expo deeply integrating silk and national customs, 2021 China International Silk Expo Proposal was released, four theme forums and seminars were held, interactive immersive exhibition areas were built, and a number of live shows and competitions were organized.

47 2021 China Intangible Cultural Heritage Research and Training Plan: Brocade Craftmanship Inheritance and Creative Design Workshop kicked off in Zhejiang Sci-Tech University

On October 19, 2021 China Intangible Cultural Heritage Research and Training Plan: Brocade Craftmanship Inheritance and Creative Design Workshop sponsored by Ministry of Culture

and Tourism of the People's Republic of China, Technological Department, Ministry of Education of the People's Republic of China and Ministry of Human Resources and Social Security of the People's Republic of China kicked off in Zhejiang Sci-Tech University. The one-month theoretical and practical learning was carried out in Zhejiang Sci-Tech University for 20 students for their comprehensively and systematically learning the history and culture, professional craftsmanship and inheritance and innovation methods of intangible heritage brocade.

48 Chongqing and Sichuan would work together to build a hundred-billion-level sericulture & silk industrial cluster during the 14th Five-Year Plan period

On October 21, Chongqing Municipal Commission of Commerce organized a symposium on promoting high-quality development of sericulture and silk industry in Chongqing. It was pointed out during the symposium that during the 14th Five-Year Plan period, the sericulture & silk industries in Chongqing and Sichuan would develop in a coordinated way, and they would work together to build a 100-billion-level sericulture & silk industry cluster.

49 Top ten innovative textile products for 2021 were released by China National Textile and Apparel Council

On October 21, China National Textile and Apparel Council carried out the work of cultivating and promoting the top 10 categories of textile innovative products in 2021, and decided to award 147 products in ten categories the title of "top ten innovative textile products in 2021". Among them, multiple silk products including the "Lady Gift" set of double-sided multicolour printing silk and porcelain, and washable pure silk quilts produced by Wensli Silk Culture Co., Ltd., "Fish's Happiness" series of silk pajamas set and organic silk bedding set produced by Jiangsu Huajia Silk Corp., Ltd., "Resonating with Nature" silk suits made by High Fortune (Zhejiang) Co., Ltd., the "Sun-proof Silk" series of silk sun-proof clothing made by Zhejiang Cathaya International Co., Ltd., "Empty Yard and Late Spring" series of digital printed silk bedding sets made by Sichuan Nanchong Liuhe (Group) Corp., multi-component silk jacquard mats and antibacterial mulberry silk/cotton underwear of Jiangsu Susi Silk

Joint Stock Co., Ltd. won the title of "2021 Top Ten Textile Innovative Products".

50 China-Cuba Sericulture Science and Technology Innovation Cooperation Project was launched in Jiangsu University of Science and Technology

On October 29, China-Cuba Sericulture Science and Technology Innovation Cooperation Project was launched in Jiangsu University of Science and Technology. At the opening ceremony, major achievements of Sericulture Research Institute of Jiangsu University of Science and Technology in scientific research and Sino-foreign cooperation projects and the project background, research content, target setting and technical route of "China-Cuba sericulture science and technology innovation cooperation" were summarized.

51 The scientific research team of China National Silk Museum published the innovation research results of ancient silk detection in *Analytical Chemistry*

On November 2, the scientific research team of China National Silk Museum published a research paper entitled Rapid Enrichment and Detection of Silk Residues from Tombs by Double-Antibody Sandwich ELISA Based on Immunomagnetic Beads in the top international journal *Analytical Chemistry*, which provides an innovative approach for the discovery of silk residues in tombs and is of great significance to the research on the origin of ancient silk.

52 The proposed list of Chinese textile model workers to be commended was publicized, and 14 people in the silk industry were selected

On November 3, the list of advanced collective labor models to be commended and advanced workers in the national textile industry was announced. 14 of the 325 National Textile Industry Model Workers commended were from silk industry.

53 Multiple silk enterprises participated in the 4th China International Import Expo

The 4th China International Import Expo was held in Shanghai

International Convention and Exhibition Center from November 5 to November 10 when a number of silk enterprises including Zhejiang Cathaya, Xinyuan Group and Suzhou Shangjiukai displayed new silk products incorporating more scientific and technological elements in the field of silk, showing the soft power of Chinese traditional culture.

54 The purchasing prices of Vietnam silkworm cocoons were raised

On November 8, the purchase price of silkworm cocoons in Bo Le, Vietnam reached 200,000 dong per kilogram, equivalent to 54 yuan per kilogram, hitting a new high.

55 Nanjing University developed a new type of nano silk with both abrasion resistance and comfort

On Nov. 8, a research team from Nanjing University, in collaboration with Stanford University, achieved sub-ambient daytime radiation cooling of nano-treated silk through molecular bonding design and extendable coupling agent assisted impregnation coating method.

56 Japan's silk industry planned to cooperate with Uzbekistan to secure a stable supply of raw silk

On November 12, Japan Silk Industry Development Cooperation Combination would establish a new mechanism to provide high-quality raw silk production technical guidance in Uzbekistan, central Asia, so as to provide a stable supply of raw silk to Japan.

57 Chinese scientists developed a degradable microneedle patch of silk protein that can be implanted into the brain for glioblastoma treatment

On November 15, a heterogeneous, heterogeneous and degradable microneedle patch based on silk protein was developed by a team of Chinese scientists for the treatment of brain glioma and related achievement entitled Silk Microneedle Patch Capable of On-Demand Multidrug Delivery to the Brain

for Glioblastoma Treatment was published in the journal of *Advanced Materials*.

58 The strategic cooperation agreement of digital sericulture joint innovation project was signed between State Key Laboratory of Silkworm Genome Biology of Southwest University and Chongqing Cloud Computing and Big Data Industry Association

On November 18, the signing ceremony of strategic cooperation framework agreement was held between State Key Laboratory of Silkworm Genome Biology of Southwest University and Chongqing Cloud Computing and Big Data Industry Association. The two sides would give full play to the advantages of high-level talents, digital technology and industrial resources to build a "digital + sericulture" synergy mechanism, so as to realize the deep integration and industrial empowerment of digital technology and primary, secondary and tertiary industry concerning sericulture.

59 2021 Video Conference of International Network of Silk Cities and Metropolis was held simultaneously in Lyon, France online and offline

On November 19, 2021 Video Conference of International Network of Silk Cities and Metropolis was held in Lyon, France, with over 60 representatives from the silk cities and Metropolis attending it online or offline. At the conference, the basic situation of various industry organizations and Silk Cities and Metropolis was introduced, Charter of the International Network of Silk Cities and Metropolis and Membership and fee payment scheme were deliberated, and the standing council of International Network of Silk Cities and Metropolis was elected.

60 2021 China National Arts Fund entitled Silk Culture Inheritance and Management Innovative Talents Training was launched in Zhejiang Sci-Tech University

On November 22, the Silk Culture Inheritance and

Management Innovative Talents Training Project sponsored by China National Arts Fund and organized by Zhejiang Sci-Tech University was launched, in which 15 trainees from all over the country participated.

61 Three sericulture systems were included in the sixth batch of China's important agricultural heritage cultural heritage list

On November 24, Ministry of Agriculture and Rural Affairs of the People's Republic of China organized the sixth batch of excavation and identification of China's important agricultural cultural heritage. As a result, 21 traditional agricultural systems (including 20 new projects and one expansion project) were identified as the sixth batch of important agricultural cultural heritages in China. Among them, Shanxi Yangcheng sericulture system, Jiangsu Wujiang sericulture system and Zhejiang Tongxiang sericulture system were selected.

62 The exhibition entitled Guangdong-Hong Kong-Macao Greater Bay Area and Silk Export in the Ming and Qing Dynasties appeared in Macau, China

On November 26, the exhibition entitled A Tale of Three Cities—The Guangdong-Hong Kong-Macao Bay Area and the Export of Silk in the Ming and Qing Dynasties was held in Museum of Macau. With a total of 112 groups of 201 exhibits from museums in Guangdong, Hong Kong and Macao and the themes of the Old Bay Area, Silk Export, World Changes and Bay Area Today, the exhibition would last until March 2022.

63 Guidance on the Development of Cocoon and Silk Industry in Sichuan Province in the 14th Five-year Plan period was released

On November 29, Guidance on the Development of Cocoon and Silk Industry in Sichuan Province in the 14th Five-year Plan period took into effect. According to the Guidance, by 2025, the production and technical level of silk industrial equipment in Sichuan Province and the benefits of comprehensive development

of sericulture resources would be greatly improved, the brand and cultural influence be significantly increased, and the independent control ability of the industrial chain and supply chain be significantly enhanced.

64 The first China Silk Industry High Quality Development Conference was held in Hechi, Guangxi, China

On December 10, the first China Silk Industry High Quality Development Conference and Hechi Silk Industry Investment Summit were held in Hechi, Guangxi. Focusing on the four themes of "development trend of silk industry", "application of sericulture biotechnology", "cultivation of the full silk industry chain" and "new concept of silk brand development", the conference and summit comprehensively combed the current development status and future development direction of sericulture and cocoon silk industry in China and abroad.

65 Overall, the prices of raw silk in China witnessed a significant rise in 2021

From January to May, under the influence of the boosted supply chain and export orders, tight supply, economic recovery, monetary easing and overall rising prices of bulk commodity, the prices of raw silk in China rose significantly, and the price of ordinary raw silk reached about 450,000 yuan/t at the end of May, with an increase of more than 30%. With large quantities of spring cocoons flowing in the market in May, the prices rose by 12% month on month. After May, bulk commodities were under intensive regulation and control. In order to balance the supply and demand, National Office of Cocoon Silk Coordination put raw silk into the industry. At the same time, due to the overall slowdown of demand growth in the second half of the year, raw silk continuously fluctuated and declined slightly, with the prices being about 440,000 yuan/t in late December.

To achieve sustainability and carbon neutrality of silk industry —Speech at Int'l Think Tank Forum on Silk Sustainable Development 2021

SUN Ruizhe

(President of China National Textile & Apparel Council)



Global climate change is affecting human society in a speed and a scale we have never seen before. It changes the ecology of industries and the landscape of economy and trade. Sustainability and carbon neutrality have become a general consensus and focus of cooperation of global industries.

Silk industry, connected with primary, secondary and tertiary industries, bearing the pursuit of human beings for better life, is a pioneering industry in globalization and symbolization. It is the industrial responsibility and of special significance to promote green innovation, green manufacturing, green consumption and recycling economy so as to achieve carbon neutrality as soon as possible.

Sustainability is certainly the right direction. We need to do the right thing and do it in a right way. Currently, there are some inappropriate international evaluation and practice on industry sustainable development. In particular, some one-sided information on the environmental impact of silk industry have misled both silk producers and consumers, and impeded the sound development of the industry.

The main purpose of the Forum is to seek for a scientific solution to achieve carbon neutrality, and an objective methodology to evaluate the life cycle of silk products to protect the image as well as interests of global silk industry.

Carbon peak and carbon neutrality are not only China's own need

to secure sustainable and high-quality development, but also a right choice for building a community with a shared future for mankind. In 2020, China announced to strive to peak carbon dioxide emission by 2030 and achieve carbon neutrality by 2060. Such commitment means that China will accomplish the maximum carbon emission reduction in a much shorter time span than what might take many developed countries and that reflects the resolution and decisiveness of China.

China's silk industry will also join the action with global partners and make contribution to the silk sustainable development. I'd like to put forward three suggestions to all the colleagues and friends in the world silk industry.

First, we need to set goals by seeking truth from facts. To achieve carbon neutrality, we must respect objective laws, make plans in line with industry realities and take action step by step.

Second, we need to tackle the most pressing issues first to enhance overall capability. We will build a green, low-carbon and recycling silk industry system to foster the green transformation of the entire value chain from raw materials, designing, production to recycling.

Third, we need to work globally to meet challenges. We will increase exchanges, strengthen promotion, reach consensus and carry out project cooperation to seek a convergence of interests in realizing the carbon neutrality of global silk industry.



Calculation and assessment of textile products' carbon footprint with modular theory

DING Xuemei

(Professor of College of Fashion and Design, Donghua University)

1 Team profile

Led by Professor DING Xuemei of Donghua University, the green sustainable development research team of textile industry focuses on carbon footprint, water footprint, chemical footprint and waste footprint of textile industry, enterprises and products, and strives to carry out systematical research on key issues such as methodology system, database construction and standard formulation of accounting, as well as evaluation and application, so as to provide green production solutions for textile enterprises, and make green development decision-making suggestions for industry institutions and government functional departments.

The team now comprises two professors, two associate professors, 15 doctoral students and 28 master students, involving members of the Second LCA Sub-Technical Committee of the Environmental Management of Standardization Administration of China (SAC/TC207/SC5), consultants of the policy working group-China working group of Fashion Industry Charter for Climate Action (UNFCCC), members of the working group on LCA of China's textile and garment industry, deputy director of Technical Committee for Standardization of China Textile Engineering Society and experts of China WTO/TBT oversea notification review (textile and garment group), etc.

2 Research contents

In the field of carbon footprint research of textile enterprises and products, there are following characteristics: textile products involve a long production chain and the processing modes of different enterprises vary greatly; a wide range of products are involved; inputs (energy, water flow and material flows) and outputs (process product flows and pollutant flow) are complex;

shared and symbiotic data is fused and enterprises' measurements of inputs and outputs data are rough. Taking into account these characteristics, the team has carried out a series of innovative basic theoretical research work and the main research contents are as follows:

1) Shared and symbiotic cross-fusion data decomposition method in textile production and processing

After the types of textile products and cross relation between the input-output shared and symbiotic data are clarified, the life cycle inventories are decomposed into carbon footprint calculation modules with relative independence and specific functions by product splitting method, hierarchical splitting method, auxiliary production splitting method and so on. As a result, the principle and method of quantification and splitting of carbon footprint accounting data are established, solving the problem of cross fusion and rough measurement of shared and symbiotic data in textile production.

2) Modular carbon footprint accounting method for textile products

A carbon footprint module database is built by taking full account the characteristics of different stages in the life cycle of raw material acquisition, production and processing, use and disposal, deconstructing the complex relationship and influencing factors of input and output of environmental resources in various unit modules such as raw materials, products, chain segments and process units and decomposing in modules the complex and diverse production process chains of textile products. The modular carbon footprint accounting method for textile products is established by building blocks with module calling and assembly, which solves the problem of data measurement of enormous textile product types (Fig. 1).

3) Multi-dimensional carbon reduction assessment method for textile enterprises

The dimension-descending algorithm of principal component analysis and the similarity evaluation method of multi-dimensional scaling are adopted based on the characteristics of the textile industry, product attributes, processing technology, processing mode and other multi-dimensional evaluation indicators. As a result, a multi-dimensional evaluation system of three-level evaluation indicators intergrated with Monte Carlo indicator weight assignment is constructed and multi-dimensional carbon emission reduction assessment method for textile enterprises is established,

solving the problem of carbon emission reduction assessment for different textile enterprises.

4) Research on standardization of carbon footprint of textile enterprises and products

Based on the life cycle theory, carbon footprint theory and the general rules of international standards, the team has taken the lead in drafting and publishing a series of technical standards for carbon footprint accounting and evaluation methods of textile enterprises and products at home and abroad according to the textile enterprises and product environmental impact characteristics, which fills the gap of technical specifications in this field.

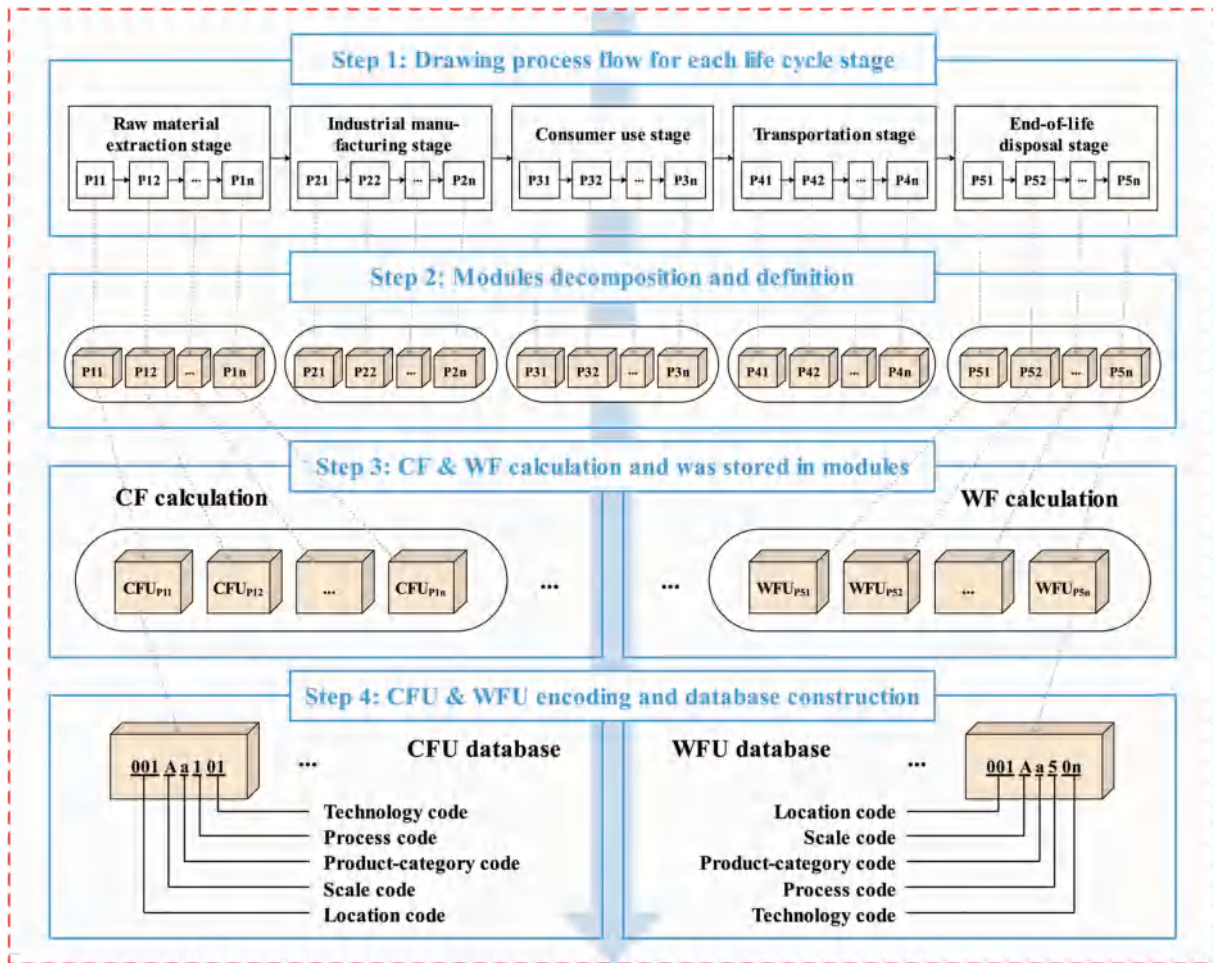


Fig. 1 Calculation method of textile products' carbon footprint with modular theory

Enhancing cooperation, promoting the global development of sericulture and silk industry

Rajit Ranjan Okhandiar

(Secretary General of ISC)



The global silk industry is currently undergoing many challenges on a number of issues, a few of which are: rapid industrialization, threat from manmade fibers, adoption of sustainable production process, climate change, influx of spurious silk, need for global information network for silk, generic promotion, trade restrictions, product diversification, use of silkworm and silk in other areas, global study on silk industry, private investment, etc. Although these are some of the major issues, we would like to identify few them as ‘common areas of collaboration’ between ISC and ISU.

1 Developing global sustainability standards for silk

Sustainable production is the creation of goods and services using processes and systems that are non-polluting, conserving energy and natural resources, economically viable, safe and healthy for workers, communities, and consumers. In many countries, the consumers’ choices are increasingly inclined to sustainable products, more particularly the textile materials. Consequently, production of many textile fibres are in the path of change with the aim of manufacturing environmentally sustainable products by suitably transforming the production processes.

Of late, some sections of the apparel and fashion industry have developed a sustainable Index which portrays silk as the least sustainable product, said to be due to the excessive usage of water, energy, chemicals, pesticides, etc., during the production process. While the ISC is in the process of countering this narrative and removing the index, we find that some of the silk production processes are required to be properly revised to make the industry environmentally sustainable. With the development and introduction of sustainability guidelines by International Organization for Standardization (ISO) and the

Product Environmental Footprint Category Rule (PEFCR) by EU, the future trade of silk in many developed countries would be subject to complying the sustainable production standards. It is ironical to note that there are no credible Life Cycle Assessment (LCA) data available for silk that truly reflect the production process in different geographical regions of the world. Due to this, it has increasingly become difficult to portray silk as a sustainable fibre compared to other textile fibres. Hence the immediate task for the global agencies of silk must be to develop sustainability standards for silk and get it endorsed by ISO and EU.

China and India contribute 98% of the global silk production. So, an LCA study undertaken in the production bases of these two countries would serve the purpose of developing the global sustainability standards. In order to create this standard, the ISC, ISU, Indian and Chinese governments may jointly undertake a LCA study by sharing knowledge, resources and finance among themselves. A Committee of scientists and technocrats can be constituted to undertake this study and results can be aggregated based on the contribution of silk production in the respective countries. The ISC and Indian government can undertake the study for India and ISU and Chinese government can undertake the study for China. The aggregated results of both the studies can be averaged suitably and termed as global standard and later the same shall be submitted to ISO and EU for its global recognition.

2 Global study on silk industry and developing the "Global Information System on Silk and Silk Commodities"

The last time a global study on silk industry was undertaken during 2001 by the International Trade Centre (ITC). The ITC has discontinued this important exercise due to financial

constraints and the attempts by ISC to revive the same could not be succeeded. This study would have been extremely useful for the global silk industry any time especially during the covid induced crisis to understand the actual trend on production, demand, consumption, product choice, etc. Being the dominant leaders of the silk industry, China and India may join together to revive this annual study under the aegis of International Sericultural Commission (ISC) and International Silk Union (ISU). As part of this initiative, a "Global Information System on Silk and Silk Commodities", with the aid of artificial intelligence, may be developed and operated by both the organizations for the benefit of industry stakeholders. The initial finance required for undertaking the study could be sourced from global trade agencies or other funding agencies. The Information System can be maintained by the respective organizations at their respective Head Quarters.

The information system can be subsequently expanded by integrating the mulberry and silkworm genetic resources, cocoon and raw silk standards, the silk designs of the various geographical regions of the world, bibliography on mulberry and silkworms, and all other information related to sericulture and silk industry.

3 Generic promotion of silk

The historic travel of silk fibre as a material of immense value and desire through almost all the ancient civilizations of the world like ancient China, Mesopotamia, Indus Valley, Egypt, Persia, Greek, Roman, Byzantine, Otoman, Mongol, etc., has created a Royal Image for SILK bestowed by rulers and consumers alike. May be silk is the only fibre that has been widely accepted in all these civilizations. It is critically important to maintain the rich heritage of silk for its sustainable existence in the coming days.

The recent reports emanating from the silk markets indicate that spurious silk products are flooding the market, especially after the easing of Covid-19 restrictions. This issue is more prevalent in Europe, USA, Thailand, India, Vietnam, Philippines, Bangladesh, Srilanka, etc. Coupled with this, raw silk is smuggled and sold at cheaper rates in certain countries. The Most Favored Nation (MFN) status allotted to certain countries is misused by the market players for fraudulently

dumping silks, very often of inferior quality. These issues are creating considerable harm to the already fragile silk industry. Further, the word 'Silk' is used with all types of products like Shampoo, synthetic fibers, cotton, etc. This is not a good practice and would adversely affect the image of silk.

In order to counter above problems, generic promotional activities for silk may be taken up all across the globe. For aligning with the preference of the present-day consumers, special efforts may be adopted for highlighting the eco-friendly characteristics of the silk, the involvement of poor and downtrodden people in the production process and the contribution of silk industry for achieving the SDGs mandated under United Nations. These measures, apart from significantly enhancing the demand of silk in the global market would also ensure maintaining the rich legacy of silk for posterity. Promotional activities may be continued in the domestic market to ensure stability to the industry, even during a crisis situation. As part of generic promotion, coordinated actions may be required to take up the matter with World Intellectual Property Organization (WIPO) to prevent the illegal use of "Silk". The word "Silk" must be allowed to use only for pure silk products.

4 Protect the interest of silk

Historically, silk as a textile material has been facing various challenges and there have always been a way out to arrest these fallouts. However, some of the present-day challenges are likely to emerge as existential crisis, which need to be tackled in a more pragmatic manner, particularly on a collaborative and coordinated manner by all the stakeholders. There is stiff competition from manmade textile fibres not only in consumption space, but also they are hijacking the innate properties of silk for solely promoting their products. There are no sector specific criteria for natural fibres, including silk, in the global trade guidelines framed by the global bodies or by many governments. Silk is just treated like any other textiles, due to which regular tariff rates and quota restrictions are imposed which adversely affecting the growth of the industry. Hence, coordinated actions are required at global level to protect the interest of silk on many issues that are cropping up very often in the supply chain activities.

The actions for silk community to Higg MSI Index

Stefano Vitali

(Vice Chairman of International Silk Union & President of Ufficio Italiano Seta)



UFFICIO ITALIANO SETA

18 months ago we could never have imagined what was going to happen during the coming months. 2020 will remain in our memory as the worst year for Italian silk industry, since the Second World War. No more events, no more meetings, no more tourism, shops closed in Italy, in France, in Germany, in UK, in Spain, in USA.

We expect some recovery and an increase in the demand for silk, but we see the clouds hanging over the future of our fiber. In garments making, we see increasing shift from silk to other continuous filament fibers. This is happening not only because of price pressure, as it already happened in the past, but also for innovation and marketing strategies of producers of man-made fibers.

HIGG material sustainable index aims to promote the image of synthetic fibers and discloses misleading, incomplete and not verified information on silk. Sustainable Apparel Coalition is a very powerful association and marketing strategy may be very strong, but the scientific approach of HIGG Index is very, very poor. Moreover, SAC has not revealed methods of calculation. No reference to ISO rules or Internationally recognized standards and China has not been consulted on the matter. SAC only based its data on silk production in India. By the way, the ISC (International Sericultural Commission), an Indian body representing the country's silk industry, has lodged an official complaint to the FTC about silk's score on the Higg Index.

"Cradle to gate" approach. Why? Silk is a renewable resource, can biodegrade unlike other fibers. As far as circular economy is concerned, the proper approach is cradle to end of life, including use. Arbitrary selection of some specific impact category and of their importance. Few sources of information and very poor quality of data used to calculate the Index. It is staggering to realize that HIGG Index does not refer at all to studies undertaken in China.

We have a lot to say about HIGG Index and the way it has been developed. We have a lot of arguments. For our silk Community it is important to react properly and wisely. We know how many universities may be active, especially in China, in making a serious study regarding the real impact of silk on the

environment. There are several experts, in our opinion it is necessary to gather them and to coordinate the research with the support of the most valuable skills.

We may obtain very serious scientific baselines, with the support of the entire silk community and we do need that China can finally let hear her voice, as being the biggest producer of silk worldwide.

It is necessary, it is the first leg of our walk, but it may not be enough. Marketing approach is the second leg and this involves silk users all over the world and proper communication strategies. We do not want a useless war against synthetic fibers, this is not our point. On the contrary, actually the platform provided by SAC, might be useful for us. We need to gather data asserting how eco-friendly the silk is and ask SAC to accept these data. Once these data will be inserted in SAC platform, silk will finally have and International recognition and her own voice.

Since ever, silk has always had its particular image, which makes it different from all the other fibers. Nowadays it is no more sufficient. Nowadays we must wake up and work hard for promoting a modern image of silk as well as underline that silk is not only a fiber, a fabric, silk is a cultural heritage not only of China but of the whole world and should be protected.

Up to now there has not been a new official strong voice defending silk and explaining the wonderful world which is behind this fiber. Now we have a great chance; to use the HIGG Index case to let the world know how green silk is.



Several concerns regarding global silk supply chain

Xavier Lepingle

(Vice Chairman of ISU, Director of ISU Fashion Design Professional Committee & President of INTERSOIE France)



The interest in a sustainable textile and fashion industry is a fundamental trend. The health crisis has accelerated the evolution of many consumers' preferences towards more sustainable products, less polluting and socially responsible. The global silk supply chain needs to show a strong commitment to these issues.

At first, I'd like to say that we need to reinforce the silk supply chain with a new common language giving clear information to measure and characterized the quality grade of raw silk. It means to define a new classification of raw silk, based on the electronic test technology (standard ISO 15625). I would like to add that this new classification should also take into account traceability, as well as social and sustainable requirements.

I welcome the continued support of ISU to work together successfully in this area. Now the objective is to validate a new relevant approach under Radar representation to describe and classify raw silk. Let me remind you that it can help the silk producers to orientate efficiently the raw silk lot for the production of the silk yarn, depending on the end use of this silk yarn. By the way, it means that we will improve the production efficiency

and reduce waste of silk manufacturers. With an appropriate system, we will meet a step towards sustainability.

Secondly, with respect of sustainability, we need to better promote silk. Today, we are all convinced that Silk has environmental qualities that should be highlighted. It's time to advocate positively silk and its process of transformation. I think that ISU has a role to play in promoting the silk fiber and the Think tank forum is a good starting point for reflection, joint action and strategy to promote and improve the good positioning of silk in terms of environmental impact and CSR.

In addition to this, the partnership between ISU and ISC is an excellent way to build a global position. Furthermore, the works and conclusions of our silk professional community may be promoted through Silky cities network, which gives the opportunity to explore complementary initiatives bringing silk into focus. As INTERSOIE, we are also ready to contribute to the sharing of ideas and experiences.

As a final point, I'd like to say that it is not question to defend silk competing with other fibres but highlighting silk as a key textile material of sustainability and circular economy.



The fallout of Higg Index on silk and the way forward

Dileep Kumar R

(General Coordinator, International Sericultural Commission)



Sustainable Apparel Coalition (SAC), a USA based global initiative has introduced a sustainability index namely 'Higg Index' for products and services, including silk. This index portray silk is an unsustainable fibre based on fabricated and unsubstantiated information and data. ISC has undertaken a detailed investigation on the formulation of Higg Index and found out major flaws which revealed the deliberate and malicious attempt of SAC to defame the centuries old richness and heritage of silk. Realising this dangerous ploy, ISC has embarked into a series of actions intending to withdraw the Higg Index from public space. Apart from these actions, ISC would like to collaborate with agencies associated with silk industry to initiate similar actions against SAC and also to develop global sustainability standards for silk that truly reflect the production process across regions. The evolved sustainability standards shall be made available for public use after validation by ISO and PEFCE authorities.

Sustainability Standards: Sustainable production is the creation of goods and services using processes and systems that are non-polluting, conserving energy and natural resources, economically viable, safe and healthy for workers, communities, and consumers. In many countries, the consumers' choices are increasingly inclined to sustainable products, more particularly the textile materials. Consequently, production of many textile commodities is in the path of change with the aim of following environmentally sustainable production processes. The sustainability standards of products and services are evolved by undertaking Life Cycle Assessment (LCA) studies. LCAs take into account the product's full life cycle: from the extraction of resources, production, use and recycling to the disposal of the remaining waste. Life Cycle Assessment (LCA) consists of 4 phases; 1) Goal and Scope definition, 2) Life Cycle Inventory

(LCI), 3) Life Cycle Impact Assessment (LCIA), 4) Life Cycle Interpretation (LCI). Since the early 1990s, numerous LCA methodologies have been developed. The existence of several different methodologies has sometimes created unnecessary confusion partly due to differing results, depending on the methodology chosen. Consequently, ISO stepped into the scenario and developed guidelines for Life Cycle Assessment through ISO 14040: 2006 and 14044: 2006. Although this measure brought some standardization to a general framework, they did not provide a technically-detailed standardisation.

The United Nations Environment Programme and the Society of Environmental Toxicology and Chemistry (UNEP/SETAC) Life Cycle Initiative, aided further developments towards consensus and a recommended best practice, and this work has since been complemented by the activities of many other organisations, such as the United States Environmental Protection Agency (US EPA) and the European Commission. The European Commission has brought out a detailed guideline on LCA study through the Product Environment Foot Print Category Rules (PEFCE), which is widely accepted in the world. The major impact categories assessed under the LCA study are: 1) climate change, 2) ozone depletion, 3) human toxicity, 4) respiratory inorganics/particulate matter, 5) ionising radiation, 6) photochemical ozone formation, 7) acidification, 8) eutrophication, 9) ecotoxicity, 10) land use, 11) resource depletion, and 12) water use.

1 Areas of contention

Although the PEFCE guidelines are greatly harmonized in developing sustainability standards, we found that the one-size-fits-all PEF method of accounting for all product categories is flawed for the natural textile category. A level playing field is not possible with a rating scheme that does not reward the attributes of

natural fibres and does not penalise key environmental impacts of fossil fuel-based fibres. The PEF Method's failure to consider and account for renewability at the start-of-life, biodegradability at end-of-life and to completely overlook microplastic pollution will mislead well intentioned consumers. The contributions of natural fibres for achieving the Sustainable Development Goals (SDGs) of United Nations are not incorporated in the PEF methodologies, which is a great injustice to millions of rural and downtrodden people finding their livelihood in the sector. Without improvement, the PEF method will cause significant collateral damage to all-natural fibre industries, including silk.

Apart from the above, we find that some of the private global initiatives are developing sustainability standards by creating methodologies and criteria suiting to their vested interests. These fake indexes are creating considerable damages to the natural textile fibre industry. The classic example is the "Higg Index", created by Sustainable Apparel Coalition (SAC), a USA based global initiative, a front agency for promoting the synthetic products.

2 About SAC and Higg Index

In simple terms, the Higg Index indicates that silk is 30 times worse than polyester in terms of the environmental sustainability factors. This is nothing but belittling the fact that silk is an environmentally sustainable product, the sustainable existence of which can be traced back to more than 5,000 years. As a fallout of the Higg Index, the Global Fashion Agenda has already advised its members to reduce the use of natural fibres by 30%.

The SAC has developed and published the above indexes without consulting the respective stakeholders including ISC, the only inter-governmental agency for silk, nor any of the silk producing and consuming countries and any of the experts in the field. The extensive use of Higg Index by the synthetic manufactures, who are also SAC members, for promoting their products is creating considerable harm to the silk sector, wherein about 22 million people from the rural area are finding their livelihood.

3 Major flaws of Higg Index

We have undertaken a detailed investigation on the

development of Higg Index and found serious flaws on a number of areas, the details of which are briefly summarised as below:

1) As per the globally accepted methodologies, the LCA study must be undertaken under the Cradle to Grave or Cradle to Cradle approach to derive data pertaining to sustainability based impact categories. However, the Higg Index has been developed based on "Cradle to Gate" approach, thereby avoiding certain critical impact assessment categories intrinsically favouring natural fibre sector, including silk sector. Further, on a deeper study on this issue it is revealed that the use and disposal phase of the value chain activities are highly disadvantageous to the synthetic products compared to natural products. SAC, thus concealed the negative aspects of synthetic fibres by adopting cradle to gate LCA which ultimately resulted in portraying silk as the worst textile fibre. It is also pertinent to add here that the microplastic pollution that occurs during the use phase of synthetic dress products can create serious health issues to living organism. This serious issue has also not been accounted for the impact assessment.

2) Many aspects of Sustainable Development Goals (SDGs), like employment generation, women empowerment, environmentally sustainable production process, poverty alleviation, etc., are intrinsically associated with the silk industry. But these factors are not accounted for determining the Higg Index.

3) There is serious lapse on the data quality assurance as mandated under the ISO and PEFCR for evolving the Higg Index. ISC has been informed by the SAC that they have adopted the study results of Astudillo et al. (2014) of Oxford University on Indian silk industry which contribute 18% weightage to the index. But the authors themselves informed ISC that their study was meant to throw light on issues associated with silk production, and was based on one specific scenario, real, realistic but also specific. They further stated that for the Higg Index, their study result was taken out of context by-apparently-being used as a generic pattern of sericulture. As such it is totally misunderstanding, and thus misrepresenting. They are also not aware of the fact that their study report has been used by a commercial data base provider and later by SAC for developing Higg Index, which has economic and other benefits. The authors

also recommended that a specific LCA study must be taken up for silk by taking into account of silk industry's contributions to Sustainable Development Goals (SDG) of UN and other innate properties of silk as a bio-fibre. It may also be noted that the data used for the purpose are sourced of a 2006 study, which is not only unrelated but also outdated.

For the 82% weightage on the index, the LCA data on Chinese industry should have to be adopted. The SAC claimed that they have obtained this data from the paper published by Huo Y (2017). But ISC found that there are no LCA studies by this author nor any LCA study so far undertaken on Chinese silk industry. SAC has not provided us a copy of Huo Y (2017) report, inspite of ISC's specific request. Hence, it is conclusively proven that SAC has fabricated 82% of the data pertains to China, the major silk producer of the world, for deriving the Higg Index.

4) As per the ISO and PEFCR guidelines, the study results, if at all undertaken under the Cradle to Gate approach, shall be used for internal consumption only and hence never to be disclosed in public space. It was also explicitly made clear that such half-baked outcomes shall not be used for comparison among the products. However, the SAC deliberately flouted this rule by allowing its members to compare silk and synthetic products, thereby severely damaging the image of silk among the consumers.

5) For deriving the Higg Index scores of different products, the basic premise of sourcing representative data truly reflecting the production bases has not been followed. For example, the results of a study undertaken among 100 farmers in a remote area of Tamilnadu province of Indian State have been used to extrapolate the data of silk for the entire country. In case of synthetic products, which has the major production base in Asia, data modelled by a high-end factory in Europe has been used for developing the Higg Index of synthetic textile products. It is ironical that both these products are compared to determine their environmental sustainability, which is highly unfair.)

6) There are more than 12 impact assessment categories, as detailed at Para 2, for arriving the environmental sustainability of the products. However, the SAC resorted in cherry picking 5 categories alone, of which two of the categories have only moderate impact on the final result. Thus, the Higg Index does not

truly reflect the sustainability of the products under assessment.

7) The ISO and PEFCR guidelines do not subscribe for aggregating the scores of impact assessment categories as such figures shall be highly misleading and do not help in resolving contentious issues. However, the Higg Index resorted in arriving aggregated score for the products, including silk, which is once again proved to be a highly unfair practice adopted by SAC.

8) As per the Higg Index methodology, a Data Submitter should submit the data in due process to calculate the Higg Index score. In case of calculating Higg Index for silk, no one from the silk sector ever submitted the Data, nor did they approve to publish the Higg score. Apparently, the authors of study report have not submitted the data for seeking the Higg Index score. It appears that the Higg Index score was developed with the specific purpose of comparing and promoting synthetic products for certain influential members of SAC thereby degrading the value of silk. This is a serious breach of all the existing guidelines.

9) The PEFCR and ISO standards provisioned innate space for consultation with respective stakeholders before finalizing the LCA study results. But we are constrained to note that the SAC has not consulted with the stakeholders involved in silk industry, and not even with the authors, whose LCA study report has been used for developing the Higg Index. There are no experts on silk in the Advisory Council of SAC nor in the entire "Involved Parties" list of Higg Index to validate the score for silk. It is also of great concern that the SAC has never consulted the ISC, the only governmental agency for silk, for deriving the Higg MSI.

10) The SAC refused to share information on arriving the Higg Index, although ISO guidelines (ISO 14044 2006) provided specific provision under 5.1.2 to share such details under "third party reports". There is no transparency in all the dealings of the SAC.

4 Actions initiated by ISC

Since the second half of 2020, the ISC was in touch with many industry partners and experts to investigate and assess the fallouts of Higg Index on silk industry. Our studies have concluded that the existence of such sustainability score has the potential to severely dent the image of silk and resultantly the demand for silk in the global market could be significantly

reduced. The signs of such repercussions are beginning to be noticed as the Global Fashion Agenda has already advised its members to reduce the use of silk by 30%. We have thus initiated a series of actions against the Higg Index and also decided to create the sustainability data base of silk, that truly reflects the nature of the industry across the production bases. Our actions are summarised as below:

1) We have contested the use of Higg Index for silk based on the above facts and requested SAC to suspend the Index till an independent LCA study is undertaken to derive credible sustainability data pertains to silk that are truly reflecting the production practice adopted in different countries. However, the SAC has refused to accept our proposal to suspend the index nor to undertake an authentic study on arriving the sustainability criteria of silk. Consequently, ISC has given a strong warning to SAC that further displays of the Higg index on silk in public domain would attract punitive actions for safeguarding the interest of silk.

2) Since no action was taken by SAC to suspend the Higg Index, ISC launched an official complaint with Federal Trade Commission (FTC), USA on 23rd March 2021, as the FTC is the responsible body for regulating the activities of such firms located in USA. FTC has already responded to our complaint by informing that the issue is being examined in detail for consideration. We expect a strong action from FTC due to the simple reason that such actions amount to "Greenwashing", which is considered as a reprehensible act as per the environmental guidelines of US government. Greenwashing is termed as an unsubstantiated claim to deceive consumers into believing that a company's products/actions are environmentally friendly.

3) At present, the existing standards of International Organization for Standardization (ISO) for LCA studies (ISO14040 and 14044) are meant for all products and services, irrespective of natural or manmade materials. Hence, ISC requested ISO to develop separate LCA standards for natural fibres, including silk. We have also requested all ISC Member Countries to write ISO on similar lines. We have been following up the matter with ISO regularly.

4) We have been in touch with other international agencies dealing with wool, alpaca, leather, cotton, flax, etc., to object

the use of Higg Index for their products, and initiate similar action as in the case of silk. Many of these agencies have already been written to FTC and ISO and the process is going on.

5) We have been campaigning with "Apparel Insider", a UK based magazine about the ill effects of Higg Index. Further, efforts are on by promoting the advantages of silk by writing articles in international magazines, like the recent article entitled "Silk and the importance of SDGs" that appeared in the January 2021 issue of Apparel Insider. There are many articles appearing in international magazines and online forums on the ill effects of Higg Index.

6) The aggressive actions of ISC to protect the interest of silk have been attracting the attention of similar international agencies for natural fibres all across the world. Consequently, the International Wool Textile Organization (IWTO) has invited ISC to join with them for creating a global initiative namely "Natural Fibre Coalition". The main intention at present for creating this coalition is to campaign with the EU for including special qualities of natural fibres in the Product Environment Footprint (PEF) methodologies of EU. IWTO states that the PEF methodologies fail to consider and account for renewability at the start of life, biodegradability at the end of life and completely overlooked microplastic pollution of synthetic products. ISC also found that many of the Sustainable Development Goals (SDGs) of UN are innately associated with silk industry, the criteria of which need to be incorporated in PEF methodologies and Category Rules (PEFCR). Considering the enormous importance of this issue, ISC has now become part of the "Natural Fibre Coalition".

5 The way forward

ISC has been in contact with ISU to work jointly for evolving a mechanism for suspending the Higg Index in the instant case and further to develop standardized sustainability data for silk at global level. As a response to our efforts, the ISU has now convened a Webinar entitled; "International Think Tank Forum on silk Sustainable Development and International Silk Union Chairman Meeting" on Thursday, the June 10th, 2021. The ISU proposes that the forum launch a Joint Initiative on Global Silk Sustainability and Green Consumption, which is going to show our commitment against Higg Index and decide the future steps for silk

sustainability, and maintain the international image of silk. In this regard, we propose the following actions as the way forward by ISC and ISU:

1) ISC and ISU jointly work together to evolve a forum to work against the malicious attempts by certain groups like SAC, whose actions are harming the silk industry. As part of this, ISU on its level may launch a formal complaint with Federal Trade Commission, USA on the use of Higg Index, due to the various reasons as explained above. This would bolster the efforts of ISC for suspending the Higg Index. All information and documents for launching the complaint shall be provided by ISC.

2) The ISU may campaign with ISO through the Chinese government for creating separate LCA standards for natural fibres/products as the provisions contained in the existing LCA standards; ISO14040 and 14044 are not able to account the innate qualities of natural products.

3) So far, no credible LCA study on silk or silk products has been undertaken that truly reflects the production base and by following the prescribed guidelines of the ISO and PEFCR. Hence, it is critically important to create credible and standardized LCA data on silk for public use. China and India being the largest producers of silk in the world (98%), it is proposed that a global LCA study can be undertaken through collaborative actions by ISC, ISU, Indian government and Chinese government. All the partners can share expenditure for the LCA study.

4) The global forum can constitute a global study group to conduct the LCA study, comprising scientists and experts with a common agenda of action. The study results can be used for arriving the global sustainability data for silk. This data can be made available to the international forum after validation by ISO and other environmental agencies in UNEP-SETAC, EU, etc. We may also ensure the participation of few selected experts, technocrats, policy planners, etc., from all over the world for providing inputs to the study.

5) The ISU may join with the "Natural Coalition Forum" initiated by IWTO with the sole purpose of incorporating natural qualities and SDG features of natural fibres in the Product Environment Footprint (PEF) methodologies of EU.

6 Conclusion

We greatly appreciate ISU for organizing this Forum with the sole purpose of removing the Higg Index on Silk. We have already explained some of our thoughts on the issue. At the same time, this occasion is also providing a unique opportunity for both the organizations to collaborate on various other issues, which can substantially facilitate the global development of sericulture and silk industry. A report on this subject shall be separately presented by the Secretary General, ISC through a paper entitled "Collaboration between ISC and ISU for the global development of sericulture and silk industry". Thus, we earnestly look forward for a close collaboration between ISU and ISC for the cause of Silk, the Queen of Textiles.

Silk environmental and the concerning of Higg index

Graziano Elegir

(Head of Innovhub Silk Division)

I will focus my speech on environmental issues, more particularly on the concern of our sector in relation to Higg Index which indicates silk as being the worst among textile materials, about thirty times worse than the most common synthetic fibres used by textile industry. Of course, knowing the high importance of using renewable resources in sustainable development, the senumbers sound unbelievable by exports in our sector. Nevertheless, we should ask ourselves why we got to this point and what we can do about it from now on.

A good review of Higg MSI was published in 2019 by an Australian Environmental Agency in the scientific journal *Sustainability*. The research was funded by Australian Wool Innovation Limited and Australian Government.

We (in Italy) basically agree with most of the comments raised by them, particularly with following statements: 1) The choice of functional unit (one kg of material) is not always the most suitable for a fair comparison; (light weight of silk cannot be taken into account); 2) the system boundary does not include the use of the product (life-time) and its end of life (reuse and recycling); 3) there is no reference to commonly used standard (ISO 14020, EPD, PEF) for comparative analysis and public disclosure; 4) the set of impact category indicators is very limited; 5) the results expressed as single over all score is questionable and particularly the use of weighting factors, which are optional elements of LCIA and their use is not fully transparent; 6) finally, few old data sources are used to assess the impact of silk production. Inventory data for silk are mostly based on a survey conducted in 2011 (and a previous one in 2006), which was developed using a small, unrepresentative low technology silk production farm inventory from the Karnataka State in India, and does not include China which is the largest global producer using high technology production system.

However, we have recently accessed Higg Index (between end of April and early May 2021) and looking at details of Silk Higg Index score, it is noteworthy to mention at least two facts: 1) the impact of raw material production account for more than 85% in all categories used by this tool; 2) it is now mentioned that data are taken both from China and India although no reference to specific study is made.

Therefore, there are for sure several methodological comments we can raise pointing out the unfair comparison among fibres and public disclosure, as well as, lack of transparency

regarding the data used to assess and weight the impact of raw material production but we likely need to make a further step forward. (e. g. The above mentioned Australian Agency is currently working at an alternative "renewability indicator" to allow a fairer comparison between natural and synthetic fibres)

So when it comes to silk sustainability. On one hand, if it is true that despite the growing environmental concern in the textile sector, still very few LCA based analyses have been carried out on silk raw materials and silk-made fabrics (or at least are available in scientific literature). On the other hand, we cannot accept unfair comparison and therefore we must react properly relying on a scientific based approach.

In the last few years, Innovhub, in collaboration with a Swiss University, has conducted a gate-to-gate study for the definition of product category rules aimed at Environmental product declaration (EPD). In this study, field-data were collected from thirteen manufacturing companies in the Como district and some environmentally related hot spots were identified as well as a set of suggestions for technologies and approaches supporting the improvement of the industry environmental performances were derived. Additionally, some data regarding raw material production in China were collected in this study but these were limited only to four farms. This work could pave the way for future environment labelling and certification of silk products, but unfortunately the results so far have been published only in a book with relatively poor distribution considering the global scenario. In the next months, it will be our duty to target a publication in a scientific Journal to improve visibility of these data.

Nonetheless, referring to Higg Index it appears clear that the main issue is the collection of more representative field data regarding raw material production because in the Higg score index the main impact is actually attributed to sericulture. With regards to this point in the next months we would expect a greater commitment from China which represents the leading country for silk and particularly the larger worldwide raw material producer.

In this context we are ready to put more and more efforts on this issue to defend the image of silk industry. However, we also believe that only a robust LCA study performed in China may change completely the global picture of the silk environmental impact counteracting the old data set used by Higg Index.

Main axis of the workshops led by Quality and Technical Committee of Intersoie France

Jacques Poulenard

(Quality and Technical Committee of Intersoie France)

In France, all the leading textile silk companies are members of INTERSOIE, which gathers all the know-how of the silk chain such as twistors, weavers, dyers, printers and finishers. The manufacturers share inside the Quality and Technical Committee all their Technical, Normative, and Regulatory questions in relation with the markets, their comments and opinions.

Quality of raw silk material, sustainability of silk products, and environmental impact all along the supply chain are concerned. The main axes of the workshops led by the Technical and Quality Committee are as follows: 1) a new Classification for the raw silk material; 2) the Carbon Footprint of the French silk production chain; 3) traceability all along the silk supply chain; 4) the promotion of silk fibre, silk products and silk production.

Today's topic is of particular interest to us who know how the silk fiber lends itself on sustainability. Silk is by nature a renewable material with low environmental impact: the silkworms feed on mulberry leaves which do not require a lot of pesticides or fertilizers to grow; the mulberry silkworms have been completely cultivated and they are not able to do without humans to care and feed them; the cultivation of mulberry trees doesn't need irrigation, and it's a water saving cultivation.

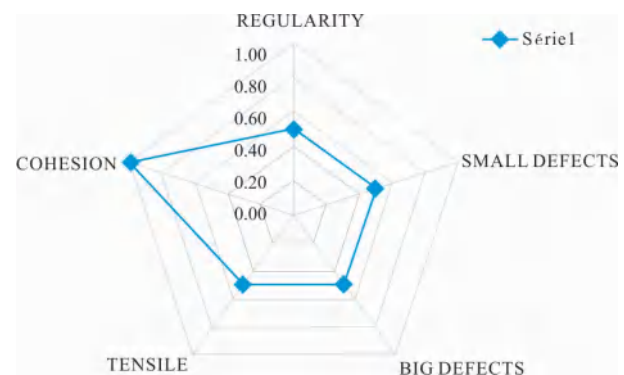
Silk has always connected with luxury and wealth. It's generally used in a range of fashion-related pieces such as scarves, shirts, blouses ... But not only! In the past, because of its biocompatibility, silk was used as suture materials in surgery. Because of its electrical properties it was used as insulator for electrical cable sheath. Moreover, it is a biodegradable fibre.

1) I'll focus on three major issues based on the French collective experience: 1) How a new classification for raw silk material can contribute to the sustainability of raw silk? 2) What is the experience of INTERSOIE in launching a climate change strategy? 3) What is our position on promoting silk?

1 New classification for raw silk material

Since a very long time the price of a raw silk lot has been defined according to its quality level measured with an old technical process named "seriplanes". Silk industry was one of the first to introduce into commerce methods of measuring the characteristics of its raw material to help buyers and sellers in concluding commercial agreements and sales contracts. On May 2014 Standard ISO 15625 *Silk—Electronic test method for defects and evenness of raw silk* was published, which is the result of the works between Chinese, Japanese, Indian, Italian, Swiss and French experts. Since that time, the Quality and Technical Committee has been working in collaboration with Italian experts to make this new method usable and to build a new classification which aims to be more accurate, with more reproducibility and repeatability.

A new way to express the measured technical criteria, based on the results of the electronic test method, was tested in Europe and shared with ISU Chinese experts for validation, comments and improvement. The graphic illustration of this new classification is proposed in the form of a RADAR diagram: on which the value of the area of the shape could represent the grade of quality of the raw silk lot; and the values on each axis could help the manufacturers for the orientation of the lot for the production of the yarn.



The aim of this project is to define the right price and the quality level of the batch according to its final destination. The response to this objective contributes to the sustainability of raw

silk by reducing waste and improving the correct orientation of the raw silk material to the correct end use. This project is in progress. The latest technical exchanges and the fruitful comments of the Chinese experts of ISU augur well for an effective collaboration around this essential project for the world of silk.

2 Carbone footprint-Methodology of the " Bilan Carbone® "

Since 2008 INTERSOIE within the Quality and Technical Committee has been engaged in the measurement of the carbone footprint of the silk production chain. The project was launched in response to a common desire to measure, then reduce, the environmental impact of the silk industry. To do so, the Committee decided to be assisted by Carbone 4, a specialized company created by Jean-Marc Jancovici who created the methodology of the " Bilan Carbone?" for ADEME, the French Agency for Ecological Transition.

The Methodology of the " Bilan Carbone" is an annual assessment of direct (internal to the company) and indirect (customer / supplier side) greenhouse gas emissions.

What is the purpose of this? 1) To reduce the company dependence on fossil fuels; 2) to give a "green" image of the Silk industry to the general public, and therefore to strengthen the attractiveness of our business; 3) to innovate (the carbon constraint will make it possible to challenge the teams)

The methodology of the " Bilan Carbone" is an inventory of the physical flows generated by the company (kWh of heating, kms traveled by employees, etc.). All these activity data are converted into a single unit: the kg CO2 equivalent. Once the collection of data and the assesement have been finalized, some actions plans, at company level and in synthesis at French silk chain have been engaged to reduce the carbone footprint.

In 2017, INTERSOIE decided to renew this project by integrating raw silk into the scope of the methodology until the finished fabric. Each company participating in this methodology can assess its own annual Carbon Footprint and compare it to past years to measure the effectiveness of the previous action plans decided. It allows to propose new action plans. Next, the summary of the results collected will be analyzed in order to determine the action plans of the sector for the reduction of its carbon impact.

3 Promotion of silk

In recent years, many criticisms have been leveled at the silk

production sector on an environmental point of view, such as the recent one embodied by the Higg Index of the SAC. The result of these attacks is to promote artificial and synthetic fibers to the detriment of natural fibers, including silk first.

First of all, I'd like to give you an overview of what are the Strengths, Weakness, Opportunities and Threads of silk?

From an environmental, social and societal point of view, there are many arguments in favor of silk and silk process of transformation. The main sticking point is the killing of the larvae to extract the continuous filament from the cocoon of the bombyx mori.

From the point of view of animal welfare, silk should not be condemned at a time when insects are proposed as an alternative to meat. The insects must be killed before dehydration, as the larvae are killed to extract the filaments from the cocoon. The died larvae are usually used as animals food, fertilizers... We haven't listened any criticism about the killing of insects for human food.

" Organic silk ", " peace silk ", " wild silk ", where the silkworms are normally allowed to live their full life cycle and die naturally, seem to be a good answer to the animal welfare and rights activists. However, this process of production doesn't allow to obtain a continuous filament, the environmental impact isn't very positive, and the products obtained with these kinds of fibers don't meet all the quality requirements of the market.

The items produced in continuous filament and in short fibres are complementary and can go together to extend the trade offer of silk products.

In the case of the Higg Index classification where silk appears as the worst of the fibres, the proposal of the Quality and Technical Committee of Intersoie isn't to try to fight against the other fibres but to promote silk and to develop all its extraordinary characteristics and advantages from environmental and social points of view. The arguments have to be based on such standardized methodology as LCA, EPD, ISO 14040, ISO 14025, which are validated on an international level. A new working has been recently created, the ISO TC 38 WG33 for working on " Animal Welfare in Textile supply chain ". First of all, a standard on Angora Rabbits is currently in progress. Mulberry Silk worms will be concerned by these works.

Finally, I'd light to highlight one key issue: we can answer to the requirements for the management of farmed silkworms in accordance with the legislation on the welfare of farmed animals and in full compliance with animal welfare principles expressed.

Silk, sustainability and circular economy

Joao Berdu

(Chairman of Bisa Overseas & Project Manager of Vale da Seda)

In some aspects life repeats itself, about 58 years ago, in early 1963 in the city of New York at a meeting at Manhattan's Fashion Institute of Technology, according to Fortune Magazine some silk men have made themselves heard, hissing the speaker "after what they took to be a slur against their true love" in a comparison with another fiber. So, as we can see, temptation to compare a new coming fiber with silk is as old as synthetic fibers and a half of a century later, here we are taking the stage to talk on behalf of silk.

Back then, in the 60's, it was enough to compare weight and shining of a fabric made of new synthetic fiber with silk fabric's weight and shining, as these were consumer's perceived values. Nowadays comparisons have different focuses, perceived values of the moment are sustainability and environmental impact.

When a chemical company compares an artificial fiber with silk, competition isn't for silk market share in manmade fiber's market. Synthetic and artificial fibers came from zero to more than 60% share in a market where silk has about 0.2% share. For synthetic and artificial fibers it is enough to get just a piece of silk's image of exclusivity and prestige, everlasting silk perceived values: "Silk is exclusive and valuable in the mind of consumers, if a fiber is better than silk in one aspect, this fiber will be valuable and exclusive in the mind of consumers". This is the chain of thought that validates fibers comparison with silk fiber and it can be used for silk fabrics, as well.

1 Environmental assessment

In the 60's, comparison was simple, weight and shining are objective aspects measured in a laboratory, but in order to have environmental impacts measured more parameters and more tools are needed, direct observation isn't enough. Life cycle assessment and carbon footprinting are increasingly popular tools for the environmental assessment of products. So far, despite of significant studies, there is no consensus on considering and

quantifying the sequestration and temporary storage and release of biogenic carbon, the carbon that is taken from atmosphere by plants and kept in plants or soil on liquid or solid form. Thus, on my presentation for didactic purposes I will take life cycle assessment as the approach that does not consider sequestration and temporary storage of carbon and carbon footprinting the approach that considers sequestration of carbon made by plants.

2 Life Cycle Assessment and Higg Index

Under the concept of life cycle assessment, in 2012 SAC-Sustainable Apparel Coalition has launched the Higg Index in order to wait on the demand of fashion brands and retailers to address sustainability on communication with customers.

In 2020, treatment given by Higg Index to natural fibers and specially the unfair treatment given to silk has got the attention of Mr. Rajit Ranjan Okhandiar, Secretary General of International Sericultural Commission who made himself heard by SAC and mobilized other silk colleagues to do so. Under the approach of life cycle assessment it is technically possible to evaluate the environmental impacts of a product under the limited "cradle to gate" concept that evaluates impacts from origin of raw material up to the exit gate of a weaving plant, as an example. What happens with the apparel? Is there any micro plastic going to ocean when it is laundered? Is it possible to upcycle it or recycle it? How fast it is disposed? By design, fabric Higg Index does not address these issues. It was amazing to see that Higg Index was proposing to measure sustainability under a "cradle to gate" concept while sustainability lies on circularity and "cradle to cradle" concept. Just this aspect seemed enough to show the inadequacy of the index to sustainability issues. But, there was more inadequacy on it.

On Example Materials tab at Higg Index, under last year web site configuration, it was possible to choose one kind of fabric and using the "Impact" button; it was possible to get the information

of what was the performance of chosen fabric against others. By doing so, it was possible to see that polyester fabric was better than 69.57% of textiles, cotton fabric was better than 8.7% of textiles and silk was graded on Higg Index as the worst of textiles.

"Impact" button is no longer working on the web site and the total impact does not appear, but each one of the index that puts silk as the worst of textiles is still there.

Each one of environmental impacts received an index based on third party studies at SAC discretion. According to Apparel Insider, Higg Index silk environmental impact data came from a 2014 study made at University of Oxford '*Life cycle assessment of Indian silk*' by Miguel F. Astudillo and others. Study actually had two different sources, Recommended Practices Publication, dated on 2013 and data from Practices of 100 Bivoltine Silk Farmers in Tamil Nadu, dated on 2006. Paper brings some questionable information regarding fertilizer and irrigation usage that led to an inaccurate silk level of environmental impact on Higg Index and its narrow source of references makes it not even representative of Indian sericulture.

Data on Astudillo paper are very unfair to silk. Just as a reference let's have a look on impacts made by cotton and silk in accordance to published researches and Higg Index regarding global warming impact; reliable sources such as Ecoinvent and British NGO WRAP-Worldwide Responsible Accredited Production, show silk fiber production has an environmental impact towards global warming 16% higher than cotton fiber production, while Higg Index states that environmental impact of silk is more than 3% higher than environmental impact of cotton per kg of fiber produced.

3 Carbon footprinting and carbon credit

While on my didactic presentation life cycle assessment does not consider carbon sink made by plants, another environmental assessment does and in my opinion it can be used by silk industry to spread two strong points of silk towards fashion sustainability in the eyes of today's end user: the role of mulberry trees on silk production and responsible consumption of articles made to last longer.

Carbon sinking is in the origin of silk in a direct correlation between cocoon production and mulberry trees cultivation. Current voluntary projects on offsetting carbon emissions thru avoidance of deforestation and forest degradation that are available on the

market include social positive effects of the initiative to attract funding from carbon credit buyers. Making difference in the life of small household farmer, this is silk. But, this is not the sole aspect, in the mind of consumers silk is dear and silk items are made to last. So, under modern circular economy concept, in the mind of consumers silk is already in a place where fashion will have to struggle to reach; a place where raw material is considered a dear and finite resource and products are designed, produced and used to last longer. Silk is there from the beginning and it was more than 5,000 years ago. History is at our side.

4 Carbon monetizing

There is no overall consensus on most appropriate ways of considering and quantifying carbon sink and offset made by plants, but according to World Bank, countries raised more than US \$45 billion in carbon tax in 2019 and there are more than 14,500 registered crediting projects, generating almost 4 billion tons of cumulative carbon credits. Carbon credits, purchased voluntarily, enable organizations to offset emissions not yet eliminated by financing projects that will remove CO₂ from atmosphere. Forestry sector makes up 42% of all credits issued in the last five years. Apple started recently a US \$200 million fund to remove CO₂ by restoring forests.

Bringing this subject to fashion, in 2018, two years after its creation, LVMH Carbon Fund reached US \$12.9 million to finance 112 projects to offset remaining group's greenhouse gas emissions after all efforts to reduce carbon footprint were done by LVMH.

Since 2018 Kering group is advertising efforts to reduce greenhouse gas emissions so that group becomes carbon neutral. On that year remaining group greenhouse gas emissions offset was about 2,4 million tons of CO₂. Offsetting continues to be accomplished through verified projects that conserve critical forests, biodiversity and support the livelihoods of local communities.

Yes, there is no scientific consensus about this matter, but consumers are demanding action, products are being created to wait on this demand and fashion icons are already taking action.

While quotation of carbon on EU emissions-trading system is in the range of 40/tCO₂e, there are projects on voluntary carbon market offering CO₂ offsetting at price range from US \$1.00/tCO₂e up to US \$17.00/tCO₂e. Projects available on voluntary carbon

market are adding on their portfolio social and economic benefits on communities surrounding reforestation projects in response to customer's demand that in addition to fight global warming also consider important to act on improving human living conditions on developing countries and regions. Improving human living conditions on developing regions, this is what sericulture does. Technology has made it possible to build a bridge between farmers and companies that are interested on offsetting carbon footprint of their activities and, at same time, compensate silk farmers for keeping alive mulberry trees that are actively working on carbon sinking.

Bringing carbon compensation market to silk world, scientific researches available in India show mulberry trees are quite efficient on above ground and below ground carbon sinking. Mulberry planted area in China is around 790,000 ha and in India mulberry planted area is about 240,000 ha. So, two biggest silk producing countries have over one million hectares planted with mulberry trees that are sequestering every year about 80 million tons of CO₂. But, none of this carbon sequestration made by mulberry trees is so far being monetized or even recognized.

Is it possible to monetize it? Will it be possible to pay silk farmers all over the world for the service mulberry trees are rendering while sinking CO₂ from atmosphere? Along with partner companies in Brazil we are working in a proper response to these questions. We are committed with the idea of finding a way to build up a business model that will enable the monetizing of carbon sinking made by mulberry trees as an additional income to silk farmers.

This initiative aims to increase silk farmers revenue and while it grows in volume and value; it will also contribute to spreading among consumers the information that in order to have silk produced "gardens of mulberry trees" must be kept alive and sane as fresh mulberry leaves free from pesticides are the sole food of a silkworm. It is important to remark this as much as possible, the marketing survey made by ISU in 2018 with 2,500 Millennial women in China, France, Germany, Italy and United States found

out that 65% agreed that silk is sustainable as silk items are made to last longer, but only 35% of them were aware of the important role of mulberry trees on silk production. In a world that is giving monetary value to CO₂ sinking it seems financially worthwhile to put light over fresh mulberry leaves protagonism on silk production.

5 Conclusion and suggestion

For sure it is in the interest of silk industry to promote independent life cycle assessment study on silk by joined efforts between International Sericultural Commission and International Silk Union. It is highly positive to have a study group to promote the production of more representative technical material reflecting environmental impacts of silk industry worldwide or even in different countries or regions of each country, making available reliable data that could be used by researchers linked to environmental aspects in different areas related to sericulture, silk industry and fashion.

But, life cycle assessment approach does not leave room to talk about, for example, the extraordinary work ABRASEDA-Brazilian Silk Association-is doing in order to protect silk farmers against the poisoning effects of contamination due to aerial applications of pesticides made by big farms cultivating sugarcane and soya-bean near small mulberry plantations. Mention of this work would be possible under carbon footprinting and circular economy approach that would make available to researchers and also to the media this kind of initiative that illustrates positive impact of sericulture on developing regions in China, India, Uzbekistan, Vietnam, Thailand and Brazil towards living standard improvement of small farm householders.

All over the world green economy is part of government policies and companies strategic plans. Questions of what must be done towards a responsible consumption and what is possible to do to stop global warming are made every day by millions of consumers. Silk can be part of the answer and it is our task to enable it.

Life cycle assessment of silk cocoon production in Brazil

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ABRASEDA

The research embraced both activities as part of sericulture: the cultivation of mulberry trees and the production of fresh cocoons. Sericulture in Brazil is very important for farmers' families who live on small plots of land. This activity provides monthly income for farmers, allowing them to support their families, when compared to other regional cultures. This scenario allows a more sustainable development for the producing regions.

The Life Cycle Assessment makes it possible to analyze the environmental sustainability of silk in comparison to other fibers. In this context, a piece of research was developed resulting in the Life Cycle Assessment of the production of silkworm cocoons, which comprised the stages from the cultivation of mulberry trees up to stage when the fresh cocoons are delivered to the rearing industry.

1 Method for Life Cycle Assessment

The research was conducted according to International Organization for Standardization for Life Cycle Assessment, making use of ISOs 14040 and 14044, and the LCA Umberto NXT Universal software tool. A cradle-to-gate (C2G) approach was used to define the limits of the system. The analysis was not restricted to the core processes (production of mulberry trees and the cocoons), but also included all the upstream processes (production of raw materials). The database of life cycle inventories Ecoinvent v. 3.3 was used to model the upstream processes, therefore, the information on the provider processes was secondary.

The analyzes were performed using the ReCiPe Midpoint method, using a midpoint approach for nine impact categories. The impact categories analyzed in the analysis of this study were: Fresh Water Ecotoxicity (FETP), Human Toxicity (HTP), Terrestrial Ecotoxicity (TETP), Climate Change (GWP), Fresh Water Eutrophication (FEP), Agricultural Land Occupation (ALOP), Water Depletion (WDP), Terrestrial Acidification (TAP) and Natural Land Transformation (NLTP).

2 Results of the Life Cycle Assessment

The cultivation of mulberry trees has a greater potential impact when compared to the rearing of silkworms. The impacts by process in each of the categories are presented below, first on the cultivation of mulberry trees, and then on the rearing of silkworms.

2.1 Cultivation of mulberry trees

For Freshwater Ecotoxicity and Freshwater Eutrophication, the hotspots were in the processes of soil correction and maintenance, due to the use of phosphorus and the production of single superphosphate, which has emissions of metal to water, such as copper, nickel, manganese, and zinc.

For Human Toxicity, the hotspot was also in the soil maintenance, due to the production of single superphosphate (emissions of manganese, arsenic, mercury, selenium, and lead) and the use of organic fertilizer, which once again results in the emission of metals to water and soil.

For Natural Land Transformation, the greatest impact was due to the limestone residue remaining in the soil, which has a beneficial impact, in the process of soil correction. The negative impacts were due to the transformation of natural land due to poultry farming and the consequent production of organic fertilizer (poultry manure), and the production of single superphosphate for soil correction.

For Terrestrial Acidification, the hotspots were in the single superphosphate production, due to the emission of sulfur oxides and nitrogen oxides, in the limestone production due to the emission of sulfur oxides, nitrogen oxides, and ammonia, in the transport of organic fertilizer and the use of the tractor for preparation of the soil, also due to the emission of sulfur oxides and nitrogen oxides.

For the Terrestrial Ecotoxicity category, the hotspots were in the soil maintenance, due to the emissions of phosphorus to water and soil, in the transport and production of the organic fertilizer,

due to the emission of metals.

For Water Depletion, the hotspots were in the soil maintenance and the mulberry cultivation, due to the consumption of water, and in the production of limestone and single superphosphate, for the amount of water used in their production.

While for the mulberry production the hotspots were identified in the impact categories Freshwater Ecotoxicity, Freshwater Eutrophication, Human Toxicity, Natural Land Transformation, Terrestrial Acidification, and Water Depletion. For the production of cocoons, the hotspots were identified in the categories of Agricultural Land Occupation, Climate Change, Human Toxicity, Natural Land Transformation, Terrestrial Acidification, Terrestrial Ecotoxicity, and Water Depletion.

2.2 Rearing of silkworms

For Agricultural Land Occupation, the hotspots were in the production of Kraft paper, used for covering the silkworms during the feeding/rearing process, and in the electricity consumption.

For Climate Change, the hotspots were in the transport of mulberry leaves to feed the silkworms, due to the emission of carbon dioxide and methane to air, in the production of the Kraft paper used for covering the silkworms during the feeding/rearing process, once again due to emission of carbon dioxide and methane, added to the emission of dinitrogen monoxide, and in the electricity production, due to the emission of carbon dioxide, methane, and dinitrogen monoxide.

For Human Toxicity, the greatest hotspot was in the barn disinfection, due to the use of chlorine, whose emissions go to air, water, and soil, and in the grid disinfection, due to the use of formaldehyde, which is largely emitted to air.

For Natural Land Transformation, hotspots could be seen in the use of electricity, due to the transformation of the natural land necessary for obtaining the electricity mix; in the transport of mulberry leaves to feed the silkworms, and in the production of Kraft paper, used for covering the silkworms during feeding/rearing.

For Terrestrial Acidification, the greatest hotspot was given to the transport of mulberry leaves to feed the silkworms, due to the emission of nitrogen oxides and sulfur oxides to air, and the production of Kraft paper, due to the emission of sulfur oxides, nitrogen oxides, and ammonia to air.

For Terrestrial Ecotoxicity, the greatest hotspot is in the barn disinfection, due to the use of chlorine, and its emissions to air, water and soil, followed by the grid disinfection, due to the use of formaldehyde, and its emissions to air, and the Kraft paper production, due to the emission of cypermethrin (pesticide used in tree farming).

For Water Depletion, the greatest hotspot was in the silkworm feeding/rearing, and in the barn and grid disinfection, due to the consumption of groundwater.

Identifying the hotspots within the mulberry and cocoon production was extremely important for enabling finding potential improvements for the silk cocoon production under local conditions.

3 Conclusion

It was possible to identify that the impacts of the production of mulberry trees stood out in comparison with those of the production of the silk cocoons. Based on the impacts identified, several opportunities can be put forward to improve the environmental profile of production of silk cocoons. However, strategies must be designed to overcome technical and socioeconomic barriers.

It is worth noting that the production of silk thread needs to be included in the boundaries of the system in order to have a more complete view of the impacts of the life cycle of silk production. Therefore, it is proposed that future research carry out a life cycle assessment study that includes the suggestions for improvement presented in this piece of research, in order to verify the extent to which the reported impacts can be lessened. In addition, research to improve the impacts of these processes not only on the environment, but also on society and the economy, can be expected.

Life cycle assessment also allows quantitative analysis of the manufacture of silk textiles in comparison with other natural fibres.

Considering the impacts of sericultural activity, it is also necessary to evaluate the impacts of other fibers, whether natural or artificial, always with the aim of mitigating negative impacts and increasing positive impacts.

Therefore, it is essential that new investigations be carried out including the silk production chain, globally, in order to have homogenized production results.

Research progress in the environmental performance assessment of silk product life cycle

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Climate change, shortage of fresh water, water pollution and exhaust emissions have posed daunting challenges to the sustainable development of the global economy and society. The agenda entitled "Transforming Our World; the 2030 Agenda for Sustainable Development" was adopted at the 70th session of the UN General Assembly and came into effect on January 1, 2016. Covering 17 Sustainable Development Goals (SDGs) such as to "ensure availability and sustainable management of water and sanitation for all" and to "take urgent action to combat climate change and its impacts", the agenda calls for all countries to take proactive steps for the full implementation of this Agenda by 2030. To combat global climate change, the Chinese government has pledged to achieve peak carbon emissions by 2030 and carbon neutrality by 2060. The Outline of the 14th Five-Year Plan (2021 – 2025) for National Economic and Social Development and Vision 2035 of the People's Republic of China set forth the goal of establishing a sound environmental governance system, continuously improving air and water quality, and implementing effective management control over soil pollution risks.

Textile products are closely correlated with people's production and life. The sustainable development of textile industry plays a major role in promoting China's ecological

progress, which is generally achieved by accelerating the green production and processing of segmented industries and products. China is the world's largest producer of cocoons and raw silk, claiming a proportion of over 80% of the world's total cocoons and raw silk output. Silk is an important textile product favored by consumers for its excellent wearability. To understand the full extent of the environmental performance of the life cycle of silk products is of great reference significance for the green design, green production and even green consumption of silk products. This paper reviews the research progress on the environmental performance of life cycle of silk and related products at home and abroad, and discusses the research methods, accounting boundary, data inventory and result assessment of the environmental performance of silk products during their life cycle, and puts forward suggestions on the quantification and evaluation of the environmental performance during the life cycle of silk products.

1 Environmental performance of silk products

The research results on the environmental performance of silk products in their life cycle are as shown in Tab. 1.

Tab. 1 Research results on the environmental performance assessment of silk products in their life cycle

Functional unit	1 kg Silkworm cocoons	1 kg Raw silk	1 kg Raw silk	1 t raw silk standard and 1 t fabric standard	100 kg silk fabric	1 m gambiered Guangdong gauze	100 silk crepe de chine dresses	100 silk damask dresses	100 kg finished silk yarn- dyed fabric
Global warming potential(kgCO ₂ eq)	0.45	80.90	—	—	20.25	1.80	—	—	1,820.97
Ecotoxicity(CTUe/kg)	—	1,043.10	—	—	—	8.00	—	—	—
Cumulative energy demand(MJ)	—	1,858.00	1,843.00	—	—	—	—	—	—
Agriculture land(m ² a)	0.38	35.60	—	—	—	—	—	—	103.98
Urbanland(m ² a)	—	1.37	—	—	—	—	—	—	—
Blue water footprint(m ³)	—	54.00	—	—	—	—	—	—	—
Eutrophication footprint (①kgP-eq; ②gP _{eq} ; ③kgNO ₃ ; ④kgPO ₄ ³⁻)	0.39 ^①	7.00 ^②	—	—	44.31 ^③	—	0.92 ^④	1.55 ^④	20.24 ^④

Continued Tab. 1

Functional unit	1 kg Silkworm cocoons	1 kg Raw silk	1 kg Raw silk	1t raw silk standard and 1 t fabric standard	100 kg silk fabric	1m gambiered Guangdong gauze	100 silk crepe de chine dresses	100 silk damask dresses	100 kg finished silk yarn- dyed fabric
Water scarcity footprint ($\text{m}^3 \text{H}_2\text{O}$ -eq)	0.02	—	—	Existing enterprises: 668.90; newly-built enterprises: 343.90; pioneer enterprises: 219.40	—	—	15.49	51.03	25.01
Ecotoxicity in water (⑤kg1,4-DCB-Eq ; $\text{⑥m}^3 \text{H}_2\text{O}$ -eq; ⑦CTU)	42.49 ^⑤	—	—	0.28 ^⑥	—	—	48,428.87 ^⑥	51,040.73 ^⑥	6,715.83 ^⑦
Water acidification footprint(kgSO_2 -eq)	—	—	—	0.33×10^{-2}	13.80	—	3.80×10^{-4}	4.00×10^{-4}	26.18
Human toxicity (⑧kg1,4-DCB-eq ; ⑨CTU)	7.71 ^⑧	—	—	—	—	—	—	—	18.21 ^⑨
Terrestrial ecotoxicity (kg1,4-DCB-eq)	0.67	—	—	—	—	—	—	—	—
Land acidification (kgSO_2 -eq)	0.25×10^{-2}	—	—	—	—	—	—	—	—
Natural land reclamation(m^2)	0.01×10^{-2}	—	—	—	—	—	—	—	—
Environmental noise pollution($\text{Pa}^2 \cdot \text{h}$)	—	—	—	—	1.09	—	—	—	—
Smoke and dust(kg)	—	—	—	—	4.08	—	—	—	—
Photochemicalozone (kgC_2H_4)	—	—	—	—	4.72	—	—	—	18.60
Abiotic depletion potential(kgSb-eq)	—	—	—	—	—	—	—	—	30.37
Metal loss(kgFe-eq)	—	—	—	—	—	—	—	—	46.37
Stratospheric ozone depletion(kgCFC-11-eq)	—	—	—	—	—	—	—	—	18.21

Note: The right superscript of the value corresponds to the units.

It can be seen from the Tab.1 that the indexes in regard to environmental performance quantification and evaluation research on silk products include climate change (global warming potential), air pollution (smoke and dust, photochemical ozone and stratospheric ozone depletion), impacts on water resources and environment (blue water footprint, water eutrophication, water scarcity footprint, water ecological toxicity and water acidification footprint), impact on land ecosystem (agricultural land, urban land, land ecotoxicity, land acidification and reclamation of natural land), impacts on human (humans toxicity and environmental noise pollution), as well as cumulative energy demand, abiotic depletion potential, metal loss, etc. The

quantitative and evaluation indexes selected in different research literatures differ from each other.

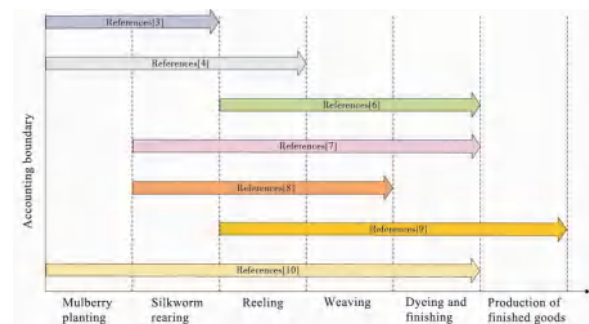


Fig. 1 Distribution of the accounting boundary of the environmental performance of silk products in their life cycle

As can be seen from Fig. 1, studies on the environmental performance of silk products in their life cycle mainly focus on the processing goods such as silkworm cocoons, raw silk, silk fabrics and silk garments, while there is no quantitative and evaluation study on the environmental performance of silk products during their life cycle. The life cycle of silk products involves mulberry tree planting, silkworm breeding, reeling, weaving, dyeing and finishing, silk products production, sales, consumers' use, disposal and so on. The environmental performance in each stage differs from each other. For instance, greenhouse gas emissions are produced, water resources are consumed and potential eutrophication is generated from cultivating, fertilization and irrigation in mulberry planting stage. However, the photosynthesis of mulberry will absorb carbon dioxide in the air, which offsets carbon emissions to a certain extent. In silkworm breeding stage, greenhouse gas emissions are generated due to energy consumption during mulberry leaf picking, transportation and silkworm house cleaning and maintenance. Energy, water and textile chemicals are consumed in the industrialization stages of reeling, weaving, dyeing and finishing, garment production, etc. During household washing and nursing in the use stage of silk products, water, detergents and electricity are consumed, greenhouse gas emissions and waste water pollutant emissions are produced, posing a potential impact on greenhouse effect and water environment degradation.

2 Discussion on quantification and evaluation of environmental performance

2.1 Quantification and evaluation method

There are three quantification and evaluation methods for the environmental performance of silk products in the life cycle in existing literatures: the method of life cycle assessment, method of carbon footprint and method of water footprint. Life Cycle Assessment (LCA) is composed of four interrelated parts, namely, the definition of objectives and scope, inventory analysis, impact assessment and result interpretation, which can quantify and evaluate the environmental performance of silk products during their life cycle "from cradle to grave". Carbon Footprint (CF) is used to quantify the carbon emissions generated

during the life cycle of a product from raw materials, transportation, processing and production to use and disposal, and is widely used to quantify and evaluate the greenhouse gas emissions of various products. The study of the carbon footprint of silk products during their life cycle focuses on the performance on climate change during the raw material acquisition, production, consumption, and recycling stages of silk products. There are two different research systems for the method of Water Footprint (WF), one of which is to characterize the amount of water resources consumed during production and consumption of all products and services in a certain region. The other is to quantify and evaluate the impacts of water resource scarcity, water eutrophication, water ecotoxicity and water acidification footprint caused by production and consumption activities. The study on the water footprint of silk products in their life cycle is to quantify and evaluate the environmental performance of water consumption and wastewater pollutant discharge during the life cycle of silk products.

The LCA method can quantify and evaluate the environmental performance of silk products in their life cycle from multiple perspectives, such as climate change, air pollution, human toxicity, ecotoxicity, etc. Nevertheless, as it has no unified definition of the selection range for the quantitative and evaluation indexes of environmental performance, and as it is generally affected by the difficulty in obtaining a comprehensive data inventory, the selection of environmental performance indexes in different studies is inconsistent, and the quantification and evaluation results of environmental performance of different silk products are often not comparable. The CF method and WF method are based on LCA theory, focusing on the quantification and evaluation of climate change impact and water resource and environmental impact of silk products in their life cycle respectively.

2.2 Accounting boundary

The consistency of accounting boundary is the prerequisite for quantification of environmental performance of silk products and comparison of evaluation results, and any change of the boundary will lead to volatility of results. Judging from Tab. 1, there is no uniform accounting boundary of existing studies on environmental performance of silk products during their life

cycle. For instance, some studies set the accounting boundary as the stage "from cradle to gate" (mulberry planting, silkworm rearing, reeling, etc.), while others the stage "from gate to gate" (weaving, dyeing and finishing, ironing, etc.), and few studies even include the environmental performance of silk products in the use stage and recycling stage into the accounting boundary.

Silk differs from cotton clothing and chemical fiber clothing in service life and daily washing and care mode for its superior wearability. Studies have shown that the average temperature and average time consumption for silk clothing care are less than those for cotton and linen clothing, so the environmental impact of silk clothing is relatively small in the daily washing and care stage. Therefore, an in-depth analysis on the environmental performance of different silk products under different consumption patterns is needed when the quantitative and evaluation research is carried out on the life cycle environmental performance of silk products.

The acquisition of silk fiber involves the planting of mulberry trees, and this stage has an effect of carbon sequestration. For example, Giacomini et al. summarized the biomass and CO₂ emission reduction level of different mulberry varieties under different cultivation methods, and proposed that the CO₂ equivalent reduced by mulberry photosynthesis was 735 times that of silk fiber produced in the mulberry orchard. Li et al. evaluated the carbon footprint of mulberry trees at the planting stage and calculated from the statistical data of agricultural mulberry production in Haining, China from 2014 to 2016 that the carbon sequestration of photosynthesis in mulberry planting process was greater than the total carbon emissions generated in the planting stage, showing positive externalities to the ecological environment. Hence, the carbon sequestration effect in mulberry tree planting stage and the distribution principle of carbon sequestration should also be included and quantified in the evaluation of the life cycle environmental performance of silk products.

2.3 Data inventory

To evaluate the environmental performance of silk products in the life cycle, it is necessary to clarify the input and output data inventories of silk product life cycle such as the water consumption

for irrigation, fertilizer application and mulberry leaf yield in mulberry planting stage, energy consumption, chemical consumption and cocoon yield in silkworm breeding stage, as well as consumption of industrial water resources, dye and chemical materials, and auxiliary materials, and silk product yield in silk product industrial production stage. Different production environments and production conditions in various countries and regions should be taken into consideration for collecting data inventories. For instance, in mulberry tree planting process, the irrigation demand of mulberry orchards is related to the latitude and longitude, altitude, landform, mulberry tree planting density and other factors. Fertilization demand is connected with soil fertility and the varieties of mulberry saplings. In the process of silkworm rearing and silk reeling, the level of production technology has a significant impact on energy consumption, resource consumption, product output and waste discharge, which in turn affects the quantification and evaluation of the environmental performance of silk products in their life cycle. The data inventory of a single region only reflects the environmental performance of silk products in the region. To comprehensively evaluate the environmental performance of silk products in their life cycle, it is necessary to take full account of regional factors, production technology level factors and production factors. For example, the conclusion drawn by Higg Materials Sustainability Index from the data of the life cycle inventory of silk products in individual countries and regions that environmental impact of silk is higher than that of other textile materials is inaccurate and incomprehensive. The by-products produced in the process of silk production also have application value. It is necessary to build a reasonable separation and distribution principle considering factors such as product characteristics, yield and value, and rationally allocate environmental performance so as to improve the accuracy of quantification and evaluation of environmental performance of silk products in the life cycle.

2.4 Result Assessment

When the evaluation results of the environmental performance of silk products in their the cycle of involve multidimensional indicators, it is necessary to normalize the evaluation results when we compare the environmental performance among different products since the units of each index are varied. The results of

environmental performance assessment can be normalized by various methods. For example, multiple environmental impacts can be transformed into a unified marginal social cost by the EP&L method to express the results in the form of value; the ReCiPe method can bring about three kinds of end-point level impacts of natural environment, human health and resource consumption by standardizing and weighting the intermediate point impact categories, which can be further weighted and normalized to obtain dimensionless evaluation results. Therefore, the appropriate normalization method should be selected according to the specific situation in the study, and the results should be clearly stated in the evaluation.

3 Conclusion

Accuracy, comprehensiveness, consistency and transparency are key principles for quantification and evaluation of products' environmental performance. The study on environmental performance of silk products in their life cycle has good referential significance for design, production and sustainable consumption of green silk products. Since the life cycle of silk products is long and involves a number of input and output factors, there are still many

problems to be discussed and solved in the study on environmental performance of silk product during the life cycle.

1) The environmental performance of silk products in the life cycle includes positive externalities, such as carbon neutralization effect of carbon fixation in mulberry planting. A scientific quantitative and evaluation model should be established to clarify the mechanism of carbon sequestration and carbon conduction pathway, and objectively quantify and evaluate the carbon neutralization effect of silk products in their life cycle.

2) According to the characteristics of silk product use, washing care and recycling, a scientific and applicable use and washing model and a recycling model shall be constructed to improve the accuracy of data inventory collection and environmental performance quantification and evaluation in the above life cycle stages.

3) To achieve comprehensiveness and transparency in the quantification and evaluation of environmental performance, a database of silk product life cycle data inventory shall be built by taking into account national, regional, and technological levels.

(Please refer to P5 – 9, Issue 11 of *Journal of Silk* in 2021 for details)

Research progress on sustainable development of textile industry

LI Yi

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Textile industry is an eternal industry, which is indispensable from the cold-proofing and private parts concealing since the earliest time to the application of high-tech fibers in aviation, aerospace and navigation. Nevertheless, for a period of time, the textile industry has been regarded as a three high and one low (high energy consumption, high pollution, high emission and low output) industry. China's major textile provinces such as Zhejiang, Jiangsu, Shandong, Fujian and Guangdong are attaching great importance to the transformation and upgrading of the textile industry, and are devoting great efforts to cultivate energy saving and emission reduction, water saving and emission reduction and environment-friendly enterprises. The academic circles are carrying out theoretical exploration and multiple researches from the perspectives of agricultural planting of textile raw materials, textile industry production, textile design creativity, textile consumption and textile recycling according to the division of textile industry chain. From the perspective of promoting sustainable priorities and key chain segments, industrial links consume the most resources and discharge the most environmental pollution. Hence, carbon emission reduction, water emission reduction and chemical footprint reduction in the production process of textile industry have become hot topics in theoretical research.

Many achievements have been made in the sustainability of textile industrial production from the perspective of organization and product, focusing on the accounting and evaluation of carbon footprint, water footprint and chemical footprint. Carbon footprint focuses on energy conservation and emission reduction to solve the problem of energy consumption and carbon emissions; water footprint focuses on water saving and emission reduction to solve the problem of water resource consumption and wastewater discharge; chemical footprint focuses on toxic emission reduction to solve the problem of chemical input and pollutant discharge. Scholars have made scientific contributions to the accounting

boundaries, accounting data, accounting standards and evaluation of three types of environmental footprints. The difference is that carbon and water are carriers and can be converted into one value, which is easy to understand and operable for people without chemical expertise. There are many kinds of chemicals, which is a comprehensive overall index to quantitatively characterize the damage and degree of ecosystem caused by the use of chemicals one by one, and there is a threshold for research.

Life Cycle Assessment (LCA) and Input-Output (IO) analysis are commonly used environmental footprint accounting methods. LCA can divide industrial production chain segments well, with the difficulty and controversy lying in the demarcation of time and space boundaries of accounting as the inconsistency of demarcation of accounting boundaries and chain segments by different scholars will lead to the deviation of accounting results. The input-output analysis method is applied to the analysis of the textile industry. From the perspective of the whole industry, the release of input-output data is often delayed. For example, China publishes input-output data every five years, and the latest data is released in 2017.

From the perspective of international trade and industrial chain division, a large number of textile products exported by textile manufacturing countries have led to "virtual water" and "embedded carbon", which means that resource consumption and pollution emissions are in the countries of manufacture, while countries of brand have earned more profits due to better brand design and operation capabilities, and countries of manufacture should pay attention to the improvement of resource and environmental problems.

With the development of research, evaluation standards and norms such as ISO 14067 international standard, PAS 2050 series of specification, GHG protocol and IPCC 2006 have been formed. China has also established seven group standards such as the General Requirements for Quantifying the Greenhouse Gas

Emissions of Textile Products and General Technical Requirements for Quantifying the Water Footprint of Textile Product that are in line with its national conditions, and has gradually established industry standards and promoted them to become national standards, thus boosting quantifiable, assessable and reportable green manufacturing of the textile industry and providing important technical support for the textile and garment industry to deal with international technical trade measures. Zero Discharge of Hazardous Chemicals (ZDHC) consist of brands and retailers in the clothing and footwear industry such as Adidas, Benetton, Burberry, C&A, Inditex, Jack Wolfskin, Levi's, Lbrands, NB, Nike, Puma and PVH. ZDHC publishes the list of restricted substances in production according to the indicators of danger, dosage and usage mode to promote the zero emission of hazardous chemicals in the textile and footwear supply chain, which has promoted the emission reduction of toxic and harmful chemicals to a certain extent. Nevertheless, some studies believe that this is a kind of hidden technical barrier and trade barrier.

To address climate change, China has made a commitment to the goal of "peaking carbon dioxide emissions by 2030 and achieving carbon neutrality by 2060". Consumers' purchase of textile green products has market selectivity. Whether environmental labels such as "carbon footprint label, water footprint label and chemical footprint label" can promote green consumption depends on the construction of green market and the formation of green consumption consciousness. From the supply side and according to the classical theory of production factors in western economics, the four production factors that produce economic value are capital, labor, land and entrepreneurship.

However, with the worsened global warming and environmental pollution, some scholars call the ecological environment the fifth production factor. If the fifth factor is converted into the cost of the commodity itself, from the perspective of cost-benefit, the government would order black products to withdraw from the market, and encourage green production and stimulated green consumption. Coupled with the gradual formation of consumers' awareness of green purchase, and the joint action of government mechanism and market mechanism, consumers will choose to buy green products, reflecting the compulsory and voluntary awareness of green purchase. From the perspective of the demand side, the formation of consumers' green purchasing intention requires in-depth research on the identification and externalization of the intention to purchase textile green products, and how to carry out the simultaneous reform of the green system by the government in order to restrain market failure.

The realization of the of "dual carbon" goal is by no means the task of one country and one industry. The advancement of research on carbon footprint, water footprint and chemical footprint requires collaborative research on the coupling relationship between "industry-ecology-health" and systematic emission reduction strategies. The calculation results of textile environmental footprint have not been standardized, and the cost, path and difficulty of enforcement need to be further studied. People's awareness of environmental labels is not high, and their purchasing power is not strong. Therefore, it is necessary to strengthen the research on consumers' willingness and path to increase the purchase rate of textile green products.

Life cycle modularization for silk products and their carbon footprint quantification model

XU Jianmei

(PHD & Associate Professor of Soochow University)

In recent years, global warming has become a serious threat to the natural environment and human economic development, the main reason for which is that human production activities lead to the high emission of greenhouse gases (GHG). The textile industry has always been a high energy consumption and high carbon emission industry, and its GHG emissions in the production and use stage account for 3% of the global GHG emissions. With the economic development and population growth, the global demand for textiles is still growing every year. In particular, nonrenewable resources such as oil consumption are increasing, which will cause a great burden on the environment. Therefore, it is imperative for the textile industry to realize low-carbon production, establish carbon footprint (CFP) evaluation system, and carry out green ecological production design. CFP is used to measure the emission of GHG in the life cycle of an activity or product. To achieve green production with low energy consumption, pollution and emission, it is necessary to calculate the GHG emissions throughout the whole life cycle of textiles, including raw material acquisition, industrial production, distribution, use, waste or reuse. Besides, it is necessary to optimize the production process according to the CFP of each stage by using raw materials with low carbon emission, so as to improve energy utilization or using clean energy, and eliminating inefficient equipment. At the same time, the research of textile CFP can help to mark up the CFP information of textile products for consumers, which is helpful in encouraging low-carbon consumption.

Based on the urgent needs of environmental and ecological sustainable development, the CFP research on textiles has become a hot spot in recent years. There are many CFP researches on cotton textiles, while few on silk products. Silk, is considered as the "Fiber Queen", and its fabrics and garments are gorgeous, noble and luxurious, which can be used as high-end apparel textiles with high added value. Compared with chemical fiber, its production process greatly reduces the consumption of fossil energy, and the carbon sequestration effect of mulberry planting is obvious. Compared with cotton, hemp and other natural fibers, its

economic value is higher. The study of the CFP for silk products can reveal the facts that silk textiles is environmentally friendly with low carbon emission, which can enhance the ecological persuasion of their export to the silk textile consumption countries. On the other hand, it can further guide the silk industry to carry out low carbon production. Therefore, as China is the largest silk producer in the world, the research on CFP of silk products in China is extremely urgent. Astudillo et al. studied the environmental impact from Indian raw silk production stage using life cycle assessment (LCA) method. These impacts include CFP, ecotoxicity, freshwater eutrophication, and water footprint. They also established the life cycle inventory (LCI) of raw silk production in South India, and found that the environmental impact of raw silk production was higher than that of other natural fibers, and the impact on the environment mainly came from the cocoon production, especially fertilization. The result can only reflect the environmental effect of India silk, instead of silk from other countries. JIANG Ting et al. calculated the carbon emission of whole life cycle of gambiered canton silk based on LCA method, and concluded that the CFP of whole life cycle of 1kg gambiered canton silk was 1.88 kg CO₂e, and the majority of carbon emission came from silkworm breeding and silk reeling. HAN Xiaoyi analyzed the whole raw silk production based on LCA, and listed LCI of raw silk. They also conducted ecological design and low-carbon production of silk products. However, these studies did not consider the carbon sequestration of mulberry trees. Giacomini et al. studied the economic and environmental problems of silk production in Brazil, and pointed out that improving the utilization rate of co-products in silk production can not only create employment and increase income, but also reduce the impact on the environment. At the same time, he also mentioned that the carbon sequestration of mulberry trees can eliminate part of the environmental impact, and estimated that the carbon sequestration capacity of mulberry is 735 kg CO₂ per kg silk production, but this result is only estimated based on macro statistical data. So far there is no research on CFP quantification of the overall life cycle for silk products.

The biggest problem in the CFP quantification for textile products is that the results are not comparable even for one kind of products. For example, in the CFP quantification of the garment production stage for pure cotton jeans, one study is 9.84 kg CO₂e/pcs, while another is 21.513 kg CO₂e/pcs. The huge difference may be caused by the different weight, design, processing efficiency of the products. However, there are also other reasons such as different system boundaries, different values of the CFP conversion factor for one material. And these reasons make the results of the same kind of products incomparable. Especially there are many kinds of silk products, and the life cycle chain of each silk product is long and complex, involving the management of mulberry garden, silkworm breeding, industrial production, use, sales, waste or reuse. The subtle changes of the system boundary, the choice of different CFP conversion factors will always get different results in calculating the CFP even for one product. Therefore, this paper proposes a modular division of the whole life cycle of all kinds of silk products. Each silk product can be constructed by combination of these modules, and thus the LCA evaluation framework of silk products including system boundary, material input and output can be established. Based on this LCA evaluation framework, the CFP conversion factors are collected, and the CFP calculating formula is established.

1 Modular construction of silk product system boundary

The CFP of silk products is generally calculated using LCA method based on PAS 2050. PAS 2050 is the first standard used to evaluate the CFP of products, and LCA is a method to summarize and evaluate the potential impact of all inputs and outputs of a product on the environment in the whole life cycle, which can be referred to in ISO 14040/44. LCA means CFP calculation covers all stages of a

product, "from cradle to grave". Firstly we need to define the calculation scope of CFP by determining its system boundary, and all the direct or indirect carbon emissions of products in the life cycle should be covered. Therefore, the definite, complete and clear system boundary is the premise of CFP calculation.

In the CFP calculation, repeated calculation of some shared stages for different silk products often happens. While modularization method can divide the complex and long life cycle chain of silk products into many small modules. Each module has its own simple structure, clear system boundary and LCI. In addition, each module will be independent and modifiable, and will not be affected by other modules. Once there is an error in the calculation of a CFP unit, only the problematic module needs amending, while other modules will not be affected, which can improve the working efficiency. Moreover, for all silk products, the life cycle modules are universal. Different modules can be combined to form the system boundary framework of a new product, which can avoid repeated calculation.

The life cycle of silk products is hereby divided into five stages: moriculture and sericulture stage, industrial production stage, sales stage, use stage and waste stage. As shown in Tab. 1, the moriculture and sericulture stage is regarded as module A; the industrial production stage of silk products is subdivided into module B to M (module I to M is the manufacturing stage of five conventional silk products); the sales stage is module N; the use stage is module O; and the waste or reuse stage is module P. Therefore, different kinds of silk products can be combined by some of the modules to realize the construction of the corresponding system boundary and the corresponding CFP calculation. Taking gray silk fabric using fresh cocoon as an example, the product can be expressed by module combination of ABDFN.

Tab. 1 Modular construction of silk textile system boundary

Module number	The name of the module	Combination of modules
A	Moriculture and sericulture	
B	Fresh cocoon reeling	
C	Dry cocoon reeling	Fresh (dry) cocoon raw silk: AB(C)N
D	Yarn twisting	Fresh (dry) cocoon thrown silk: AB(C)DN
E	Yarn dyeing	Fresh (dry) cocoon colored silk thread: AB(C)DEN
F	Weaving	Fresh (dry) cocoon gray silk fabric: AB(C)DFN
G	Fabric dyeing	Fresh (dry) cocoon dyed silk fabric: AB(C)DFGN
H	Fabric printing	Fresh (dry) cocoon printed silk fabric: AB(C)DFHN
I	Scarf processing	Fresh (dry) cocoon brocade: AB(C)DEFNOP
J	Garment processing	Fresh (dry) cocoon printed silk scarf: AB(C)DFHINOP
K	Tie processing	Fresh (dry) cocoon printed silk clothing: AB(C)DFHJNOP
L	Silk quilt processing	Fresh (dry) cocoon silk tie: AB(C)DEFKNOP
M	Silk bedding processing	Silk quilt: ALNOP
N	Sale	Fresh (dry) cocoon Brocade bedding: AB(C)DEFMNOP
O	Usage	Fresh (dry) cocoon Dyed silk bedding: AB(C)DFGMNOP
P	Waste or reuse	

1.1 LCA framework of moriculture and sericulture

It is chronicled that silk originated from China, and Chinese silk industry has experienced 5,000 years of development. As a big country in the production and export of silk products, China should speed up the promotion and application of energy saving and emission reduction technology in the silk industry, and improve the green production level of the industry. During the moriculture and sericulture phrase (module A), there are also a large amount of GHG emissions due to the use of fertilizer and energy. Fig. 1 is the LCA framework of module A, which defines the system boundary, input and output of this stage. The module A can be roughly divided into three detailed stages. The first stage is the moriculture. Every year mulberry branches should be pruned and fertilized at the end of winter and the beginning of spring, and herbicides should be applied before mulberry leaves grow, so as to reduce the competition between weeds and mulberry trees for nutrients. In the early stage of mulberry leaf growth, pesticides should be used to reduce pests, and the soil moisture of

mulberry garden should be adjusted in time. Therefore, the type and amount of chemical fertilizer and pesticide, irrigation method (irrigation and drip irrigation) and water consumption all directly determine the amount of carbon emissions. The second stage is sericulture. Before sericulture, the silkworm rearing room and tools should be disinfected. Then breeding, warming and incubation should be started. After the fifth instar rearing, the silkworm and sericulture tools should still be disinfected in time during this period to prevent the spread of virus or disease such as sepsis, and muscardine in a large scale. After this, it is mounting, cocooning, and harvesting. In the second stage, the use of disinfectant water and silkworm medicine, the oil consumption of mulberry leaves transportation and the consumption of labour are the main reasons for carbon emissions. The third stage is cocoon transportation and sale. The carbon emissions of this stage are generated by gasoline and electricity consumed in the process of cocoon transportation and storage.

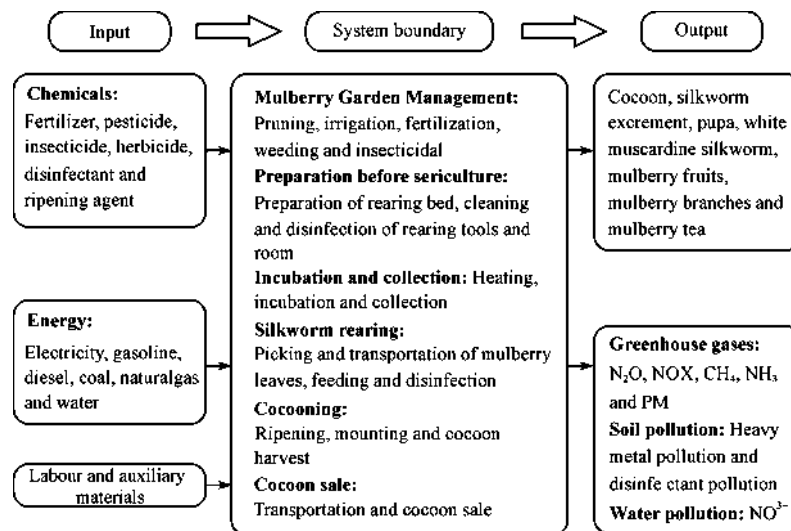


Fig. 1 LCA framework of moriculture and sericulture phase

1.2 LCA framework for industrial production, sales, use, and waste phase of silk products

In this study, silk products are divided into two categories; one is business-to-business silk products, such as gray silk fabric, dyed silk fabric, and printed silk fabric; the other is business-to-customer products, such as silk clothing, ties, scarves, and bedding. The two kinds of products have some shared product modules, such as silk reeling module and weaving module. And each product has its own specific processing phase or module. Fig. 2 lists the specific process of different modules defined as forementioned, as well as the system of these modules.

By selecting and recombining of these modules, it's easy to establish the system boundary of a new silk product.

It can be seen from Fig. 2 that the difference between fresh cocoon raw silk and dry cocoon raw silk mainly lies in the difference of cocoon storage and pre-processing. Fresh cocoon raw silk needs to be refrigerated, which consumes more power, while dry cocoon raw silk needs to be dried and cooked at a high temperature, which consumes more energy such as coal and natural gas. Dyeing, printing and finishing processes will use dyes and auxiliaries, and a lot of water resources; the printing and dyeing process will release formaldehyde, nitrogen dioxide,

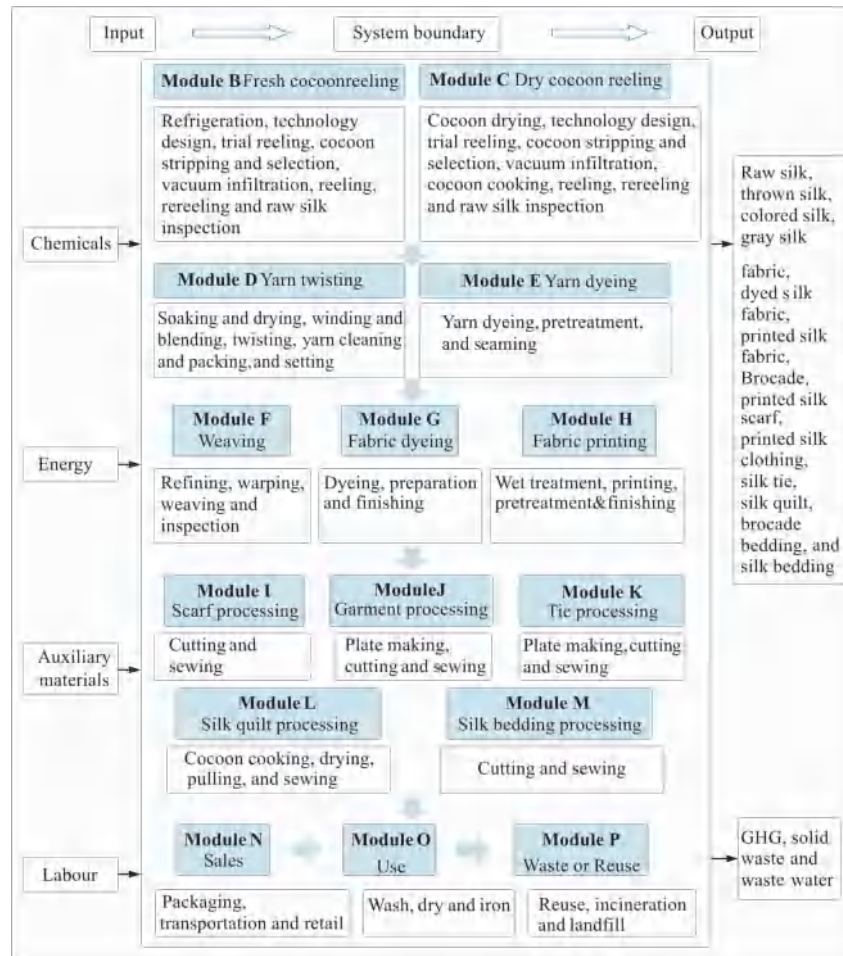


Fig. 2 LCA framework of modules B-P expressing different stages of the silk products

aniline, chlorinated compounds and other gases, which are the main sources of GHG emission. And some consumption such as electricity consumption contributed by the machine running throughout the industrial production, and gasoline consumption contributed transportation throughout the product life cycle, are also the main GHG emission sources. The use stage of silk products mainly includes washing, drying and ironing. The way of washing (machine washing or hand washing) and the times of washing, drying and ironing determine the carbon emissions in the use stage, so the carbon emissions in this stage are closely related to personal use habits. The waste stage of textiles mainly involve landfill, incineration and reuse. The reuse of textiles can effectively reduce carbon emissions, and incineration causes the largest carbon emission among the three waste treat methods.

2 Calculation of CFP of silk products based on modularization

2.1 Calculation method of CFP

GHG mainly comes from the use or consumption of chemicals

(fertilizers, pesticides, herbicides, dyes, additives, etc.), energy (natural gas, coal, gasoline, electricity, steam, etc.), auxiliary materials (packaging materials, etc.) and labour. The photosynthesis of mulberry leaves can produce carbon sequestration effect, which converts CO_2 in the atmosphere into carbohydrates and sequesters it in plants in the form of organic carbon, and effectively reduces the content of CO_2 in the atmosphere. However, the carbon sequestration effect of plants is seldom considered when calculating CFP in the current literature. In the whole life cycle of silk products, there might be co-products such as silkworm excrement, pupa, white muscardine silkworm, mulberry fruits, mulberry branches, mulberry tea, etc. Therefore, the CFP of the silk products can be partially distributed to the co-products according to the physical relationship between them, or their economic values. Therefore, with the increase of the utilization rate and the economic value of co-products, the CFP distributed to co-products will also increase, while the remaining CFP of the silk products will decrease. The CFP accounting of silk products should include six parts: the first

partis the carbon emissions generated by chemical input; the second part is the carbon emissions generated by energy use; the third part is the carbon emissions generated by material usage; the fourth part is generated by human consumption; the fifth part is the carbon sequestration generated in the process of plant growth and the sixth part is the carbon emissions allocated by co-products. Among them, the part of carbon emissions caused by human consumption in the production process was generally not considered, because it's believed that CO₂ produced by human respiration was generated all the time, and has nothing to do with the product processing. However, for the same product, the consumption of labour caused by different production efficiency is often quite different, and this part of the difference should have different impacts on the environment. Especially for labor-intensive products, labour consumption should be within the scope of CFP accounting. The specific calculation formula of CFP for a silk product having m modules can be computed as follows.

$$CFP = \sum_{i=1}^{n_1} (f_{CH_i} \sum_{j=1}^m CH_{ij}) + \sum_{i=1}^{n_2} (f_{EN_i} \sum_{j=1}^m EN_{ij}) + \sum_{i=1}^{n_3} (f_{MT_i} \sum_{j=1}^m MT_{ij}) + f_{PE} \cdot \sum_{i=1}^m n_i - \frac{K \cdot A \cdot Y}{H} - CFP_{co-pro} \quad (1)$$

In the formula, CFP is the total carbon emission, n_1, n_2, n_3 are the number of chemical, energy, and material kinds respectively, m is the number of modules, $f_{CH_i} (i = 1, 2, \dots, n_1)$ is the CFP conversion factors of the i^{th} chemical, $CH_{ij} (i = 1, 2, \dots, n_1; j = 1, 2, \dots, m)$ is the consumption of the i^{th} chemical in the j^{th} module, $f_{EN_i} (i = 1, 2, \dots, n_2)$ is the CFP conversion factors of the

i^{th} energy, $EN_{ij} (i = 1, 2, \dots, n_2; j = 1, 2, \dots, m)$ is the consumption of the i^{th} energy in the j^{th} module, $f_{MT_i} (i = 1, 2, \dots, n_3)$ is the CFP conversion factors of the i^{th} material, $MT_{ij} (i = 1, 2, \dots, n_3; j = 1, 2, \dots, m)$ is the consumption of the i^{th} material in the j^{th} module, f_{PE} is the daily carbon dioxide exhalation of each person, $n_i (i = 1, 2, \dots, m)$ is the number of days required in module i , A is the carbon absorption rate of mulberry, Y is the economic output of mulberry, H is the economic coefficient of mulberry, K is the remaining percentage of the biogeic carbon in 100 years, and CFP_{co-pro} is the amount of CFP allocated by co-products.

2.2 Carbon footprint conversion factors

The CFP conversion factors (CFP-CF) of various energy sources and materials are obtained by calculating the indirect carbon emissions in the production stage and the direct carbon emissions in the use stage. For the same material, especially energy, different countries and regions have different CFP conversion factors, we should choose the most suitable CFP conversion factors for silk products. And the suitable CFP conversion factors of the main materials and energy involved in the whole life cycle of silk products are collected in this study, as shown in Tab. 2. Generally speaking, the CFP conversion factors of fossil energy have three levels, i. e. regional factors, national factors and international factors, and their priority decreases in turn. Usually, we choose the CFP conversion factors of the region nearest to the product processing site. When it is difficult to calculate the CFP conversion factors of a material, the CFP conversion factors of its substitute can be directly used instead.

Tab. 2 CFP conversion factors of various inputs of silk products throughout their life cycles

Material type	Material inputs	CFP-CF (kgCO ₂ e/kg)	Involved modules	Material type	Material inputs	CFP-CF (kgCO ₂ e/kg)	Involved modules
Energy	Gasoline	157.48	ABCNP	Pesticides	Dimethoate	24.2	A
	Aviation gasoline	0.83 ^a	N		Dichlorvos	28.59	A
	Diesel oil	141.75	ABCNP		Bisultap	48.40	A
	Kerosene	19.05	BC		Glyphosate	70.75	A
	Fuel oil	34.91	ABCNP		Paraquat	71.48	A
	Natural gas	4.55	BCGHL		Nitrofen	42.16	A
	Lubricating oil	7.92	ABCDEFGH IJKLMN		Chlorothalonil	43.99	A
	Standard coal	0.59	ABCGH		Carbendazim	57.46	A
	Steam	0.05	ABCGH		Triadimefon	57.10	A
	Water	0.12 ^b	ABCD EGHO	Chemicals	Lime	0.15 ^a	AEGH
Materials	Electricity	T/CNTAC 11 – 2018	All modules		Caustic soda	0.82	BCEGH
	Carton packaging	1.04	All modules		Soda ash	1.31	BCEGH
	A4 printing paper	0.01 ^c	All modules		Concentrated sulfuric acid	0.12	EG
Fertilizers	N-fertilizer	7.76	A		Formic acid	3.14	EGH
	P-fertilizer	2.33	A		Baking soda	1.35	BCEGH
	K-fertilizer	0.66	A		Industrial salt	0.18	BCEGH

Note: a represents kgCO₂e/MJ; b represents kgCO₂e/t; c represents kgCO₂e/sheet

2.3 Development of carbon footprint accounting software for silk products

At present, the software for carbon footprint accounting mainly includes GaBi developed by German-based PE international and SimaPro developed by Dutch PRÉ Consultants company. The two types of software feature rich database, powerful computing power and wide application range, and they can usually be used to calculate the carbon footprint of textile and garment products. Silk products, whose production process is different from that of other textile fiber products, has a large variety, a long life cycle chain and complex system boundaries. Therefore, in order to accurately calculate the carbon footprint of silk products, it is necessary to develop exclusive carbon footprint

accounting software suitable for silk products. Fig. 3 is the framework of carbon footprint accounting software based on the modular construction of silk product life cycle, which mainly includes five parts: products selection, data input, database, carbon footprint calculation and results analysis. In the process of product selection, there are specific silk products and customized products, among which several common silk products are listed for specific products, while other silk products need to complete customized selection through the combination of modules. There is a complete database of carbon emission coefficients of materials in the life cycle of silk products in the software, and carbon footprint accounting and uncertainty analysis can be completed by inputting the collected data into the software.

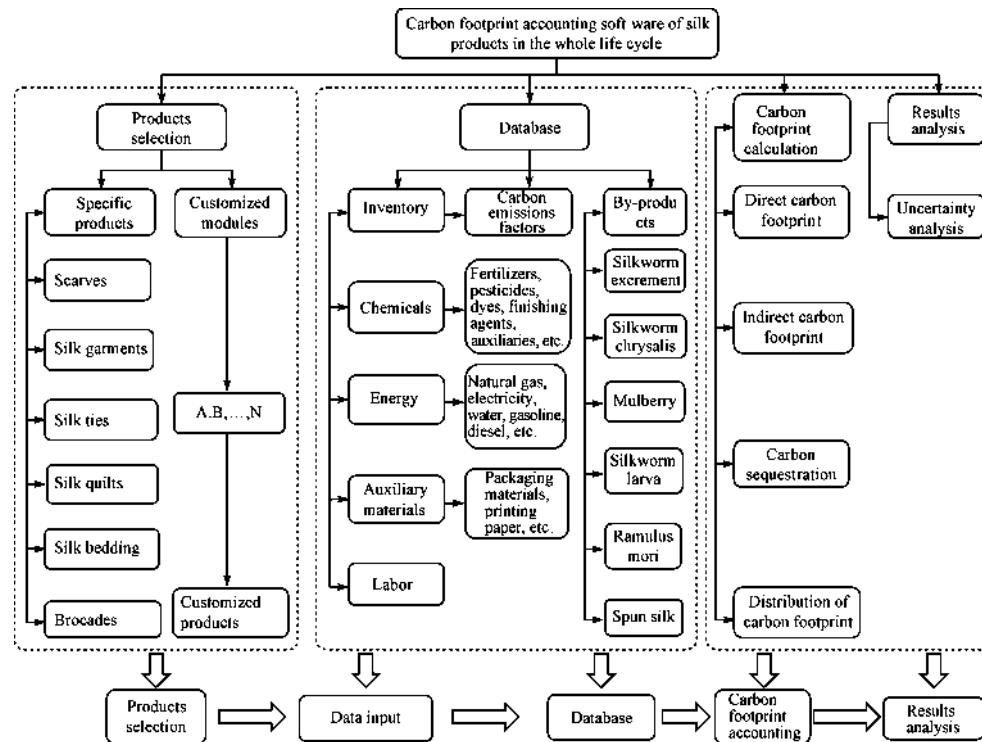


Fig. 3 Framework of carbon footprint quantification software for silk products

3 Conclusion

Low-carbon and green silk products have been imperative, and carbon label has been paid more and more attention. This paper has constructed a modular method in determining the system boundary of a silk product using LCA method. Based on this method, different modules can be freely combined to form the system boundary of a specific silk product, through which the CFP calculation of the silk product can be quite efficient and accurate. The article has drawn the following conclusions:

1) The standardized construction of the LCA framework can facilitate the standardized accounting of the CFP of all kinds of

silk products, and make the quantification results of different products comparable;

2) The study lists the life cycle of silk products, collects the carbon emission coefficients of materials involved in its life cycle and establishes a CFP calculation model in which the allocation of CFP and the carbon sequestration of mulberry trees are taken into account.

3) The accounting software framework for silk products is constructed, which provides a theoretical basis for the development of LCA evaluation software specific for silk products in the future.

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Proposal for the comprehensive and objective assessment of life cycle of silk products

International Silk Union, International Sericultural Commission, Ufficio Italiano Seta, INTERSOIE France, Brazilian Silk Association

With a view to reflect the carbon neutrality and sustainability of silk products in a more comprehensive and objective manner, International Silk Union (ISU) joined hands with several organizations, such as International Sericultural Commission (ISC), Ufficio Italiano Seta (UIS), INTERSOIE France and Brazilian Silk Association (ABRASEDA), to table the following proposals:

1 To question the method of developing Higg MSI scoring on silk

Higg MSI arrived the environmental impact value of silk as 1,086, which is more than 30 times worse than synthetic fabric. The irrationality of its scoring is mainly manifested on the following aspects:

1) Higg MSI's assessment of the life cycle of silk only stays at the stage from sericulture to fabric (that is, from "cradle to gate"). Referring to the international standards of ISO 14020: 2000 Environmental labels and declarations-General principles and ISO 14040: 2006 ISO 14040: 2006 Environmental management—Life cycle assessment—Principles and framework, the life cycle assessment of silk products should be a research type from "cradle to grave", which covers the production, use and disposal of silk ready-to-wear, silk apparels and silk home textiles. Silk is the "queen of fibers", and its manufactured goods have a long service life and are eventually biodegradable. Therefore, the research from "cradle to grave" is more convincing, complete and scientific.

2) The evaluation indicators of Higg MSI only include "global warming potential", "nutrient pollution in water/eutrophication", "water scarcity", "fossil fuel depletion" and "chemistry". More indicators should be added to comprehensively evaluate the environmental performance according to the *Product Environmental Footprint Category Rules Guidance (PEFCR)*.

3) As manifested by relevant data, Higg MSI's scoring data of silk originated from a paper entitled Life Cycle Assessment of Indian Silk published by Miguel F. Astudillo et al on the *Journal of Cleaner Production*. The data in this paper collected before 2013 are lack of timeliness, and using the data from individual countries or regions to evaluate the environmental impact of silk is not representative or comprehensive. It is understood that the research was carried out for a completely different purpose rather than the Higg Index.

4) Higg MSI has not made public its calculation method and is free from social supervision. Silk producers know nothing about the results and cannot trace their origins. Over time, the consumers' negative perceptions on silk are intensified and the producers are bruised.

2 To make a comprehensive and objective assessment of life cycle of silk products

In 2015, nearly 200 countries adopted the Paris Agreement at the United Nations Climate Change Conference in Paris. Many countries have enacted low-carbon development strategies in succession. In 2020, China set out the goal of "achieving peak CO₂ emissions before 2030 and carbon neutrality before 2060". The UK boosted the reduction of greenhouse gas using two approaches, restriction and incentive, and identified low-carbon electricity as the core of low-carbon development. By formulating the National Programme for the Mitigation of Climate Change, France clearly defined the selecting and formulating principles of emission reduction measures.

It is a joint duty and commitment of the countries, silk sector, business circles and consumers to respond to the global low-carbon development strategies and facilitate the healthy development of silk industry. The international silk industry requires an open, comprehensive and objective assessment system

for the life cycle of silk products to steer the production and consumption of silk industry.

1) It is necessary to determine the boundary of the assessment system which confirms to the current production and consumption of silk according to relevant international standards, as well as evaluate its environmental performance in the full life cycle from sericulture, production and design to recycling and disposal of silk products. The evaluated sustainability scores are validated by ISO and provided for public use and interpretation.

2) The evaluation sample should be comprehensive, representative and accurate. It should include major silk producing countries such as China, India and Uzbekistan, as well as silk manufacturers and consumers in Europe and the United States, involve the key links of silk production such as silk reeling, twisting, weaving, printing and dyeing, and truly reflect the production technology and production conditions of the international silk industry, and the consumer behavior and consumption habits.

3) It is a compelling duty to divide the industrial chain in a rational way, make a comprehensive, in-depth, transparent as well as really traceable inventory analysis on each stage and gradually improve the life cycle assessment of silk products, so that a more open and transparent evaluation system that withstands the test of practice can be widely applied in the silk industry, and

the awareness of environmental responsibility of the silk industry can be raised.

4) It is essential to actively seek policy support, fully exert the linkage between trade organizations and enterprises, allow high-quality and time-sensitive industrial data to be applied to the assessment system and objectively reflect the environmental performance of silk products. It is essential to promote market-oriented green technological innovation, standardize LCA research in the global silk industry, formulate Silk Product Category Rules (PCR), industry standards and sustainability indexes to guide silk enterprises in green production.

5) Last but not least silk needs all of us to take the initiative to cultivate consumers' green values and green spending habits, and give full value to the publicity function of the media platform, so that consumers can fully understand "carbon neutrality, sustainability and ecological environment protection", and create a demand engine for the development of green silk industry.

It is essential to plan energy resources as a whole and advocate greenness and low carbon. We are liable to co-build a green home for silk. Industry organizations, enterprises and brands of international silk should pool efforts, seek common development, propel the comprehensive and objective assessment of the life cycle of silk products, and guarantee the healthy and sustainable development of the silk industry.

Work report of the International Silk Union Education Research Professional Committee

CHEN Wenxing

(Director of ISU Education Research Professional Committee, Academician of Chinese Academy of Engineering, President and Professor of ZSTU)

The COVID-19 outbreaks at home and abroad have brought a great impact on the cocoon and silk industry since 2020. Under such a condition, the development strategies have been adjusted promptly. In addition to boasting a complete industry chain and strong support ability regarding silk, China has attached great importance to scientific and technological innovation in recent years, resulting in the close industry-university-research cooperation to address the bottleneck problems in design, research and development of new processes, technologies and products, as well as transformation and upgrading. The development of silk protection products and multifunctional silk products in response to the COVID-19 and other infectious diseases has accelerated the speed of R&D and marketization, enhancing the competitiveness of silk products. In brief, the silk industry has withstood the test of the epidemic, exhibiting strong resilience and vitality.

Since its founding in 2017, 16 members from China, Australia, India, Poland, Brazil, Thailand and other countries have joined ISU Education Research Professional Committee. In September 2019, the second meeting of the committee was held but we haven't found any opportunity to gather for discussion and exchange since 2020 due to the epidemic. Nevertheless, the committee members have been paying close attention to international epidemic situation from their respective countries and in their respective jobs, adopting various methods to assist silk enterprises in resuming work and production, actively providing response measures, and working to the training of silk talents and scientific and technological innovation under the new situation. A brief introduction to the work of the committee in terms of silk education, scientific research, and cultural exchange will be introduced as follows.

1 Silk Education

1.1 Training of professional talents

The training of silk professionals in various universities has

distinctive features. For instance, Zhejiang Sci-Tech University (ZSTU) resumed the major of silk design and engineering in 2017, which is the only silk major for undergraduates in China at present. Integrating art with engineering, the major aims to train versatile and advanced application-oriented talents with not only knowledge of textile and silk engineering, but artistic accomplishment, innovative design theory and practical ability. In May 2021, the graduation exhibition themed with "Silk Thinking & Future" from the first graduates of this major was launched, gathering the design works of all graduates that covered several major directions such as apparel, pan-furniture, and cultural and creative products with diverse and distinct themes, rich content and multi-dimensional concepts. More than 60% of the exhibition works have been adopted by related companies and transformed into products, indicating quite high academic performance and creative level of the students majoring silk over the past four years.

ZSTU held a seminar on silk design and engineering construction in China National Silk Museum in November 2021 when YU Chongwen, Director of Teaching Steering Committee of Textile Specialty in Colleges and Universities of Ministry of Education, WU Haiyan, Professor of China Academy of Art, WU Jingen, president of Zhejiang Silk Association, LIN Ping, Chairman and CEO of High Fashion Silk (Zhejiang) Co., Ltd., TU Yongjian, senior craft artist of Babei Group Co., Ltd. and other experts and scholars were invited to attend the seminar. At the seminar, these experts and scholars not only conducted in-depth discussions on the professional orientation, training objectives and curriculum setting of the major of "silk design and engineering", but also provided suggestions for construction of the major from the aspects of specialty feature, curriculum system and professional development, and put forward many useful suggestions and opinions. It was hoped that the university would further base itself on the advantages of

the silk industry in China, especially in Zhejiang province, inherit the culture of silk education, serve the transformation and upgrading of the silk industry, and better train versatile and advanced application-oriented talents regarding silk.

Soochow University is also an institution of higher education in China that specializes in training silk talents and has always adhered to the features of developing silk products, silk culture and full silk industry chain to promote discipline construction and industry development and innovations. In 2019, the silk culture education brand was successfully selected as the Suzhou Innovation and Excellence Project and the national excellent course named Silk Culture and Products won the first prize of the Teaching Achievement Award of Soochow University. This online open course exhibited the full silk industry chain, the long history and culture of silk, and exquisite silk products close to people's lives in plain language, video, animation and pictures, so that university students and the public could fully understand traditional silk culture, silk products and related knowledge.

In the context of biological sciences and led by modern biotechnology, the Research Institute of Applied Bioresource of Zhejiang University is committed to the diversification and high value utilization of silk, and focuses on education and research work of the development of silkworm spinning mechanism, oriented breeding of silkworm to produce multifunctional silk, fibroin biomaterial construction and tissue regeneration and repair based on the characteristic material of silk and fibroin. In the past three years, a total of 41 teachers and students have been selected to participate in five sericulture-related international conferences, a total of 87 people have been selected to attend six domestic academic conferences, three foreign experts have been invited to visit and exchange and two doctors been selected for exchange and study in overseas universities.

Scientific research institutions also play an important role in the cultivation of silk talents. Sichuan Academy of Silk Sciences has participated in the teaching of specialized courses regarding silk, paper review and thesis defense for master degree. For instance, it has offered multiple courses for the "Brocade Inheritance and Innovation Art Design Talents Training Class" of College of Chinese & ASEAN Arts, Chengdu University, organized silk product innovation design competition entitled "Brocade Sichuan & Origin of Silk", and collected more than 1,600 works, greatly enhancing the overall ability of creative design and product research and development talents in the industry.

1.2 Skill training and education

From November to December 2021, ZSTU carried out online training and teaching activities for "Training Program on Processing Technology and Innovation Design of Modern Silk Products" of the Ministry of Science and Technology of PRC and 21 participants from 10 countries including Ethiopia, Pakistan, Bhutan, Maldives, Bangladesh, Nepal, Thailand, Iran, India and Vietnam took part in the activities. Themed by silk product processing and innovative design, the activities aim to impart related knowledge such as mulberry planting and silkworm raising, silk reeling and silk fiber weaving, product design and dyeing & finishing, building a bridge for information exchange, talent exchange and scientific and technological cooperation between the Chinese silk industry and its counterparts in Asia and Africa.

ZSTU hosted the ninth sessions of "Training Program on Art & Technique Heritage and Creative Design of Brocade" in October 2021, when several renowned experts were invited to give lectures, and a large number of off-campus resources and platforms were introduced for production-university-research cooperation to jointly advance the inheritance and innovative development of China's intangible cultural heritage of brocade. Since 2017, ZSTU has held nine training class for more than 180 inheritors and practitioners from over 20 regions in China.

The kick-off ceremony of "Silk Culture Inheritance and Management Innovation Personnel Training Program" hosted by ZSTU and funded by the China National Arts Fund was held on Xiasha Campus of ZSTU and 15 students from Shenzhen, Suzhou, Hangzhou and other places attended the training. Multiple renowned professors from inside and outside the university, silk experts and business and management entrepreneurs were invited to form a teaching team, with the contents covering all aspects of the silk industry chain, including silk cultural inheritance, silk commodity planning, silk brand operation and new formats of live broadcasting. Besides, many silk enterprises were visited on the spot. In order to build silk as the carrier of China's independent fashion culture, the silk industrial culture was inherited and the management was innovated through centralized training, visits, expert lectures, case studies, etc.

Soochow University hosted the National Advanced Training Course on Reeling Technology and Management in 2019, with the training contents covering silk producing process, product quality management, raw silk quality practical detection technology, national and industry standards, product quality problem analysis,

etc., which built a technology exchange platform of "industry-university-research cooperation" for silk production enterprises, boosting the high-quality development of cocoon silk industry.

Focused on high-quality and efficient sericulture production technology, new silkworm variety breeding technology, cocoon quality and silk producing process technology, the application of new reeling and cocoon boiling equipment, fresh cocoon reeling process technology, Sichuan brocade and Sichuan embroidery craft, and improvement of cocoon and raw silk quality, corporate technical management, reeling factory planning and design, etc. in recent years, Sichuan Academy of Silk Sciences has carried out 33 skill training sessions for enterprises in silk industry inside and outside Zhejiang province mainly by means of conferences and lectures, on-the-spot teaching and expert consultation. The training involved 778 trainees and over 50 enterprises and public institutions.

Various silk-related training and teaching activities have not only enhanced the professional skill of silk practitioners, but strengthened the communication and exchanges between China and other countries in the field of silk from multiple levels and perspectives. In response to the new international situation, the committee members and related institutions will devote greater efforts to cultivate talents in silk industry, and make new contributions to the high-quality development of silk industry.

2 Silk research

Centering on the key and common technologies of the silk industry, Chinese experts have made a lot of works in the deep processing of silkworm resources, intensive and industrialized silkworm rearing, processing of functional silk and the products thereof, digital and short-flow silk reeling equipment and technology, creative design and weaving technology for silk products, ecological and intelligent printing and dyeing of silk, silk cultural relics protection, etc. A group of industrial technology innovation talents have been gathered and trained through industry-university-research cooperation, promoting the development of the silk industry.

The mulberry twig total alkaloids tablet, a new hypoglycemic pharmaceutical, has successfully come into the market, the fibroin bone nail has been applied to clinical test and fibroin fresh-keeping agent has been put into industrial production, marking the comprehensive utilization of cocoon silk resources is expanding to the high-tech fields of biology, medicine and chemical industry.

The rapid development of 5G, artificial intelligence and other new technologies has accelerated their application in intelligent manufacturing, and new breakthroughs have been continuously made in full-age silkworm artificial feeding and the R&D of intelligent silk breeding equipment technology. Such technologies have been actively applied in various regions and traditional silkworm breeding mode is transforming to factory-based automated one. High Fashion Silk (Zhejiang) Co., Ltd. has taken active steps to promote the intelligent information workshop project by increasing the silk worker stands stand from four sets to 30 sets for each worker, realizing the workshop intelligent management in primary level. Cathaya Group has developed new silk products with special organizational structure and textures through mathematical modeling and computer intelligence technology. The double-sided digital printing technology developed by Hangzhou Honghua Digital Technology Stock Co., Ltd. and Wensli Group has avoided the excessive water consumption and waste slurry in traditional printing process and made the unprinted area of thick fabric adopting one-sided printing printed. The 2021 Zhejiang provincial key R&D program "Silk Fabric Washing-free Printing and Dyeing Technology R&D and Industrialized Application" is expected to further advance the energy-saving, cost-reducing and sustainable development of silk printing and dyeing.

Preliminary effects have been achieved in silk new material research and development. For example, great technological breakthroughs have been made in the bombyx mori-spiderbionic silk developed by Zhejiang Jiaxin Silk Co., Ltd. by combining the genes of bombyx mori and spider to improve the silk performance. As a result, the strength of super bionic silk is 3.86 times the ordinary silk, and it is expected to be applied to military and biomedical fields in the future.

Sichuan Provincial Silk Science Research Institute has devoted more efforts to scientific and technological research and development of the key generic technologies in cocoon silk industry. Since 2019, it has undertaken 25 ministerial and provincial scientific research projects. Among the enterprises using the self-developed automatic cocoon cooking machine with high efficiency and decompression, some have scored 95.5 points regarding raw silk cleanliness, with the grade being above the 6A standard. The selected new tussah silkworm variety "Chuanzuo 3" has passed the provincial certification. As the major drafter, the institute has established the group standard Code of Practice for Fresh Cocoon Reeling of China Silk Association and the Sichuan

provincial standards Technical Regulations for Prevention and Control of Main Diseases of Oak Tree and Technical Regulations for Prevention and Control of Main Diseases of Tussah, all of which have been released and implemented.

In October 2020, Soochow University hosted the "Textile Silk Technology and Industrial Development Forum" themed by "weaving the innovation-driven intelligent future of silk industry", attracting over 100 representative entrepreneurs and experts from 61 Chinese textile and silk enterprises to actively exchange the newest scientific and technological achievements and high-quality development prospects in the textile silk industry and share new concepts and new technologies in textile and silk fields so as to promote the high quality and sustainable development of textile and silk industry.

In June 2020, "World Silk and Silk Road International Research Center" was established in ZSTU, aiming at conducting world-wide studies of Silk Road and related silk cultural heritage. In November, 2020, ZSTU hosted the 1st International Symposium on Silk and Silk Road Research, and scholars from UNESCO, DKNVS, US Textile Pattern Research Foundation, University of London, University of Cambridge, University of Oxford, as well as universities in Japan, Netherlands, India, Russia, Israel and other countries attended the meeting, which provided new directions for the study of Silk Road and silk and new thought for domestic silk talents training. The meeting was held online and offline simultaneously due to the epidemic and the live broadcast attracted over 4,000 audiences online.

The project "Energy-Saving and Emission Reduction Silk Production and Industrialization Application" jointly completed by ZSTU and Hangzhou Textile Machinery Group Co., Ltd. won the first prize of 2020 CNTAC Science and Technology Progress Award. Professor HU Zhiwen, deputy professor WANG Bing, and their teammates from ZSTU have succeeded in developing the "fibroin reinforcement technology" for the conservation of unearthed silk cultural relics after over a decade's efforts, overcoming the frangibility of silk during the reinforcement. This technology has been applied in the silk fabrics in Ningshou Palace Garden in the Forbidden City, Mogao Grottoes in Dunhuang, as well as the cultural relics unearthed from the tomb of Princess of Xiaohu. The team has also developed a test strip which can quickly detect silk in silk fabric in the archaeological sites with high sensitivity and specificity, making a breakthrough in the detection principle. Such technology has also been applied in the shipwreck sample of "Nanhai No. 1" and silk fibre is detected.

In October 2021, the research paper entitled "Rapid Enrichment and Detection of Silk Residues from Tombs by Double-Antibody Sandwich ELISA Based on Immunomagnetic Beads" jointly published by China National Silk Museum, ZSTU, Institute of Cultural Heritage, Shandong University and Hubei Provincial Museum on the TOP international journal *Analytical Chemistry* brought an innovative approach for detecting the silk residues from tombs, which is of great significance to the study of ancient silk.

Journal of Silk run by ZSTU has been included in the list of "Characteristic Sci-tech Periodicals in Chinese Universities and Colleges" by Technological Department, Ministry of Education of the People's Republic of China and the list of "Top 100 Science and Technology Journals of Chinese Universities" by Society of China University Journals. In the meanwhile, it has won a series of awards such as "Excellent Online Journal Award of China Science and Technology Papers" granted by Science and Technology Development Center, Ministry of Education of the People's Republic of China, and first prize of Zhejiang Provincial Excellent Periodical Award. In the beginning and end of July of 2021, it respectively won "Sub-project of Selecting and Cultivating High-level Talents for Excellence Action Plan for China STM Journals" of China Association for Science and Technology and Nomination Award of the fifth "Chinese Government Award for Publishing"; in September and November, it won the "Outstanding Cover and Layout Design Award" of China Periodicals Association and Journal Award of Zhejiang Shuren Publishing Award, respectively.

3 Research and exchange of silk culture

The establishment of Zhejiang Silk and Fashion Culture Research Center, the key research base of philosophy and social sciences in Zhejiang Province is aimed to create a height for fashion culture research. On May 22, 2021, Zhejiang Federation of Humanities and Social Sciences Circles and ZSTU jointly hosted the 2021 academic seminar entitled "New Fashion, New Silk Road & New Theory" successfully, which gathered many experts, scholars from silk, fashion, culture and other fields and industry representatives in Hangzhou for discussion and theoretical academic research of excellent silk tradition inheritance and modern fashion construction during the "major window" period in Zhejiang Province.

To inherit silk culture and run the journal with features

—Report on the 65th anniversary of the founding of *Journal of Silk*

LI Qizheng, XU Shiyong, YANG Yizhou

Editorial Department of *Journal of Silk*

In October 1956, Mr. ZHU Xinyu, a renowned silk expert and silk educator who aspired to revitalize China's silk industry by means of science and technology, founded *Zhejiang Silk Industrial Communication*, the predecessor of *Journal of Silk* beside the West Lake of Hangzhou. Now, *Journal of Silk* has become a professional journal with a long history, great clout and authority in international silk field. The current editor-in-chief is Professor CHEN Wenxing, Academician of Chinese Academy of Engineering and President of Zhejiang Sci-Tech University.

As a small, exquisite, professional, unique and superior journal, *Journal of Silk* strives to "lead silk technology and inherit textile culture" based on interdisciplinarity, focuses on serving the building of a powerful silk national and the national "Belt and Road" initiative, and is dedicated to amplifying the voices and enhancing the influence of Chinese silk. At the same time, being both reader-oriented and author-oriented, and featured by interdisciplinarity, *Journal of Silk* centers on seeking high quality contents and building periodical brand, publishes academic papers on basic research, technological innovation and cultural inheritance regarding silk (textile) based on a high level of peer review and reports important news of silk industry. Its clout is on the rise year by year. In recent years, it has mainly built the brand and shaped features of the journal through the following four aspects.

1 To serve the national initiative as an "important window"

1.1 Pioneering in the field for 65 years, *Journal of Silk* has been striving to act as "an important window"

As one of the earliest, prestigious, professional and most widely circulated journals in history, *Journal of Silk* has been committed to advancing subject development, recording and developing Chinese silk in the past 65 years. After generations of

silk men's unremitting efforts, it has been indexed in more than 20 periodical databases at home and abroad, issued in over 20 countries and regions such as France, Italy, Japan, India and Brazil and highly appraised by silk industry organizations in various countries, making itself an "important window" for the spread of Chinese silk science and culture overseas.

1.2 The platform resources have been integrated to serve the Belt and Road Initiative

As one of China's few industries dominating internationally, silk is an important cultural carrier and medium for the Belt and Road Initiative. At present, the periodical agency is responsible for taking the lead in running four major service platforms in silk textile industry, namely, the Secretariat of the International Silk Union, China Silk Information Center, the Secretariat of the Zhejiang Textile Engineering Society, and Hangzhou Oriental Silk Culture and Brand Research Center, which are among the most influential communication platforms in international silk field.

1.3 The journal connects with world organizations to amplify silk's voices on the international stage

As the journal of International Silk Union and China Silk Association, *Journal of Silk* began to take over the management of the Secretariat of the International Silk Union in December 2019. In 2020, the International Silk Union joined Union of International Association (UIA), becoming the first international organization of the silk industry in UIA with the secretariat in China. In addition, the influence of the periodical office and the journal has been expanded by supporting the activities of such industrial events as the Video Conference of International Network of Silk Cities and Metropolis, China International Silk Expo, Vietnam International Silk Culture Festival, China (Suzhou) International Silk Expo and Western China International Fair.

In the meanwhile, the journal aims to disseminate the information of silk industry and promote the interaction and exchange between industries through two official websites of www.worldsilk.com.cn and www.cnsilk.cn and Wechat public accounts of World Silk Network, Journal of Silk, Textile World, Hangzhou Oriental Silk, Textile Intangible Cultural Heritage and other new media.

2 To pioneer silk science & technology based on interdisciplinarity

2.1 The advantages of the journal should be given full play to build up discipline construction

Featured by cultural cross and integration and silk science & technology, *Journal of Silk* has been advancing the development of new engineering and new arts disciplines and facilitating the integration of silk science & technology and culture. Advancing shoulder to shoulder with the silk discipline of Zhejiang Sci-Tech University, *Journal of Silk* has become a significant force in discipline construction and an important platform for expanding social influence.

2.2 The journal focuses on cutting edge findings of silk to lead the development of science and technology

Journal of Silk focuses on introducing outstanding academic achievements in basic research, technological innovation and cultural inheritance in the field of silk. It publishes over 240 papers on silk cutting-edge findings and academic research annually by requesting for contribution of articles from experts, soliciting contributions on feature articles and publishing special issues, which has made great contributions to advancing the scientific and technological progress and the spread of history and culture of the silk sector.

3 To protect and inherit classics and enhance innovation and development

3.1 The journal aims to protect and inherit silk craftsmanship

As a major ground for communication and promotion, *Journal of Silk* has organized four sessions of "Training Program on Processing Technology and Innovation Design of Modern Silk Products" sponsored by the Ministry of Science and Technology of the People's Republic of China and eight sessions of "Training Program on Art & Technique Heritage and Creative Design of Brocade" sponsored by the Ministry of Science and Technology of

the People's Republic of China. More than 80 foreign students from countries along the Belt and Road and over 180 brocade inheritors have participated in the training and research.

3.2 The journal aims to carry forward silk culture

Journal of Silk strives to record the studies on silk culture, make an in-depth explanation of the historical origin and development of silk culture, and construct the discourse system of Chinese silk culture. Meanwhile, it works to delve into, sort out, protect, inherit and develop national cultural heritage, revitalize the great wealth left by our ancestors such as silk with a high sense of historical responsibility and step up our efforts to booster the inheritance, innovation and development of silk historical classic fashion industry.

4 The Journal has been widely recognized for distinctive features

4.1 The journal aims to form an academic highland for silk research

Run by Zhejiang Sci-Tech University and jointly sponsored by Zhejiang Sci-Tech University, China Silk Association and China Textile Information Center, *Journal of Silk* boasts a high level team led by an academican, five oversea editorial board members and over 40 leading experts and editorial board members in the field of silk and textile. Besides, more than 600 universities and research institutes of experts and scholars across the country regard the journal as an important one to publish scientific research results.

4.2 The journal's academic indicator ranking rises significantly

Journal of Silk has been among the "Core Journals of China" and "Core Chinese Science and Technology Periodicals" since it was included in the "Guide to Core Journals of China" in 1992. In 2015, it was indexed in "CSCD database" of Chinese Academy of Sciences, making it one of the only two authoritative journals in national textile discipline. In 2017, it was included in Elsevier Scopus database, and in 2020, it was entitled as "RCCSE China's Authoritative Academic Journal (A +)", ranking second among the 41 journals. In 2021, it ranked second among 37 textile journals in Annual Report for Chinese Academic Journal in terms of impact factors. In 2022, *Journal of Silk* is successively indexed in the three core periodicals in China, namely "CSCD", "CSSCI" and "CSTPCD" and in over 20 domestic and

international journal databases such as SCOPUS, EBSCO, CA, JST, CSA and CNKI.

4.3 Various awards it has won indicate it is widely acclaimed and recognized

Over the 65 years, *Journal of Silk* has been entitled as "Outstanding Scientific Journal of Chinese University" by Technological Department, Ministry of Education of the People's Republic of China and "Top 100 Science and Technology Journals of Chinese Universities" by Society of China University Journals, and has been awarded "Outstanding Online Journal Award of China Science and Technology Papers" by Science and Technology Development Center, Ministry of Education of the People's Republic of China, and First Prize of Outstanding Journals of Zhejiang Province. At the beginning of 2021, it won the Sub-project of Selecting and Cultivating High-level Talents for Excellence Action Plan for China STM Journals (the only selected project in Zhejiang Province). The journal won nomination award of the 5th Chinese Government Award for Publishing (the only award-winning journal in the textile field in Zhejiang Province and China), "Excellent Cover Design Award & Excellent Layout Design Award" and the 30th Zhejiang Shuren Publishing Award (the highest government publication award in Zhejiang Province; only five journals were awarded) in July, September and November, respectively.

5 Conclusion

Journal of Silk features academic journal and an artistic cover. In 2020, it was redesigned from the inside out and noted designers were invited to design the layout and cover. The cover design of the 12 issues throughout the year involves not only "Land Silk Road" ranging from Chang'an to Rome but also "Maritime Silk Route" and cities along it, playing an active role in spreading contemporary Chinese values and showing the spirit of Chinese culture, which has been highly acclaimed inside and outside the industry. As China has embarked on a journey of "carbon neutrality" in 2021, the cover of *Journal of Silk* is synchronously themed by "carbon neutrality". Meanwhile, the journal has doubled its efforts to solicit contributions regarding sustainability and life cycle assessment research.

In 2022, *Journal of Silk*, aiming to better serve China's silk industry, will solicit contributions under the themes of "Belt and Road", "carbon neutrality" and "sustainable development" according to the 14th Five-Year Plan and development needs of China's textile industry. Besides, based on national strategic needs, it will keep in alignment with the international first-class periodicals, embrace the responsibility and mission of international silk academic exchange, continue to forge ahead and welcome the 20th National Congress of the Communist Party of China with outstanding results.



INTERNATIONAL
SERICULTURAL
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COMMISSION SERICICOLE INTERNATIONALE

An inter-governmental organization instituted in 1960

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29 November 2021

Prof. Chen Wenxing,
Editor in Chief,
Journal of Silk
Hangzhou, Zhejiang,
Peoples Republic of China

Dear Prof. Chen Wenxing,

Greetings from International Sericultural Commission, Bangalore, India.

It is with great pleasure we came to know that the Journal of Silk is celebrating its 65th founding anniversary. We have been referring the Journal of Silk for a very long time. The journal has always been providing detailed analytical information about the Chinese silk industry and also about the advancements taken place in the sector. The information provided by the Journal of Silk has been the credible source for ISC to update the global silk statistics. The other information provided through the journal has been immensely helpful to the policy planners and researchers of the silk industry all across the globe. I have, at many of the times observed that the global silk fraternity talk highly about the quality of the Journal of Silk.

On this occasion and on behalf of the ISC Member Countries, congratulations for the 65th anniversary of the founding of Journal of Silk. We hope that the Journal of Silk contribute to complement the progress of global silk industry.

With Warm Regards,

Yours sincerely,

DILEEP KUMAR R.
PROGRAMME COORDINATOR



Dileep Kumar R
国际蚕业委员会项目总协调

中国品牌建设丝绸桑蚕品牌集群

贺 信

《丝绸》杂志社：

欣闻《丝绸》创刊 65 周年，我谨代表中国品牌建设丝绸桑蚕品牌集群，并以我个人的名义，表示热烈的祝贺！

春华秋实 65 载，精益求精创名刊。《丝绸》创刊以来，经历了艰难而又坚实的起步，稳健的发轫壮大，始终以“引领丝绸科技、传承纺织文化”为己任，专注于刊登丝绸（纺织）领域基础研究、技术创新和文化遗产等方面的学术论文，成为丝绸（纺织）领域办刊历史悠久、影响力大且具权威性的专业期刊。

65 年来，《丝绸》以宽广的视野，敏锐的视角，严谨的科学理想，搭建了专业的桑蚕丝绸行业交流平台，为传播丝绸科技和文化、助力脱贫攻坚和乡村振兴做出了重要贡献。

进入新时代，站在新起点，希望《丝绸》矢志如初，以习近平新时代中国特色社会主义思想为指导，增强“四个意识”、坚定“四个自信”，从党的百年奋斗重大成就和历史经验中汲取智慧和力量，进一步发挥刊物“增进学术交流、推动技术创新、促进成果转化、引领时尚潮流、加快应用推广、报道行业资讯、交流管理经验、传播丝绸文化”的作用，服务“一带一路”倡议，为推进桑蚕丝绸产业高质量发展，展示和提升中国丝绸的国际话语权和影响力作出新的贡献！

中国品牌建设丝绸桑蚕品牌集群主席：朱保成

2021 年 11 月 16 日

朱保成

中国蚕桑品牌集群主席、国家农业部原党组成员、纪委书记

《丝绸》杂志创刊 65 周年寄语

中国丝绸协会会长 唐琳

光阴荏苒，岁月如歌。《丝绸》杂志自 1956 年创刊以来，迄今已经走过了 65 个春秋。值此《丝绸》杂志创刊 65 周年之际，我谨代表中国丝绸协会向杂志社全体编创人员表示热烈的祝贺，并向长期以来关心支持丝绸业发展的各界人士表示衷心的感谢！

六十五年来，《丝绸》杂志历经几代人的辛勤耕耘，在贯彻落实国家大政方针、发布丝绸科技资讯、反映行业呼声诉求、宣传报道企业改革创新成果等方面发挥了重要的作用。《丝绸》杂志沐风栉雨一路走来，记载了行业科技进步的非凡历程，更见证了中国茧丝绸产业的发展壮大。如今站在“两个一百年”历史交汇点上，面对着世界百年未有之大变局，我们深知行业改革发展任务依然任重道远，唯有抢抓机遇、准确识变、主动求变、果敢创新，方能实现弯道超车，更好地推动行业迈向高质量发展的快车道。

征程万里风正劲，重任千钧再起航。《丝绸》杂志是展示行业科技成果的重要窗口，更是国内外业界信息交流的重要平台。希望你们要切实加强党的领导，自觉同以习近平同志为核心的党中央保持高度一致，增强“四个意识”，坚定“四个自信”，做到“两个维护”，不断提高政治判断力、政治领悟力、政治执行力，坚守舆论阵地，唱响时代强音。同时，要始终践行为行业服务的办刊宗旨，立足新发展阶段，贯彻新发展理念，构建新发展格局，认真总结办刊经验，不断创新工作方式，积极营造百家争鸣的学术氛围，大力弘扬中华丝绸传统文化，讲好中国丝绸故事，着力打造国际一流学术名刊，为推动“十四五”我国丝绸文化产业发展水平再上新台阶，做出更加卓越的贡献！

最后，预祝《丝绸》杂志越办越好。

唐琳

二〇二一年十一月二十二日

中国纺织信息中心

致《丝绸》创刊六十五周年的贺信

一根丝，连接古今中外。在螺祖养蚕绿丝的传说中，在古代丝绸之路的驼铃声里，在纺织强国建设的光明征途上，丝绸是最具中国文化特色和全球符号意义的纺织品类。

一根丝，关系人民幸福。丝绸产业贯穿一二三产，集成科技与时尚创新，关系消费与产业升级，弥合区域差距与城乡差距，是打造现代产业体系和稳步推进共同富裕的重要力量。

产业高质量发展离不开创新驱动与引领。行业科技期刊是荟萃科学发现、融汇技术前沿的重要载体，是推动学术交流、展示创新成果的重要平台，在积聚创新资源、推进科技创新中发挥着支点作用、枢纽作用。《丝绸》始终专注于深化丝绸产业的基础研究、技术创新和文化挖掘，成功打造了一个集前沿创新，科技交流和文化遗产于一体的学术交流平台，成为丝绸产业领域的重要阵地。六十五年的努力，产业内的新技术、新工艺、新设备、新产品通过《丝绸》得到了很好推广。

六十五年的积累，《丝绸》在学术组织力、人才凝聚力、创新引领力、国际影响力上都有显著提升，已成为高水平丝绸学术思想的策源地、产业创新发展的桥头堡，受到了社会各界的广泛认可。

当前，中国已进入“中国制造向中国创造转变、中国速度向中国质量转变、中国产品向中国品牌转变”的高质量发展阶段，创新成为改变产业未来格局、决定行业前途命运的核心变量。高水平的学术期刊承载着行业的科技竞争力和未来话语权，加快世界级纺织学术期刊建设正变得比以往任何时候都更加迫切。

作为丝绸领域最具代表性的期刊，《丝绸》担当重任。中国纺织信息中心将继续与《丝绸》一道，以时代为引，推动科技创新与文化创意在丝绸的当代表达、中国表达、国际表达。祝福《丝绸》！期待未来！



中国纺织品商业协会

贺 信

《丝绸》：

值此《丝绸》创刊 65 周年之际，特向贵刊致以热烈的祝贺。

自嫫祖结丝衣被天下以来，中华民族的历史也是一部丝绸发展史。《丝绸》诞生于西子湖畔，自创刊以来，始终致力于中国丝绸产业宣传与文化推广。随着机构变革和技术创新的发展趋势，杂志社全体同志秉持着为行业谋发展，为科技搭阶梯，为读者拓视野的使命，积极探索新的发展思路。特别是党的十八大以来，围绕“一带一路”国家战略构想，深入学习和贯彻习近平新时代中国特色社会主义思想，立足新发展阶段、贯彻新发展理念、构建新发展格局，努力推动丝绸产业高质量发展。

祝愿《丝绸》勇于开拓创新，为中国丝绸的发展壮大作出更大的贡献。





Speech for the 65th Anniversary of the founding of the JOURNAL OF SILK

by Mr. Stefano Vitali,
vice-chairman of International Silk Union and president of Ufficio Italiano Seta

Distinguished leaders and guests, dear silk partners,

I am Stefano Vitali, vice-chairman of International Silk Union (ISU), and president of Ufficio Italiano Seta (UIS).

This year is the 65th Anniversary of the founding of Journal of Silk, which is also the Journal of International Silk Union since last year.

On behalf of UIS, I would like to extend warm congratulations for this anniversary.

There is a long history of exchange and collaboration between Como, Italy and Hangzhou, China.

For us, silk, more than just a business, is a tradition and culture deeply rooted in Como Lake.

Coincidentally, West Lake Hangzhou shares the same tradition and culture.

Therefore, it is easy for us to find common words and interests in Hangzhou.

We are used to keep strong relationship with Hangzhou silk people and to pay close attention to the development of Chinese silk industry.

We have common interest in promoting silk as a sustainable fiber and in this moment we are working actively together with International Silk Union, for this reason.

Beginning November the city of Como has been designated by UNESCO to be part of the creative cities network, for the sector "crafts and folk art".

It is a consequence of the strong tradition of Como with silk.

I am confident that this will enable us to strengthen more and more our long history and friendship.

We look forward to an early triumph of the fighting against the pandemic, so that Italy and China can carry out more exchanges and cooperation.

Thank you!

Stefano Vitali

Como, Italy, November 30, 2021

Stefano Vitali
国际丝绸联盟副主席、意大利丝绸协会会长

「丝绸」創刊65周年、おめでとうございます。

シルクを中心とした多様な学術成果を公表する学術雑誌として、長年にわたり、
高い学術的レベルを維持し、学界や産業界に多大な貢献をされてきたことに敬意を表します。
シルクが重要な天然繊維資源として見直しが進む中、これからも益々ご発展されることを祈念しております。

森川英明
信州大学繊維学部学部長、教授



Journal of Silk Anniversary – Renata Amano

Hello, I'm Renata Amano president of the Brazilian Silk Association.

2021 marks the 65th Anniversary of Journal of Silk, and I would like to present our thankfulness from Brazil silk team.

Since 1956, Zhejiang Sci-Tech University, China Silk Association, China Textile Information Center, and Chinese Academy of Engineering come together with the main purpose of leading silk technology and textile culture, very well balancing tradition, and innovation.

Due to its interdisciplinary and high-quality content, Journal of Silk attracts business leaders and academic researchers.

The hard work of representative experts and leaders, editorial board members, authors, readers and related units tuned Journal of Silk into a success as the China's leading silk research journal and also appearing in the list of the three core periodicals in China nowadays.

Congratulations to Journal of Silk for generating silk knowledge worldwide, and keeping silk legacy alive, as a periodical brand which built deep integration with international silk industry organizations!

Long life to Journal of Silk!

Renata Amano

国际丝绸联盟副主席、巴西丝绸协会会长



Maringá, 24 de Novembro de 2021

Ao
Journal of Silk
Att. Professor Chen Wenxing – Editor-in-Chief
Hangzhou – CHINA

Caro Professor Chen Wenxing,

A seda nasceu na China e há milênios fala chinês. Há 65 anos o **Journal of Silk** faz com que a seda fale fluentemente também a língua da ciência permitindo que o conhecimento gerado a partir de estudos e pesquisas seja traduzido e compartilhado, com o uso da seda, em melhor qualidade de vida para a sociedade.

Cumprimentos pelo 65º aniversário da fundação do Journal of Silk.

Felicidades!

Carpe diem...



João Berdu Garcia Junior
VALE da SEDA
Bisa Overseas

João Berdu

巴西丝绸谷项目负责人、巴萨海外董事长

“Journal of Silk” 発刊 65 年を記念して

福井大学 堀 照夫

Journal of Silk が創刊から 65 年の長年にわたり発行を続けて来られたことに敬意を表し、心よりお祝い申し上げます。雑誌の名称から察しますと、当初は絹の研究に関する論文を主体に創刊されていたのでしょうか。しかし、最近の雑誌のコンテンツを見ますと繊維全般に渡った幅広い研究が対象となり、多くの質の高い論文が掲載されていることに感心しております。

私は 1971 年にスイスの大学に留学し、博士号を取得後、1975 年に母校である福井大学に助手として着任しました。講師、助教授、教授を経て現在は産学官連携本部で客員教授として企業等と共同研究などを進めています。また、繊維関連分野の連携を目的に NPO 法人「繊維技術活性化協会」を運営するとともに、ベンチャー企業「サステナテック㈱」を福井大学内に設立し、環境負荷低減を目指した繊維技術の普及を行っています。

私が講師の時（1979 年であったと思う）に当時の浙江丝绸工学院から中国国費留学生の張為衆氏を研究室に迎えました。当時、研究室の教授であった清水融先生が張さんを直接指導されましたが、張さんはまだ若かった私を慕って研究のアドバイスを求めて来ました。よく夜遅くまで議論をしました。張さんとの出会いが今の浙江理工大学とのご縁の始まりです。

浙江理工大学の歴史は長く、最初は「蚕学館」と言う専門大学で、中国でも古い大学の一つであったことも張さんからお聞きしていました。シルクの専門大学であった蚕学館が、その後、時代の要請に応えるように繊維系を主体とした工学系の大学「浙江工程学院」となり、今では中国の重点大学の一つである浙江理工大学にまで発展されたことは大変素晴らしいと思います。このような発展を遂げられた大学は世界でも稀だと思います。

張さんは福井大学で 1 年の研究生を経ての修士課程（当時は繊維染科学専攻であった）に進学し、修士を取得されました。大変優秀で福井大学の学生よりはるかに優れていました。物理化学などの基礎から我々の専門であった染色化学についても習得されていた。教授との激しい議論もよく目にしました。修士課程修了後は東京工業大学の博士課程への進学が決まりましたが、一時帰国されるに当たって張さんは清水先生と私を中国に招待してくれました。1982 年だったと思います。上海に入り、上海で大学や名所旧跡などを見学させてもらった。まだ日本人が訪問することはあまりない時代で、国賓のような丁寧な接待を受けました。上海からは列車で杭州に入り、駅では大勢の大先生達に出迎えられ感動しました。

浙江丝绸工学院では清水先生と私は数日間わたって講義を行ないました。私は主に自分の専門であった「染色速度論」を講義しました。全ての講義を張さんが日本語から中国語に通訳してくれました。清水先生は染色全般について講義されたのでホテルで夜遅くまで翌日の講義の資料作成に追われていました。学生や教員らが熱心に聴講されました。数日の講演を終え、その後は杭州、紹興近辺を 1 週間近く旅行し、初めて見る中国の奥深い歴史と街並みに感動し、毎日の豪華な中華料理も堪能しました。

その後も、浙江丝绸工学院からは紀先生やご子息の王晟さんらも私の研究室に留学されました。王晟さんは福井大学で修士終了後は北海道大学の博士課程で学位を取得され、浙江丝绸工学院に教員として着任されました。王晟さんのその後のご活躍は皆様ご存知の通りです。私の浙江丝绸工学院への訪問はまだ続きました。私と家族だけで、日本の染色関連の先生方と、日本学術振興会 120 委員会の一行として、さらに私の研究室学生全員を引率しての研究発表会などを経て、2007 年には福井大学の工学部長と浙江丝绸工学院を訪問し、福井大学と「学術交流協定」を締結しました。同時に学内に福井大学分室まで設置いただきました。

浙江丝绸工学院の創立 110 周年記念式典の年、私は福井大学副学長も兼任していたこともあり、この式典に福井大学代表として招待されました。ファッションショーなども盛り込んだ盛大な式典には大変感激しました。その後も多くの学生や先生らが福井大学に留学されています。

最近では 2019 年に浙江丝绸工学院らを会場に The 15th Asian Textile Conferenceが開催され、アジアのみならず世界各国から多くの繊維研究者・技術者らが一堂に会し、招待講演、研究発表、大宴会などが華やかに行われました。行き届いた会の運営に中国の力をまざまざと目の当たりにしました。

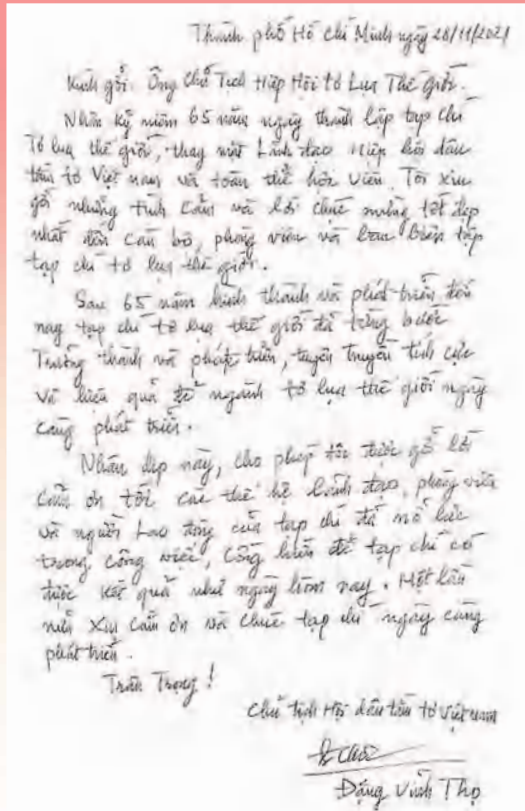
シルクは、およそ紀元前の 20 世紀頃に中国で使われ始めたといわれています。長い間中国から海外に出ることはなく中国で成長してきた産業でした。まさに人類が憧れた繊維で、“繊維”の原点の一つがシルクです。その後も色々な繊維が登場し、我々はこれらを身に着て快適な生活ができています。今では衣料用繊維製品のほとんどが中国で作られています。欧米の先進国では、産業革命以降隆盛を極めてきた繊維産業は衰退産業となり、研究者や技術者も激減しています。安価で大量に生産される繊維産業は中国の他に東南アジアやアフリカにシフトしています。繊維産業は衣食住の一角を担う大事な産業です。この産業が無くなることはなく、衣料用以外にも繊維の優れた特徴を生かし、繊維材料は建築・建設、移動体、メディカル、宇宙・海洋開発などの他の産業用途にも色々と展開されています。

シルクや綿などの天然繊維に始まった繊維産業は研究者らの研究開発により合成繊維へと展開し、今日ではSDGsを対象に循環可能な繊維製造へと変貌を遂げなければなりません。「繊維産業は終わった」と言う人が大勢いますが、それは大きな間違いです。今後も人類がこの美しい地球を守るためには新しい繊維産業を目指さねばなりません。私は現在、水を使わず廃液も出さない超臨界染色の実用化に向けて取り組んでいます。美しい地球環境を守るためです。環境負荷が高いと言われる繊維産業に革新技術が必要となっています。繊維に関わる研究者・技術者は地球温暖化が進む中、今こそ繊維技術に革新をもたらす必要があります。

繊維研究成果の発表の場を提供する Journal of Silk は今では中国シルク協会、中国紡織情報センターと共同運用されていると聞いています。世界の繊維のメッカとして君臨する中国・杭州から多くの革新技術が発信されることを心より祈念しています。

堀照夫

日本繊維技術活性化協会理事、福井大学教授



Dang Vinh Tho

国际丝绸联盟副主席、越南蚕桑协会会长

ສະບາຍດີ

ຂ້າພະເຈົ້າ ນ້ອຍນິດ ຈັນທະນິດ ຈາກ ສປປ ລາວ. ຂ້າພະເຈົ້າຂໍຕາງໜ້າ ບໍລິສັດ ສົ່ງເສີມປູກມອນ-ລຽງມ້ອນ ແລະ ກະຊິກາອິນຊີ ຈຳກັດ (Mulberries) ພ້ອມດ້ວຍພະນັກງານ ວິຊາການ ແລະ ຊາວກະຊິກອນປູກມອນລຽງມ້ອນ ທັງໝົດໃນປະເທດລາວ ຂໍສະແດງຄວາມຍິນດີມາຍັງ ວາລະສານຜ້າໄໝ ໃນວາລະຄົບຮອບ 65 ປີ ແລະ ຂໍອວຍພອນໃຫ້ ວາລະສານຜ້າໄໝ ຍືນຍົງຢູ່ດຽວກັບພວກເຮົາຕະຫຼອດໄປຊ່ວຍກາລະນາ

Congratulations for the 65th anniversary of the founding of Journal of Silk

ດ້ວຍຄວາມເຄົາລົບ ແລະ ນັບຖືຢ່າງສູງ

ນ້ອຍນິດ ຈັນທະນິດ

Noynith Chanthamith

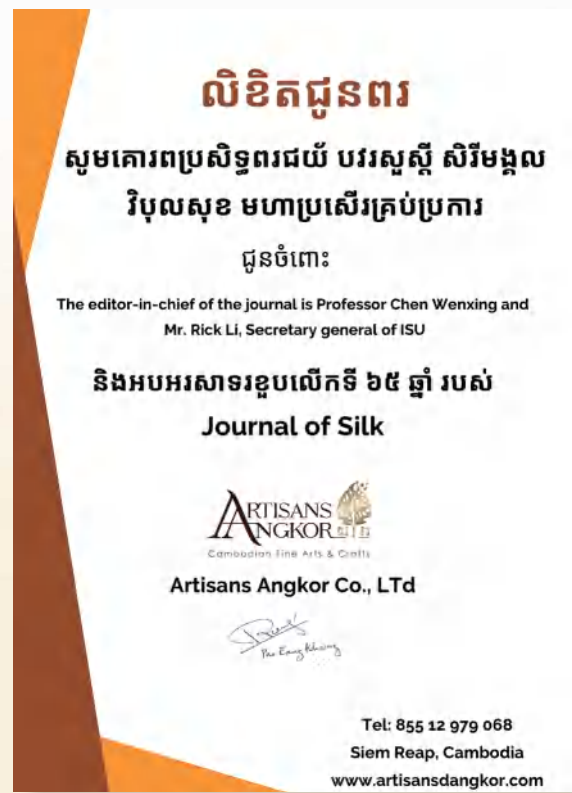
Noynith Chanthamith

老挝蚕桑有限公司总经理



TEX Simheang

柬埔寨Kei Meas Handicrafts创始人



PAV Eang Khoing

吴哥工匠丝绸公司产品总监

O'zbekiston Tabiiy Tolalar Ilmiy-Tadqiqot Instituti nomidan Men Abduxakim Axunbabayev "Journal of Silk" jurnali tashkil etilganining 65 yilligi munosabati bilan samimiy tabriklarimizni izhor etaman.

Ushbu uzoq bosib o'tilgan yillar sizning yetukligingiz va sifatigizning belgisidir.

Bu yillar davomida siz yuqori sifatli va ishonchli ma'lumotlarga ega, yetakchi jurnallardan biri ekanligingizni isbotladingiz.

"Journal of Silk" jamoasiga uzoq yillik do'stligimiz va hamkorligimiz uchun minnatdorchilik bildiramiz va kelgusi ko'p yillar davomida muvaffaqiyat va farovonlik tilaymiz!

"Congratulations for the 65th anniversary of the founding of Journal of Silk"

Hurmat va ehtirom ila,

Tabiiy Tolalar Ilmiy-Tadqiqot Instituti jamoasi



Abdukhakim Akhunbabaev

乌兹别克斯坦丝绸研究所高级管理负责人

山东纺织工程学会

贺词

《丝绸》杂志社：

欣闻《丝绸》杂志创刊65周年的喜讯。在此谨向贵刊表示热烈的祝贺！多年来贵刊在国际丝绸领域内创刊历史悠久，发行范围广，在业界影响力巨大，且独具权威性。为纺织科技的推广、学术交流和丝绸文化的传播做出了重要贡献。

我们坚信贵刊在新的历史时期，在丝绸强国建设和国家一带一路倡议下，必将进一步展示和提升行业国际话语权和影响力。在丝绸纺织领域技术创新和文化遗产等学术交流方面做出更大贡献。



山东纺织工程学会

祝贺《丝绸》创刊六十五周年

弘扬华夏丝绸艺术魅力
彰显中华民族文化光辉

浙江蚕缘家纺股份有限公司



浙江蚕缘家纺股份有限公司



平井利博

公立大学法人 長野大学理事長

国立大学法人 信州大学名誉教授、特任教授（研究）

Toshihiro Hirai, Ph.D.

Chairman of Public University Corporation, Nagano University

Professor Emeritus of National University Corporation, Shinshu University

Faculty of Textile Science and Technology, Fiber Innovation Incubator, Chief Coordinator
Congratulation on the 65th anniversary of the Journal of Silk!

This Journal has made significant contributions to the history of silk science and the silk industry through the progress of science and engineering for such a long time.

When we look back at the history of the field, not only the silk industry but also the fiber & textile industry have been in the immense turmoil of evolution.

It has managed the field well, though not easy, through such a harsh era. The silk industry is still surviving in Japan but on a tiny scale. The textile industry changed its feature to an importing industry decades ago; the import rate is 98%. The textile department in the Japanese government has changed from Textile Department to Life-Products Department, and the textile division is one of the sections, but no silk section. However, we still have a couple of academic societies on silk science and technology.

In such a problematic situation, silk science has been making a challenge in Japan. A venture company is challenging to produce “spider silk”. The approach is based on gene technology by modifying natural spider silk using microbes. In this field, China’s silk science has already extended in the area with very rapid progress speed. This field can be accelerated further by employing a new technology utilizing the “Clustered Regularly Interspaced Short Palindromic Repeats” (CRISPR).

China’s remarkable stride in progressing in science and technology is overwhelming the global silk industry leader, too.

I express my sincere congratulation on the Journal’s continuing progress to result in the welfare of humankind through global collaboration. I sincerely hope our intimate partnership lasts long from now on.

六十五年创刊时光，《丝绸》辉煌众人可鉴。
祝《丝绸》之途愈行愈宽。

吴元新

中国政协副主席、中国工艺美术大师、国家级非遗传承人

嘉木餘蔭

賀絲綢雜誌創刊六十五周年

徐行健

徐行健

国务院特殊津贴专家，中国家纺艺术设计终身成就奖

六十五年的“丝录文语”，记录引领了中国丝绸行业的科技发展。祝愿未来的《丝绸》之路，独树一帜，用五彩缤纷的故事展示出国际化的丝绸科技与文化！

刘军

《纺织学报》主编

丝绸杂志社。

《丝绸》是业界同仁的良师益友。

我與《丝绸》相識近四十年，也受益良多。
這兩年，《丝绸》內容豐富，更具學術味，版式
新穎，更具美觀度，獲獎不少，閱者無數，令
人欣喜。

值此創刊六十五周年之際，謹祝《丝绸》
雜誌社同仁不忘初心，為行業開創新格局作出
更大貢獻！

浙江省絲綢協會 吳金根

吳金根

浙江省絲綢協會會長

桑絲香像苦像絲像一生像，
農工厚商厚綢厚一身厚。

朱良均

2021年12月9日

朱良均

浙江大學應用生物資源研究所所長

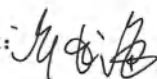
青岛大学纺织服装学院贺词

尊敬的《丝绸》杂志社：

贺《丝绸》创刊 65 周年，祝百尺竿头，更进一步！

65 年凝聚了《丝绸》人过去的不凡成绩，更代表了一个全新起点。青岛大学纺织服装学院与贵杂志保持了密切的合作关系，帮助我院及时发表系列成果，提高了学院在行业内的影响力。谨愿贵杂志继续发挥纺织行业媒体优势，宣导行业政策与新闻，促进科技创新、行业技术升级，成为纺织行业师生信赖的优秀期刊，积极推动行业发展，再创辉煌！

青岛大学纺织服装学院院长：



青岛大学纺织服装学院

2021 年 11 月 19 日

青岛大学纺织服装学院

成家風骨

祝賀《絲綢》雜誌
創刊六十五周年

天津美院 閻維遠



阎维远
天津美术学院

尊敬的《丝绸》杂志编辑：

真“丝”彩“绸”引前沿，灿烂辉煌世界知！

值此《丝绸》杂志创刊 65 周年之际，江南大学纺织科学与工程学院、《服装学报》编辑部向贵刊表示热烈祝贺！

65 年风雨历程，《丝绸》杂志高质量发展谱华章，从一本行业通讯，成长为质量优良、特色突出、在国内外有一定影响的核心期刊，既兼顾行业又兼顾学术，既传播技术又传播文化，是中国高校科技期刊走特色化道路、引领行业发展的典范。

65 年来，贵刊及其主管、主办单位——浙江理工大学与我校建立了深厚的友谊，并在我校成果展示与学术交流方面给予帮助与支持。借此机会，我再次向贵刊表示衷心感谢！

祝《丝绸》越办越好！



江南大学纺织科学与工程学院

贺丝绸杂志创刊甲子纪念
绸丝
路泽
祭新
和造
北京服装学院
美术学院

北京服装学院美术学院

贺信

《丝绸》编辑部：

值此《丝绸》创刊六十五周年之际，谨向贵刊致以最热烈的祝贺和最诚挚的敬意！

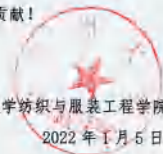
六十五载栉风沐雨、风雨兼程，贵刊坚持以“引领丝绸科技、传承纺织文化”为宗旨，以“服务于丝绸强国建设和国家‘一带一路’倡议”为使命，致力于展示和提升中国丝绸的国际话语权和影响力，已成为丝绸（纺织）领域办刊历史悠久、影响力大且具权威性的专业期刊。近年来，贵刊通过突出学科交叉融合特色，整合行业资源做精做专服务内容，深化与国际国内丝绸产业组织的交流合作，探索出一条专业期刊与行业组织融合发展的新模式，为促进理论创新、共享科研成果、培养科研人才、推动行业发展搭建了高层次学术交流平台。

六十五载寒暑相替、春华秋实，贵刊多次荣获教育部科技司“中国高校特色科技期刊”、教育部科技发展中心“中国科技论文在线优秀期刊奖”、中国高校科技期刊研究会“中国高校百佳科技期刊”和浙江省优秀期刊一等奖等荣誉。2021年，贵刊获“中国政府出版奖期刊提名奖”、中国期刊协会“优秀封面和版式设计奖”和“浙江树人出版奖”。2022年，继续入选“CSCD 核心”“北大核心”“中国科技核心”国内三大核心期刊目录，被评为“RCCSE 中国权威学术期刊（A+）”。

衷心祝愿贵刊与时俱进、继往开来、再创佳绩，在服务国家倡议、打造平台载体、创新发展路径、引领科技进步上做出更大贡献！

苏州大学纺织与服装工程学院

2022年1月5日



苏州大学纺织与服装工程学院

祝賀絲綢雜誌創刊六十五周年

傳承絲綢文化

拓展新時代絲路研究

武漢紡織大學伯明翰時尚創意學院

武汉纺织大学伯明翰时尚创意学院



祝贺《丝绸》创刊六十五周年！弘扬中华文化、引领科技创新、服务强国建设、祝愿再创辉煌！

中国纺织服装教育学会

峥嵘岁月六五载，励精图治新时代！祝愿《丝绸》期刊越办越好！

中国轻工业出版社有限公司

《丝绸》创刊65年来，一直致力于丝绸科技创新，推动丝绸产业高质量发展，充分体现了学术性、权威性和前瞻性，奠定了一流的学术地位。值《丝绸》65周年庆典之际，祝《丝绸》对标国际一流期刊，不忘初心，再创辉煌！

中国纺织出版社有限公司

抚今追昔 六十五载波澜壮阔风雨路
继往开来 新时期严谨求实更上层楼

中国服装设计师协会

祝《丝绸》杂志成为我国纺织业向文化引领的时尚产业进发的先锋！

江苏省纺织工程学会

千封锦缎西霞路，万里行舟大海驰，祝贺《丝绸》创刊65周年。

浙江省纺织工程学会

祝贺《丝绸》创刊65周年。

《辽宁丝绸》编辑部

丝路华章，匠心传承，让世界爱上中国丝绸
坚守65年，以初心 鉴匠心，树立丝绸行业新标杆

浙江美嘉标服饰有限公司

祝贺《丝绸》创刊65周年。

杭州亮点纺织品印整有限公司

祝贺《丝绸》创刊65周年。

陕西康富来丝绸有限公司

祝贺《丝绸》杂志创刊65周年，《丝绸》杂志为丝绸工业的科技进步和丝绸文化的弘扬做出了重要贡献。我们继续加强合作，为提升纺织行业全球引领力和话语权而不懈努力！

东华大学纺织学院

值此《丝绸》期刊创刊65周年之际，天津工业大学纺织科学与工程学院谨向贵刊表示诚挚而热烈的祝贺。祝愿《丝绸》期刊继续传承和发扬中国优秀传统丝绸文化，为我国纺织行业的发展做出更大的贡献。

天津工业大学纺织科学与工程学院

甲子继远丝丝隽永，研学传播月月弥新。

苏州大学艺术学院

《丝绸》杂志在各栏目的坚持努力下，创办了一本高质量的学术期刊，是纺织行业内外读者的良师益友。

大连工业大学服装学院

《丝绸》创刊65周年致贺：赓续丝路文明，共筑学术高地。

南京艺术学院设计学院

热烈祝贺《丝绸》杂志创刊65周年，《丝绸》65载光阴见证了新中国丝绸事业发展的光辉历程，衷心祝愿《丝绸》不断刷新成绩，实现更高的学术目标。

广州美术学院工业设计学院

贺《丝绸》杂志创刊六十五周年纪念：

思路长，六十五载锦绣文章；忆初心，扬鞭奋进再创辉煌！

四川美术学院设计学院



千丝万缕 织成文章锦绣
六十五载 铸就期刊辉煌

西安工程大学服装与艺术设计学院

传嫫祖五千载技艺，引丝路新百年征程！

新疆大学纺织与服装学院

丝路漫漫，学海茫茫，感谢《丝绸》的一路相伴，值此创刊65周年之际，祝杂志越办越好，传承丝国文明，泽被后世。

浙江科技学院艺术与服装学院

祝贺《丝绸》创刊六十五周年
宣传丝绸业界成果，
展示丝绸行业风采，
打造院校学术高地，
铸就丝绸期刊辉煌。

西安美术学院设计艺术学院

衷心祝贺《丝绸》创刊61周年！祝愿《丝绸》杂志越办越好！再创新高！

云南民族大学艺术学院

丝路漫行，万紫千红又一春！庆贺《丝绸》创刊65周年。

中华女子学院艺术学院

六五华诞普天庆，丝绸之路续辉煌

大连艺术学院服装学院

国韵丝绸传天下，寸积铢累世界知。

玉林师范学院美术与设计学院

世界丝绸网

世界丝绸网（www.worldsilk.com.cn）是国际丝绸联盟的官方信息发布平台，以“交流合作 携手发展”为运营理念，现设有官方网站、微信公众号、头条号、搜狐号、百家号、企鹅号等信息发布平台，旨在通过发布产业资讯、传承丝绸文化、加强沟通交流、服务企业联合、推动产业升级，促进国际丝绸产业的可持续健康发展。



- 官网设中英文双语版面
- 发布国际丝绸联盟官方通知、活动和报道
- 服务 24 个国家和地区的成员单位
- 实时发布国际产业资讯
- 实时发布国际丝绸产业数据
- 发布国际会议、论坛等专家行业解读
- 官网支持手机自适应和 IP 自适应



官方网站

2600 余
篇发文量

32 万 余
次访问量



官方微信公众号

2100 余
篇发文量

138 万 余
次阅读量

7800 余
关注人数

Topic selection direction of *Journal of Silk* for 2022

Being both readers-oriented and authors-oriented and featuring interdisciplinarity, *Journal of Silk* focuses on seeking content quality and building journal brand and strives to “lead silk science and technology and inherit textile culture” by publishing academic papers on basic research, technological innovation and cultural inheritance concerning silk (textile) based on a high level of peer review. In 2022, *Journal of Silk* is successively included in the list of the three core periodicals in China, namely “CSCD”, “CSSCI” and “CSTPCD” and is indexed in over 20 domestic and international journal databases. Besides, it has been rated as “RCCSE China’s Authoritative Academic Journal (A+)” and ranks second among 37 textile journals in Annual Report for Chinese Academic Journal Impact Factors. In 2022, as per the 14th Five-Year Plan and development needs of textile industry, the journal will focus on such themes as the “Belt and Road Initiative”, “carbon neutrality” and “sustainable development”, and the details are as follows:

1. Basic research and technological innovation

- (1) Research on fiber and other new textile materials;
- (2) Research on processing technology of yarn spinning, silk spinning and other fibers;
- (3) Research on new weaving techniques and equipment;
- (4) Research on new dyeing and finishing technology and related auxiliaries;
- (5) Research on intelligent textile and clothing engineering;
- (6) Research on standards and testing of textile products;
- (7) Research on sericulture life science and medical textiles;
- (8) Research on application of information technology in textile industry.

2. Fashion industry research and economic management

- (1) Research on industry reform and development strategy;
- (2) Research on brand management and technological innovation;
- (3) Research on marketing and consumer psychology.

3. Design theory and method

- (1) Fashion design and theory;
- (2) History and theory of silk design;
- (3) Digital design technology and theory of textiles and silk;
- (4) Theory, structure and product design method of silk textiles and garments.

4. Industry history and culture

- (1) Research on the history of textile culture and science & technology;
- (2) Cultural studies of weaving, dyeing, clothing and textile intangible cultural heritage;
- (3) Archaeology, analysis and reproduction of ancient textiles and production tools.

5. Industry window

- (1) Industry standards and interpretation;
- (2) Design works and display;
- (3) Industry information and reports.

The Eighth Editorial Board of Journal of Silk

Counsellors	YANG Yongyuan XIANG Zhonghuai LI Chaosheng BAI Lun QIAN Xiaoping	Honorary President of China Silk Association Academician of Chinese Academy of Engineering, PhD Supervisor of Southwest University Former Vice Director of National Cocoon and Silk Coordination Office Former Vice President of Soochow University, Professor Honorary Curator of Suzhou Silk Museum
Honorary Directors	TANG Lin QIAO Yanjin	President of China Silk Association Director of China Textile Information Center, Senior Editor
Director	CHEN Wenxing	Academician of Chinese Academy of Engineering, President of Zhejiang Sci-tech University, Professor
Vice Directors	FU Guangwei QIAN Youqing DONG Kuiyong CHEN Guoqiang FU Yaqin ZHENG Jinhuan	President of China Textile Engineering Society, Professor Executive Vice President of China Silk Association Vice Director of China Textile Information Center, Professor Professor of College of Textile and Clothing Engineering, Soochow University Dean of Graduate School, Zhejiang Sci-Tech University, Professor Professor of College of Textile Science and Engineering (International Institute of Silk), Zhejiang Sci-Tech University
Standing Editorial Board Members:	YIN Naidong, LIU Wenquan, ZHAO Feng, LIU Jun, PAN Zhijuan, LU Cheng, ZHU Chengyan, LI Long, LAO Jihong, CHEN Yuyue, TAO Hong, Toshihiro Hirai	
Editorial Board Members: (According to strokes of Chinese family name)	YU Bin, WANG Wei, WANG Yongqiang, WANG Zhulin, FANG Xiuju, YIN Naidong, YE Wen, ZHU Liangjun, QIAO Yanjin, FU Guangwei, LIU Jun, LIU Wenquan, XU Xing, LAO Jihong, LI Long, LI Jialin, LI Qinsheng, LI Chaosheng, LI Chaode, ZOU Fengyuan, SHEN Xingjia, LU Xin, CHEN Wenxing, CHEN Yuyue, CHEN Guoqiang, CHEN Xiangping, ZHENG Jinhuan, ZHAO Feng, XUAN Youmu, ZHU Chengyan, FEI Jianming, YAO Juming, YUAN Xuanping, GU Guoda, QIAN Youqing, TAO Hong, TAO Wenrui, HUANG Chen, QI Dongming, LIANG Yong, LIANG Hui'e, DONG Kuiyong, FU Jufen, FU Yaqin, LU Cheng, LAN Nianxin, LIAO Jun, PAN Zhijuan, XUE Yan	
Overseas Editorial Board Members:	Toshihiro Hirai (Japan), NI Qingqing (Japan), Frank K. Ko (Canada), Vootla Shyam Kumar (India), WANG Xungai (Australia)	
Youth Editorial Board Members:	Director: YU Bin Vice Directors: JIANG Yuqiu, LU Yehu Members of the Editorial Board: (According to strokes of Chinese family name) YU Bin, WANG Laili, WANG Ping, WANG Hede, NIU Li, LU Yehu, TIAN Wei, SHI Sheng, QU Hongjian, LÜ Lihua, LIU Hao, XU Zongpu, SUN Fengxin, YANG Yuqiu, SU Miao, DU Zhaoqun, LI Yi, LI Zheng, LI Zhi, LI Qiang, YANG Xue, WU Jindan, HE Jiazhen, SONG Wenfang, ZHANG Xianming, ZHANG Duoduo, ZHANG Liping, ZHANG Yanliang, ZHANG Chunyan, ZHANG Hong, ZHANG Heng, ZHANG Zuyao, ZHANG Yue, ZHANG Bin, ZHANG Beibei, SHAO Weili, MING Jinfa, LUO Jie, JI Yong, JIN Yao, ZHOU Lan, ZHENG Huanda, HU Jiyong, HU Pengpeng, KE Ying, ZHONG Wei, HONG Jianhan, CAO Jiliang, JIANG Yuqiu, HAN Wanli, LU Cheng, WEN Run, PEI Liujun, PAN Ruru, XUE Zhebin, Hafeezullah Memon (Pakistan)	

Executive Members of the Council

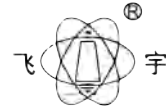
(In no particular order)



Zhejiang Cathaya International Co., Ltd.



China National Silk Museum



Hangzhou Textile Machinery Group Co., Ltd.



Jin Fu Chun Group Co., Ltd.



Wensly Group Co., Ltd.



School of Design, Nanjing
University of the Arts



Apparel & Art
Design College, Xi'an
Polytechnic University



Shaanxi China Silk Co., Ltd.



Hang Zhou HSDP Group Co., Ltd.



High Fashion Silk
(Zhejiang) Co., Ltd.



Zhejiang Babei Textile Co., Ltd.

Council Members

(In no particular order)

Anhui Fiber Inspection Bureau
School of Textile and Garment Engineering, Changshu Institute of Technology
Transfar Zhilian Co., Ltd. Global Application Technology Center
Xiamen Academy of Arts and Design, Fuzhou University
School of Design, Guangxi Normal University
School of Art and Design, Guilin University of Electronic Technology
Hangzhou Textile Shining Conversion Co., Ltd.
Hangzhou Xinsheng Printing & Dyeing Co., Ltd.
Hebei Academy of Fine Arts
Hubei Province Fibre Inspection Bureau
Hunan Institute of Engineering
School of Packaging Design&Art, Hunan University of Technology
College of Design, Jiaying University
Jiangsu Vocational College of Information Technology
Jiangxi Institute of Fashion Technology
School of Fine Arts and Design, Kaili University
Clothing and Design Faculty, Minjiang University
College of Textile & Clothing, Qingdao University
Shandong Vocational College of Light Industry
College of Art and Design, Shaanxi University of Science & Technology
School of Textile and Fashion, Shanghai University of Engineering Science
College of Fashion and Design Art, Sichuan Normal University
Suzhou Jinda Silk Co., Ltd
Zhejiang Fashion Institute of Technology

Zhejiang Jasan Holding Group Co., Ltd.
School of Fashion Design & Engineering, Zhejiang Sci-Tech University
College of Life Sciences and Medicine, Zhejiang Sci-Tech University
Zhejiang Meijiabiao Clothing Co., Ltd.
Chongqing University of Education
Anhui Tincai Silk Co., Ltd.
Foshan Nanhai Tianfu Technology Co., Ltd.
Guangdong Silk-Tex Group Co., Ltd.
College of Biological and Chemical Engineering, Guangxi University of Science and Technology
Guangzhou Nanyang Polytechnic College
College of Textile and Garments, Hebei University of Science and Technology
Huading Group Holding Co., Ltd.
Liuzhou Quality Inspection and Testing Research Center
China Silk Enterprise Limited
School of Art, Soochow University
School of Textile Materials and Engineering, Wuyi University
Xinyuan Cocoon Silk Group Co., Ltd.
School of Art & Design, Xuzhou University of Technology
Zhejiang Canyuan Home Textile Co., Ltd.
College of Textile Science and Engineering (International Institute of Silk), Zhejiang Sci-Tech University
China Textile City
Zibo Daranfang Silk Group Co., Ltd