SILK

Proceedings of ISU

ISSN 3005-2688

VOL.2 NO.4

2025.10

Sponsored by

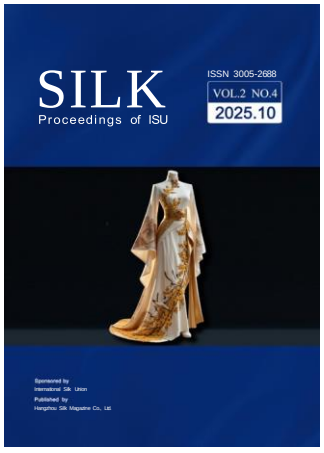
International Silk Union

Published by

Hangzhou Silk Magazine Co., Ltd.

2025.10

SILK, Quarterly
Established in 2023
Vol.2, No.4, Sum 4
Published on Oct. 20, 2025



Cover design: WEN Liangzhen
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SILK

Sponsored by:
International Silk Union (ISU)

Co-organized by:
Zhejiang Sci-Tech University

Edited and Published by:
Hangzhou Silk Magazine Co., Ltd.

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Website:
www.intsilk.com

ISSN:
3005-2688
Printing:
Hangzhou Shuanghong Printing Co., Ltd.
Subscription:
$10 for a single copy and $40 for a full year

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Uganda Silk Industry: History, Present Status, Potential and a Strategy for Development

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Abstract: This article provides a comprehensive overview of the sericulture industry in Uganda, tracing its history, analyzing its current status, and outlining a strategy for its future development. The industry's origins date back to the 1920s, with significant pioneering efforts by private individuals and associations in the late 1980s and 1990s, leading to a pilot project funded by the European Union. Despite initial success in training hundreds of farmers, the sector faced challenges including a lack of consistent government support, market access for bulky cocoons, and inadequate value-addition infrastructure, causing a decline in production. Recent years have seen a revitalization led by the Government of Uganda through the Ministry of Science, Technology and Innovation, which is funding the "Commercialization of Sericulture Technologies and Innovations" project. This current initiative focuses on establishing mulberry plantations, building farmer capacity, developing post-cocoon processing technologies, and creating a supportive policy environment. The article highlights the significant potential of sericulture for job creation, rural income generation, and export earnings, given Uganda's favourable climate and existing market demand. The strategy for development involves scaling up production, integrating modern technologies, and leveraging both public investment and growing foreign private interest from companies in Iran and China to build a sustainable and commercially viable silk industry.

Key words: Uganda sericulture; silk industry development; silk sector history; cocoon production; commercialization of sericulture; agricultural diversification; value addition; rural employment

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1 Natural environment

Uganda natural environment is suitable for sericulture. Uganda is located in eastern Africa, west of Kenya, south of South Sudan, east of the Democratic Republic of the Congo, and north of Rwanda and Tanzania[1]. It is in the heart of the Great Lakes region, and is surrounded by three of them, Lake Edward, Lake Albert, and Lake Victoria. While much of its border is lakeshore, Uganda is landlocked with no access to the sea. The country is mostly plateau with a rim of mountains. The climate is tropical and generally rainy with two dry seasons (December to February, and June to August). It is semiarid in the northeast. The total area is 241,551 square kilometers (93,263 sq mi) of which the land area is 200,523 square kilometers (77,422 sq mi) and water is 41,028 square kilometers (15,841 sq mi)[2].

The country has elevation extremes with the lowest point being 614 metres (2,014 ft) Albert Nile at border with South Sudan and highest point: 5,111 metres (16,768 ft) Margherita Peak on Mount Stanley.

Land use as of 2012 records comprised of arable land of 69,000 square kilometers (27,000 square miles; 34.41%) of which permanent crops occupy 22,500 square kilometers (8,700 square miles; 11.22%), forest cover occupies 28,100 square kilometers (10,800 square miles; 14.01%) while other land use occupies 80,931 square kilometers (31,248 sq mi; 40.36%).

The country has a warm tropical climate with temperatures falling in the range of 25–29°C (77–84°F). The months from December to February are the hottest, but even during this season the evenings can be chilly with temperatures in the 17–18°C (63–64°F) range. The country receives an annual rainfall of 1,000mm to 1,500mm. The rainy seasons are from March to May

and from September to November. During these months, heavy rains can make roads and terrains hard to traverse. The period from January to February and again from June to August are dry.

2 History of sericulture development in Uganda

In Uganda the potential of sericulture industry has been demonstrated. It started as a research activity as early as 1920[3]. In the 1970s and 1980s, Zirubaberi Nyiira Mijumbi did some activities in attempt to convince government to invest in sericulture[4]. The modern story of Uganda's sericulture sector, however, began in 1986 when entrepreneur John Ndyabagye was introduced to the idea by a UNDP official. Upon returning to Uganda, he partnered with Gershom Mugyenyi to pioneer the industry, leading to the registration of the Uganda Silk Producers' Association (USPA)[3].

A pivotal moment came with a feasibility study sponsored by the Japanese Silver Volunteers, which led to the startup of Uganda Silk Industry Limited (USIL) in 1990. From 1991 to 1993, the Swiss Development Cooperation sponsored the training of twenty Ugandans in sericulture at the International Center for Training and Research in Tropical Sericulture in Mysore, India, building a critical mass of technical expertise[3]. This was followed by a significant intervention: the European Union-funded Silk Sector Development Project (SSDP) from 1994 to 1999. The SSDP aimed to establish a pilot commercial sericulture sector through USPA, setting up silkworm egg storage facilities, providing farmer loans, and establishing 24 Silk Development Centers as incubation hubs[3]. The project successfully trained over 400 farmers across 12 districts, with 388 producing international-grade cocoons.

A 1999 EU evaluation found the project highly relevant, noting sericulture's high returns, suitability for rural poor, women, and youth, and the presence of a critical mass of skilled farmers and technical expertise. It recommended government support and policy formulation. Consequently, the project was transferred to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) in 2000. However, this transition led to mismanagement, and the sector declined due to a lack of technical support and, crucially, the inability to profitably export bulky, low-weight cocoons without local value-addition infrastructure[4].

Hope was restored with the intervention of the International Centre of Insect Physiology and Ecology (ICIPE), which, with support from IFAD and the Ugandan government, installed a silk reeling machine at Kawanda. This led to the formation of the Bushenyi Silk Farmers Association (BSFA) in 2002. In 2003, a 60 multi-end silk factory was commissioned in Rubare, Sheema district, by H.E. President Yoweri Museveni[3]. Active farmers increased to 286 by 2005. Despite these efforts, production fluctuated due to internal splits, the diversion of attention to a new factory in Kawanda, the death of key promoter Gershom Mugyenyi in 2008, and a persistent lack of working capital and consistent government support[5]. Despite international orders, BSFA struggled with low production capacity. A 2005–2007 JICA study on sericulture development was never implemented, as sericulture was not a national crop priority for JICA at the time.

From 1971–72, Zerubaberi Mijumbi Nyiira was working as a senior Entomologist at Kawanda Research Institute. He requested for assistance from the Japanese (through their embassy) to help establish sericulture in Uganda. The Japanese gave mulberry seeds to help establish a mulberry nursery. At that time, Nyiira worked with one Olivia Makumbi to start experimental rearing of silk worms at Kawanda using silk eggs from Japan. He also conducted research on wild silk variety which could be used in the manufacture of bullet proof jackets. However, it is until November, 1986 when a true story of Uganda's sericulture sector started. In 1986 the rotary club of Kampala nominated a budding business entrepreneur Mr. John Ndyabagye for a business tour to the United States in June to September 1986. This trip turned out to be a good omen for the introduction of sericulture in the Great Lakes region of East and Central Africa. At the end of the orientation when everyone was asked on which aspect of the American life each would like to visit, Mr. John Ndyabagye opted for the small and medium scale industries among which were the Head offices of the United Nations Development Program in New York city from which he met along with a gentleman Mr., Gary a senior officer at the UNDP whose ancestral home was Niger. This man from West Africa introduced the idea of sericulture and its viability within the African continent. In their discussions, Mr. Gary explained that according to assessment by the UNDP, Uganda was a potential country for sericulture practices especially due to its climate. This therefore implored the Ugandan born Mr. John Ndyabagye to pioneer silk production within his home country. On his return to Uganda, Mr. John Ndyabagye sold some of his assets which gave birth to silk in Uganda. He looked for a technical person and he met Gershom Mugyenyi. This is when two ambitious men Gershom Mugyenyi and John Ndyabagye met in the capital of the country, Kampala, and shared fruitful ideas to introduce this viable venture. The two were fully convinced that sericulture is such a viable cash crop venture that would fit in the diversification of agriculture agenda of the new government of President Y.K. Museveni who had liberated the country into peace. It is this peaceful atmosphere that created a conducive and fresh environment to give birth to new ideas such as sericulture. This fruitful idea was well appreciated by the President of the Republic of Uganda who was hungry for success and was determined to promote the idea beyond the expectations of the dreamers.

The two moved on to register a virgin association named Uganda Silk Producers' Association (USPA) with the Registrar General's Office in Uganda. This association was an umbrella organization formed with the legal framework to champion and promote the silk industry while protecting the interests of the silk producers as well as the standard qualities of sericulture in Uganda. However, the ideas of the two remained unimplemented until gaining the president's endorsement during a meeting in Bushenyi District on April 20, 1990.

A feasibility study on silk production in Bushenyi, Uganda was carried out by Japanese Silver Volunteers sponsored by the rotary club of Tokyo which sparked off the startup operations of Uganda Silk Industry Limited (USIL) in September, 1990. Prior to this, development of commercial cocoon production in Uganda began in 1992 through the initiatives of two private entrepreneurs, USIL and the Inuula Silk Estate Ltd. (ISEL). The companies were importing good quality hybrid bivoltine eggs from Japan, rearing the eggs in their own premises up to the third instant and then distributing the young silkworms (YSW) to farmers. The farmers received extension support and limited credit from the companies to rear the silkworms up to the cocoon stage. Fresh cocoons were then collected by the companies and dried up to the time of

exporting to a Japanese buyer (Yamato International Inc.).

The Swiss Development Cooperation sponsored over the period 1986–93 the overseas training of twenty Ugandan nationals whose names are attached (most of them from Kawanda Agricultural Research Institute (KARI) staff) at the International Center for Training and Research in Tropical Sericulture, Mysore, India (Table 1). Courses included Diploma in Tropical Sericulture, Diploma in Sericulture Management, Specialization in Tropical Science, Diploma in Silk Rearing and spinning and Certificate in Sericulture.

Table 1: List of Ugandan national trained in sericulture under sponsorship of the Swiss development cooperation

SN/No.	Name	Course
1	Mugyenyi Gershom	Diploma in sericulture (1989)
2	Sempa Michael	Diploma in silkworm rearing and spinning (1990)
3	Kiwumui Michael	Diploma in sericulture (1987)
4	Katerega Robert	Diploma in silk reeling and spinning (1988)
5	Irungu Eric	Diploma in sericulture (1988)
6	Sessanga Bosco	Diploma in sericulture (1989)
7	Mugarura V	Diploma in sericulture
8	Jumba Patrick	Diploma in sericuture
9	Semakula Fred	Diploma in sericulture (1990)
10	Mugume Nyambiro Abigail	Diploma in sericulture (1991)
11	Rweihangwe Doreen	Diploma in sericulture management (1992)
12	Tindyebwa	Diploma in sericulture
13	Mujuni Alfred	Diploma in sericulture
14	Mwesigye Ihwezo Innocent	Diploma in sericulture (1993)
15	Twakire Mauda	Diploma in sericulture (1991)
16	Mugisha Kenneth	Diploma in sericulture (1993)
17	Musasizi Jovita	Diploma in Tropical sericulture (1992)
18	Egesa Eugene	Diploma in sericulture (1995)
19	Karamagi	Diploma in sericulture
29	Kikoba E	Certificate in sericulture

Other in-country training was carried out for private enterprise staff within the framework of the Japanese collaboration. The Kawanda Agricultural Research Station (KARS) was involved since 1985 in mulberry trials of imported varieties and silkworm strains testing. At that time there was no skilled manpower in sericulture activities in Uganda.

In March 1993, the USAID/Export Policy Analysis and Development Unit sponsored a Uganda Silk Study, where the basic features of the Silk Sector Development Project (SSPD) were laid. The same consultant, Mr. A.C. Morton, was called in July-August 1993 to lead a 6-week mission funded by the United States Agency for International Development (USAID) for the preparation of a Project Proposal. The mission also comprised of Mr Gershom Mugyenyi as Sericulture Expert (who was then the Head of National Sericulture Development Centre, Kawanda, MAAIF) and Mr Bernd Muller as USPA adviser and Co-Director of the SSDP Supervision of the project was to be exercised by the Uganda silk Producers Association

In accordance with the Fourth Lomé Convention, in 1991 Uganda qualified for a transfer of loss of earnings. The Project as identified in the Project Design Preparation Report was financed under the Stabex 1991 allocation, for an initial commitment of € 2,200,000. The Financing Agreement (FA) between the European Community and the Republic of Uganda for a Silk Sector Development Project (SSDP) did not report the time frame of the Project; however, a duration of two years was specified in the Technical and Administrative Provisions for implementation annexed to the document.

The main objective of the Silk Sector Development Project was to support a pilot sericulture development and strengthening of a commercial sericulture sector through the Uganda Silk Producers' Association[3]. From 1994 to 1999, there was a pilot silk sector development project to support the initiative of silk pioneer through the Uganda Silk Producers Association as the pilot project. The main Components of the Silk Sector Development Project were:

i. Establishment of core facility for silkworm egg storage and treatment
ii. Providing commercial loans to silk farmers
iii. Establishment of at least 24 Silk Development Centers as incubatoion centres. While each farmer was given money to set up a mulberry garden, the project design provided

establishment of Silk Development Centers, where there were more than ten silk farmers in the area. The centre served as a teaching centre. Normally there was a mulberry garden and a purpose built silkworm rearing house at the centre. The silk development centre also served as an eggs distribution point. Once a week the farmers in the area would meet at the centre and hold a baraza to compare notes about their sericulture practices. That is why we called them incubation centres as farmers learnt a lot from each other and thus improved the quality of their silk cocoon production.

This provision of the silk Development Centers in the project design was the key attraction of the European Commission to fund the silk project in Uganda. This unit held the promise of multiplier effect countrywide to spread the knowledge and skills of sericulture in Uganda.

iv. Institutional strengthening of Uganda Silk Producers Association

By its constitution the Uganda Silk Producers' Association had set itself up as a regulatory authority for the silk sector in Uganda. It was therefore deemed right to strengthen it as an institution with an important mandate and authority within the framework of sericulture development and practice in Uganda.

v. Provision of sericulture support services provided by or through Uganda Silk Producers Association. These support services include:

- Whole farm survey
- Sericulture manuals
-Training at Silk Development Centers through extension services mechanism.

The project time-frame was extended by means of presented work plans. A first addendum in the original FA granted an increase in the commitment of funds by € 500,000 in August 1996. A second addendum granted a further increase of €185,000 , with a total commitment of €2,905,000 to cover the extended period to 30th September 1999. The project resulted in over 400 silk farmers trained in mulberry growing and silkworm rearing and facilitated to build silk worm rearing houses in over 12 districts of Uganda. Indeed 388 farmers successfully acquired both knowledge and skills of producing silk cocoons of international grades A, B and C.

In 1999, an evaluation of the Silk Sector Development Pilot Project (1994–1999) was carried out by three experts from EU and the following were the findings:

- Silk Project in Uganda was relevant and because of good climate, cocoon production can be all year round, not seasonal;
- Sericulture has very high returns if compared to other crops—represents real opportunity for diversification and increase of farmers' income;
- Sericulture is good for rural poor, women and youth—pr omising regular monthly income;
- There was a critical mass of silk farmers with adequate knowledge and skills;
- Silk technical expertise was available in Uganda;
- Government should formulate policy and support the silk sector.

The evaluation findings presented a very crucial opportunity to farmers to engage in sericulture for employment and income generation. There was a strong evidence that with Government support, sericulture can greatly reduce the levels of unemployment and also increase household income as a contribution to the prosperity for all agenda by the National Resistance Movement (NRM) Government.

It was a recommendation from these experts to transfer the project from private ownership of the Uganda Silk Producer's Association to the Government of Uganda under the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) in lock, stalk and barrow which was effected in the year 2000. The executive committee of USPA was left out in decision making of the project which was now under MAAIF. Decision making was therefore left to the staff under MAAIF who had less expertise in sericulture, a factor that led to mismanagement of the funds.

SSDP which had been designed to produce and export dried cocoons when the international market of dried cocoon had run shortage in the late 1980's was terminated, hence sustainability of the project was left difficult. It had several weak points throughout the project tenure i.e. from the programming to operation and unfortunately, an adequate follow-up programme was not realized all over the EU project sites. The number of cocoon producers declined thereafter, due to decreased and lack of technical and financial support. While technical and financial supports are some of the reasons the sector declined, many farmers across the country that had been supported under the European Project produced a lot of cocoons but the project failed to market them mainly because they were bulky, weightless and unprofitable to export. Many farmers buried the cocoons and lost confidence and morale.

Meanwhile, Uganda started a trial on cocoon processing in 1999 with assistances from International Centre of Insect Physiology and Ecology (lCIPE), International Fund for Agricultural Development (IFAD), African Development Foundation (ADF), and Government of Uganda. Raw silk production promoted another phase of the silk industry in Uganda. JICA trained several Ugandans in silk processing from reeling, re-reeling, weaving and garment design. ICIPE installed a small 10 multi-end silk reeling machine at Kawanda Agriculture Research Institute to experiment on silk processing. With ICIPE restoring hope, a precious nucleus of silk farmers in Bushenyi persevered and kept the candle of hope burning. They organized themselves into a group and formed the Bushenyi Silk Farmers Association (BSFA) in 2002. On June 26, 2002, after the success of the reeling test at Kawanda (shown by samples sent to Japan, India and China), IFAD through ICIPE donated a full set of silk processing machines to BSFA. At the same time, the Ministry of Agriculture donated land to BSFA at Rubare Farm (now in Sheema district) to facilitate the construction of the silk factory donated by IFAD-ICIPE. The association was fully recognized by Bushenyi Local Government as a Community Based Organization in 2003. The 60 multi-end silk factory was commissioned on April 26, 2003 by H.E the President of Uganda, Gen Yoweri Kaguta Museveni (Fig. 1 and Fig. 2). In 2003 the number of active cocoon producers was 105 and it increased to 133 in 2004 and 286 in the first half of 2005.

These cocoon producers were mostly located in the western region of the country with Kanungu district being the most active

in cocoon production followed by Bushenyi and Mbarara districts. Only Mukono district in the central region was active. Other active districts were Jinja, Kamuli, Iganga, Busia and Mbale. Most of the farmers in the western region have been renovating their mulberry plantations since August 2005.

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Fig. 1 His Excellency President Yoweri Museveni Commissioning Bushenyi Silk Factory—in the picture is also the late Gershom Mugyenyi, Hon. Dr. EliodaTumwesigye (Area MP) and Hon. Dr. Richard Nduhura (then Minister of State for Industry)

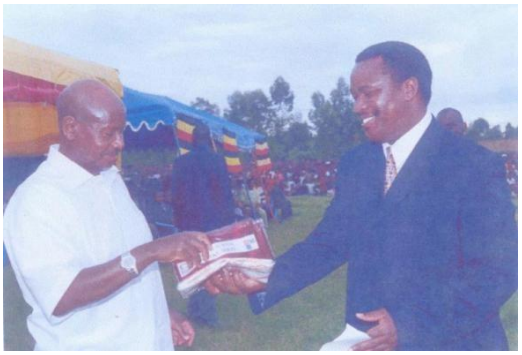

Fig. 2 Hon. Dr. EliodaTumwesigye handing over silk cloths made by BSFA to President Museveni after commissioning the factory

However soon after that, the BSFA founders were diverted to developing a huge fully automated silk factory in Kawanda under a company called NOBWE Silk Development Ltd. This was funded by the US government through the African Development Foundation. There were also splits within the farmer groups and production further plummeted.

H.E the President later sent the Vice President H.E Prof Bukenya on September 1, 2006 to Bushenyi and later the Minister of Agriculture to seek ways of supporting BSFA and to strengthen the silk sector in Uganda. To revitalize silk production, farmers and executive members of BSFA met under the supervision of Government officials held elections where Dr Elioda Tumwesigye was elected to be the Chairperson of the unified BSFA and the team embarked on a difficult task of mobilising farmers.

The new executive tried to re-activate BSFA and made a decision to re-focus much attention on Bushenyi Silk Factory. The executive also sought to strengthen collaboration with IFAD/ICIPE and to re-establish full control of the Bushenyi Factory and make it operational once again with a hope that BSFA will feed NOBWE Kawada Factory.

BSFA mobilized all available cocoons in the country and exported two tons to ICIPE and this gave BSFA some funds to re-start operations. Farmers were paid and others started rehabilitating mulberry gardens, rearing houses as well as starting rearing silk worms. With collaboration of BSFA-IFAD/ICIPE, a total of 388 farmers were restored and ICIPE provided support to renovate the factory and construct a new block to house the weaving /bleaching and training sections of the Bushenyi Silk Market Place. The factory then started production albeit at a low capacity as the Association lacked working capital to buy farmers' cocoons and pay its workers among other challenges.

But despite all these efforts by the farmers and the executive committee as well as the visit by the then Vice President of Uganda, there was no significant support from the Government to support sericulture enterprises. This was worsened by the death of Gershom Mugyenyi, an entomologist from the Ministry of Agriculture in 2008 who was a key promoter and the shifting of attention from Bushenyi Factory to the bigger Kawanda Factory which unfortunately did not work as expected. It is also noted that production did not pick up because farmers who had lost out by burying cocoons could not easily resume silk production.

At its peak Bushenyi Silk Farmers Association served about 1,170 farmers in the region and 30 staff members. Of these 346 silk farmers were in Greater Bushenyi district, 260 farmers in Kiruhura district, 310 farmers in Kanungu and 254 farmers in Kabarole. All these were organized in other associations which included Mbarara Silk Famers Association, Kanungu Silk Farmers Association, Bushenyi Reelers Assocaition and NOBWE Silk Reelers Association. At present, Bushenyi Silk Farmers Association is still legally recognized by Government and has benefited from programmes run and managed by the relevant line ministries of Agriculture Animal Industry and Fisheries and Ministry of Trade and Industry including participation in trade and agricultural shows. It is also recognized by the International Centre of Insect Physiology and Ecology (ICIPE) Nairobi Kenya and International Trade Center Geneva as well as the Japan International Co-operation Agency (JICA). These ministries and institutions have been providing BSFA with relevant technical assistance. As a result, BSFA collaborated with Ankole Western Institute of Science and Technology (now Ankole Western University) and a local NGO Integrated Community Based Initiatives (ICOBI) and trained 52 youths who are orphaned and vulnerable in sericulture. These trained youths however needed to be supported to set up gardens, rearing houses and to acquire hand-reeling units.

At the same time there was increased demand for Bushenyi silk products worldwide, although the production capacity was low. BSFA exported some of its products to China, Ethiopia and Kenya. According to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), senior entomologist, Uganda had orders for silk yarn from Egypt, Ethiopia, India, and Hong Kong (China), and finished silk products to Iran and investors from India, Iran and Israel had shown interest to buy farmers' cocoons and process them from Uganda.

The major challenge that had made the silk sector fail to take off in Uganda was lack of value addition and market for silk products. The BSFA Chairman (Dr. Elioda Tumwesigye) at his own cost went to Egypt, Thailand, India, Japan, China, Ethiopia and South Africa to learn more about silk and identify opportunities for market of silk products. BSFA also exported silk yarn to Ethiopia and Hong Kong (China). It had international orders that it cannot satisfy, which is a very good opportunity to take advantage of and scale up sericulture in Uganda.

At that time Uganda produced three metric tones of silk yarn that were processed at Bushenyi Silk Factory and by other silk farmers' associations in Kabarole, Bushenyi, Kiruhura and Kanungu districts using hand reeling machines.

In 2011, BSFA exported 3.8 tonnes of cocoons and raw silk yarn to Hong Kong and 48kgs of yarn to Ethiopia which revived the spirit of farmers to embark on the growing of mulberry cultivation silk warm rearing and cocoon reeling.

Despite enormous effort by the farmers associations such as BSFA in promoting silk production, the majority of the producers are scattered and small-scale subsistence farmers who engage in non-market oriented products and predominantly use rudimentary technologies. The products were often of low volume and poor quality and were expensive to assemble for sustained market supply. The new farmers had no rearing houses and lack knowledge for quality silk production. They also lacked post-harvest equipment (like cocoon frames and disinfectants).

BSFA lacked operational funds for constructing new rearing houses for new farmers as well as payment of allowances for essential staff needed at the factory. There was also a need for staff to travel and give support to farmers to practice good rearing techniques (field operation), deliver young silkworms and collect cocoons among other key activities. Electricity load shedding also affected production and fulfilment of export orders which necessitates a standby generator to ensure constant production and yet BSFA could not easily borrow working capital funds because of lack of security.

There was also a challenge of lack of silk eggs yet good quality eggs is an indispensable prerequisite for a sustainable silk industry and this is the key limiting step. Farmers often prepared for silk worm rearing but became discouraged when no eggs were available.

BSFA had its own hatchery building and got eggs from Kawanda and ICIPE Kenya and produced young silk worms for distribution to farmers. BSFA had staff trained in silk worm incubation and rearing as well as cocoon and yarn processing with support from JICA. BSFA planed to continue buying eggs for the first one year as it establishes its own grainage including multiplication, silk worm egg production, preservation and distribution.

To address the above, BSFA had formulated a holistic framework of training farmers and equipping them with the necessary infrastructure for production such as hand reels and re-reeling machines. As part of a comprehensive package, 300 members in Greater Bushenyi and Kiruhura districts were to be provided with iron sheets and cement and they were to construct silk rearing houses under the supervision of BSFA technical team. However, BSFA needed to enter into agreements with the farmers before providing the items, stipulating that the cost would be repaid as they began production. The farmers were expected greatly contribute to supporting more farmers as well as enhance sustainability of this support through a revolving fund model. In addition, BSFA intended to establish silkworm egg production (grainage) in collaboration with National Sericulture Research Centre (Kawanda) which would cost-effectively supply sericulture farmers with eggs and thus improve the sericulture industry in Uganda. It also had plans to expand the silk market place and collection centre at Rubaare Sheema district.

Japan International Cooperation Agency (JICA) sponsored Sericulture Development Programme/Project in 2005. The Agency hired a Japanese expert Eika Felipe who was based at National Sericulture Development Programme (NSDP), National Sericulture Centre (NSC), Ministry of Agriculture, Animal Industry and Fishery (MAAIF), Kawanda Agricultural Research Institute (KARI) at National Agricultural Research Organization (NARO), Kawanda, Wakiso. Her terms of reference were:

1) Collection and analysis of available information on sericulture in Uganda;
2) Conducting surveys on the roles and activities of National Sericulture Center;
3) Conducting surveys on sericulture extension at the local government and community levels;
4) Conducting surveys on sericulture technologies at on-farm level;
5) Conducting a survey on silk yarn production (e.g. kind, quantity, quality, and marketability);
6) Conducting a survey on stakeholders of sericulture development in Uganda.

The report was submitted in 2007 and was supposed to be implemented by JICA. Unfortunately, the report findings and recommendations for the development of Sericulture Sector in Uganda were not implemented. A follow-up by the Principal Investigator of Commercialization of Sericulture Technologies and Innovations in Uganda Clet Wandui Masiga in 2016 to JICA offices in Uganda indicated that the project did not proceed as sericulture fell outside JICA's national crop priorities.

In 2017/2018 financial year, the Government of Uganda funded a feasibility study. The funding was guided by the government's commitment to develop the country's industry through exploitation and development of natural resources, agro-processing and knowledge based industries. This was part of funding to support technological innovation through the innovation fund to help anyone with scientific ideas that need to be developed into business ideas. The feasibility study was funded under the title: 'Evaluating the utility of sericulture technologies, silk based textiles and other silk derived innovations as tools for household wealth creation and employment generation in Uganda.'

This study implemented part of the National Industrial Policy that came into force in February 2008 and the National Textile Policy that came into force in Jan. 2010. Specifically, the National Textile Policy recognizes that silk sector shall be developed to spur village level processing especially the cottage industry which would offer income opportunities for women and youth. The policy clearly states that the Government shall support the silk and other fiber production and processing in Uganda.

Uganda is a net importer of apparels with net aggregate imports and exports amounting to US$776 million and US$58.1 million respectively. Export of lint significantly picked up in 2016 peaking at a record high of 5,625 MT. This increase in cotton exports can be explained by stable global cotton prices that preceded year 2016 and stimulated increased production in the following season, leading to more cotton on the market. In 2015, demand for cotton exceeded supply. This caused competition among the buyers, driving up prices. This motivated production the following year and subsequent increase in cotton volumes available for exports of lint from Uganda. Lint imports have however had a fluctuating trend with an export volume of 1.702 MT in 2015.

Challenges facing the CTA sector spread across the production, processing, and marketing levels including competition from used cloths. On a global level, the four leading players in the used cloths trade include the USA (19.5%), the UK (13.3%), Germany (11.5%) and China (7.9%). Within the EAC, Uganda and Tanzania are among the top fifteen world importers of used cloths. Uganda accounts for 3.2 per of global imports of used cloths and Tanzania 3.0 percent. This is both a threat and an opportunity for locally CTA products.

In line with EAC's regional strategy for growing the CTA sub-sector, Uganda imposed an environment levy on used cloths increased from 15 to 20 percent of its cost, freight and insurance in 2017/2018. Rwanda increased the levy from $0.2 to $2.5 per kg in financial year 2016/17 and to US$ 4 per kg in financial year 2017/18. This provides a good opportunity for innovative alternative interventions to make the sector work for all. Commercializing sericulture is one of the interventions that can improve the competitiveness of the sector, create jobs and improve the incomes and contribute to moving the population from subsistence to commercial farming.

A turning point came in the 2017/2018 financial year when the Government of Uganda funded a new feasibility study, aligning with the National Textile Policy (2010) which explicitly supports silk sector development. This laid the groundwork for the current government-led initiative.

3 Present status of sericulture in Uganda

Commercialization of sericulture technologies and innovations in Uganda is a government of Uganda project which aims at promoting the development of the silk industry to create gainful employment and improved levels of income in sericulture through utilization of next generation sericulture technologies, innovations and management practices[6]. This project also aims at increasing domestic production of silk and its byproducts, thus raising rural incomes for smallholder producers and ensuring the supply of affordable silk products to Ugandan consumers and export markets. The project is implemented by Tropical Institute of Development Innovations (TRIDI) and funded by government of Uganda through the Ministry of Science, Technology and Innovations (MOSTI) as a subvention to Uganda National Council for Science and Technology (UNCST). The current revitalization of the silk industry is driven by the government-funded project "Commercialization of Sericulture Technologies and Innovations in Uganda," implemented by the Tropical Institute of Development Innovations (TRIDI) and supervised by the Ministry of Science, Technology and Innovation (MOSTI) and the Uganda National Council for Science and Technology (UNCST)[7]. Significant progress has been made since the 2019/2020 financial year[5]. In the financial year 2019/2020, government provided financial support which resulted into the following activities implemented[7]:

vi. Project management and coordination structure established with a total of 45 skilled and support staff who have undergone basic training.
vii. Baseline study on sericulture ecosystem (institutions, farmers and infrastructure in the country was conducted in Sheema, Mbarara, Bukedea, Bulambuli, Iganga, Mukono, Mubende, and Pallisa to determine the willingness of farmers to engage in sericulture on commercial basis, establish potential impact in districts not accessed, and continue to generate data for evidence-based policy making and bench mark for monitoring, evaluation and learning).
viii. The curriculum to establish and run an academic program in sericulture and silk technology has been drafted and under review[5].
ix. Specifications for establishing and operationalizing a complete line of next generation equipment for post cocoon technologies and innovations have been completed and contract to manufacture, install and build capacity of Ugandans to operate the processing line finalized[5].
x. Experimental development of sericulture technologies and innovations have been established at Sheema, Iganga, Mukono, Kamuli, Bukedea, Bulambuli, Pallisa, Zombo and Busia.
xi. To enhance commercial production, there has been mulberry plantation establishment, management and production in Sheema, Mbarara, Mubende, Bukedea, Iganga, Kamuli, Kayunga, Kween, Luwero, Nakaseke, Pallisa, Nwoya, Zombo, Buikwe, and Bulambuli on a total of 601 acres. More farmers were identified in Lira, and Sironko who will receive support[5]. There is a capacity of 1,203 (794m, 409w) farmers and 33 (11 W, 21M) extensionists in silkworm rearing technologies.
xii. Some of the basic tools and equipment for commercialization of sericulture technologies were obtained and are being used for research and development works.
xiii. The rationally-designed rearing houses whose microclimatic and environmental conditions are suitable for the purpose are under evaluation.
xiv. On-farm commercialization at farmers' fields is already ongoing on 92 farms. Their capacity continued to be enhanced through regular extension services. These farmers will act as trainer of trainers. Additional 450 farmers who had been silk farmers were followed up and their needs identified.
xv. Three staff have been trained in egg production. Technical evaluation of the works on development of physical infrastructure for egg production was completed for works in Sheema district. The size was increased and works to complete the adjusted works commenced.
xvi. National Sericulture Commercialization and Technology Transfer Steering Committee have been identified and their terms of reference developed.
xvii. Specifications and accessibility of sericulture laboratory technologies and innovation tools and equipment have been completed and others delivered.
xviii. Two international study visits and negotiations to acquire

technologies and innovations have been conducted to Japan and China.

xix. Uganda's accession to International Sericulture Commission is facilitated for the first time since its founding in 1948 as a UN registered inter-governmental organization engaged in the development of sericulture and silk industry in the world.

xx. Uganda attended the 25th International Congress on Sericulture and Silk Industry co-organized by the Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan; International Sericultural Commission (Bangalore, India); and National Agriculture and Food Research Organization (NARO) at Tsukuba, Japan.

xxi. Strengthened communication, information and knowledge management for sericulture development by documenting, publishing, and disseminating brochures, banners, books, project profiles, information packs, position papers, posters, and presentations through meetings, field visits, conferences, exhibitions and media.

xxii. In monitoring, learning and evaluation, fourteen field visits were conducted, including seeing is believing tours hosted on various occasions for a total of 150 stakeholders and visits conducted for statehouse monitoring unit, MoFPED budget monitoring unit, officials from the Auditor General Office. Furthermore, 28 meetings and one review meeting were held for stakeholders from different districts.

Currently, mulberry gardens are well established in Sheema, Mubende, Mukono, Bukedea, Pallisa, Kayunga, Bulambuli, Zombo, Kamuli and Gomba. New plantingings were established in May 2020 in Buikwe, Busia, Bulambuli, Kween, and Nwoya districts totaling 320 acres. In financial year 2020/2021, the project will therefore consolidate the gains and continue the cycle of sericulture industry value chain by focusing on next stages to ensure commercialization. There are consequently a number of key priorities for 2020/2021[6, 11]. These key activities are to invest in post cocoon technologies, completing rearing houses and grainage, maintenance of established mulberry gardens and expansion of area under nucleus and smallholder farms. This will also ensure that the government does not lose money already invested.

4 Summary of historical stakeholders in Uganda and their role in sericulture development

Sericulture has had a long history in Uganda and it is now beginning to pick up, thanks to the contributions of various stakeholders[4].

i. Tropical Institute of Development Innovations (TRIDI). It is the current lead implementing agency for the government's sericulture commercialization project. It aims to:

- Carry out and or implement activities of commercialization of sericulture technologies and innovations with due diligence and efficiency, and in accordance with sound technical, economic, financial, managerial, environmental and social standards and practices;

- Procure the goods and services to be financed out of the Agreement in accordance with sound procurement procedures; and ensure that the goods and services shall be used exclusively in the carrying out of the Project;

- Maintain policies and procedures adequate to enable stakeholders to monitor and evaluate in accordance with indicators acceptable to the partners, the progress of the Project and the achievement of its objectives;

- Maintain a financial management system and prepare financial statements in accordance with consistently applied accounting standards acceptable to government of Uganda, both in a manner adequate to reflect the operations, resources and expenditures related to the Project; and at the MOSTI's request, have such financial statements audited by independent auditors acceptable to government of Uganda, in accordance with consistently applied auditing standards acceptable to the Auditor Generals, and promptly furnish the statements as so audited to MOSTI and Auditor general;

- Enable MOSTI, MFPED and the Auditor Generals offices to inspect the Project, its operation and any relevant records and documents;

- Prepare and furnish MOSTI, MFPED and Auditor General with all such information as they may reasonably request pertaining to the foregoing;

- Develop and present the commercialization of projects concerning sericulture technologies and innovations according to the specifications of the MFPED development committee guidelines: the approval and review of the Public Investment Plan (PIP) projects.

- Develop and submit proposals in partnership with MOSTI and UNCST for up-scaling the commercialization of sericulture technologies and innovations in Uganda for income generation, employment and job creation in line with government priorities.

- Contact and or follow up with MOSTI, UNCST, MFPED, Parliament and any other relevant institutions and agencies to sustain the commercialization of sericulture technologies and innovations in Uganda.

ii. Ministry of Science, Technology and Innovation (MOSTI). Funded by government of Uganda, it is in charge of the overall supervision of the Project on Commercialization of Sericulture Technologies and Innovations in Uganda. It is to constitute a committee to monitor activities of TRIDI, and provide TRIDI with technical advice on the basis of observations from the monitoring[4].

iii. Uganda National Council for Science and Technology (UNCST).

- UNCST plays a supervisory role of the project and is a member of the project steering committee;

- UNCST ensures that TRIDI takes full responsibility of ensuring that Memorandum of Understanding (MOU) between UNCST and Sheema local government is implemented to its conclusion while implementing the project;

- UNCST performs monitoring and evaluation of the project and is provided with funds from the project for such work as is agreed upon during the inception workshop and as per budget specifications;

- UNCST designates a desk officer who works very closely with TRIDI in establishing a commercial insect programme;

- UNCST aims to to develop sericulture policy and related activities for its adoption by cabinet in consultation with MOSTI, TRIDI and other relevant partners;

- UNCST participates in monitoring activities of TRIDI, and provides TRIDI with technical advice on the basis of observations from the monitoring;

- UNCST provides TRIDI with technical assistance, given reasonable request from TRIDI within 30 days of receipt of the request.

iv. Uganda Export Promotion Board (UEPB): The premises of the board were used as offices for the silk related meetings and conferences. They also made contributions to the silk sector by availing farmers with 500 boxes of silkworms.

v. Japan International Cooperation Agency (JICA)[3]: the history of sericulture is tied up with Japan. It would have been impossible to start sericulture in Uganda without encouragement and inspiration from Japan as illustrated by the following historical events:

- In 1989, the silk idea was introduced to Mr. Y. Hasegawa who later convinced Yamato International to look into the suggested idea.

- In 1990, Rotary Club in Tokyo sponsored two Japanese experts to come to Uganda and educate its people about the silk industry.

- In 1991, one of the silk experts Mr. Machida returned to Uganda and spent three months in Bushenyi establishing mulberry gardens and holding meetings with peasants.

- In 1993, USAID sponsored three USPA's members to visit Japan and get acquainted to different sericultural practices. It was hosted by the Yamato International Limited president Mr. Y. Kashiwada.

- Two of the Ugandan sericulturalists studied in Japan.

- From 1991 to 1998, Yamato supplied silkworm eggs for the experiment to assess cocoon production in Uganda. A cash amount of $30,000 was also given.

- JICA did a comprehensive report on sericulture develo pment in Uganda.

- A Japanese expert Mrs. Eika Yamada Felipe sponsored by Japan International Cooperation Agency did tremendous work under difficult circumstances to raise the profile of sericulture in Uganda. She undertook studies, developed reports and manuals and her supervision institutionally strengthened the National Sericulture Center at Kawanda where production of silkworm eggs, training cocoon reelers and general research was focused.

vi. Uganda Silk Producers Association (USPA) [3]:

- In Uganda, sericulture promotion was pioneered in the private sector USPA which was created by a few people to champion the cause of sericulture as a diversification in agricultural production. It's registered as a non-government organization with a constitution of rules and regulations.

- Their main challenge was to create awareness among the rural peasants that sericulture has a positive potential to transform their economic lives. Sericulture in the rural country side was to create opportunities for employment and income generation for the underemployed especially the women, youth and the elderly. Over 10,000 households were mobilized to plant mulberry trees.

- A new idea is often first considered as ridiculous the dismissed as trivial until it finally becomes what everyone knows.

- Mr. Gershom Mugyenyi who was the chief sericulturalist and secretary of the association was a regular visitor to Sabahar Handmate Ethiopian Silk Center as an advisor and marketier of silk yarn from Uganda.

- Mr. Emmanuel Ablo from Ghana who worked with the World Bank visited the silk project in Uganda and was impressed by the efforts. He therefore promised to introduce the silk idea in his own country. Today, Ghana also produces silk cocoons.

- They conducted a baseline study for silk farmers in U ganda.

- Sericulture in Uganda is now looked at as a success story. The Ugandan government has fully embraced it under the Ministry of Science and Technology and Innovation. This has now generated a new momentum with ramifications beyond the boundaries of Uganda with Ugandans trained in sericulture in Japan, India and Russia diversifying the idea to the neighboring countries such as Rwanda.

- Feasibility of the sericulture idea was supported by two influential Ugandans, the president of the Republic of Uganda, and Prof. Emmanuel Mutebile, the current governor of the Bank of Uganda. The pioneers of the association are always indebted to Mr. Choi a South Korean citizen World Bank Representative who on hearing Mr. John Ndyabagye's propositions on silk in the early 1990s requested USAID to pay for the feasibility studies and the European Union to fund the pilot project.

- The current status of sericulture in Uganda is progressively promising. There's market for silk products in Iran and Hong Kong (China). Also, Uganda has attracted more investors from Iran and China.

- Uganda still yearns for knowledge, equipment and tech nical expertise from traditionally silk producing countries of Asia.

- It designed manuals to be used by silk farmers and ex tension workers.

- They worked out a methodology of providing loans to silk farmers and the methodology included a mechanism for loan recovery.

- It persuaded 2,478 households to take up mulberry growing and silkworm rearing (Table 2).

Table 2: Households that adopted sericulture with support of USPA

Districts	No. of Farmers	Rearing Facilities	
		Houses	Mulberry Acreage
Bushenyi	826	200	2,200
Kanungu	780	150	1,000
Kiruhura	236	40	192
Kabarole	446	40	108
Mukono	20	20	50
Jinja	20	10	20
Kamuli	40	10	40
Iganga	70	30	85
Jinja	50	20	50
Total	2,478	520	3,375

vii. The Ugandan government through the Ministry of Agriculture, Finance and Trade.
viii. viii. The United States Agency for International development (USAID).
ix. ix. Yamato International Limited Japan for connecting the Ugandan silk sector to Japanese silk experts.
x. x. Swiss Development Cooperation (SDC) for scholarships.
xi. xi.The African Development Foundation (ADF).
xii. xii. The International Trade Centre (ITC).
xiii. xiii. The International Centre for Insect Physiology and Ecology (ICIPE).
xiv. xiv. The Uganda Silk Producers Association was required to champion sericulture within the country until a regulatory Authority was created.
xv. xv. The Silk pioneering farmers.
xvi. xvi. The National Sericulture Centre at Kawanda which was institutionally facilitated by JICA to be the center piece for sericulture in Uganda.
xvii. xvii. The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF).

5 Potential and a strategy for sericulture development in Uganda

The goal of the government of Uganda is to create gainful employment and improved incomes through next-generation sericulture technologies and management practices. The strategy is built on Uganda's proven potential for high-quality, year-round cocoon production[4]. The textile industry is also a typical "loose-lipped" industry[1] and the strategic objectives are:

- To increase the area under mulberry from 200 acres to 50,000 acres.

- To boost silk yarn production from nearly zero to 2,200 metric tonnes annually.

This will be achieved through interventions in three result areas[7]:

i. Production: Scaling up mulberry cultivation and cocoon production through nucleus and smallholder farms.
ii. Technology Transfer: Deploying modern post-cocoon processing technologies for value addition and improving silkworm rearing practices through research[8].
iii. Capacity Building: Continuous training for farmers, extension staff, and technicians across the value chain.

The involvement of foreign private companies from Iran and China provides a ready market for cocoons and introduces much-needed capital and technical expertise. This public-private partnership model is crucial for building a sustainable and commercially viable industry. Furthermore, research into diversified uses of mulberry, such as for herbal tea and wine, presents additional income streams[9].

6 Conclusion and recommendations

Uganda's sericulture industry has traversed a long and challenging path, from early pioneering efforts to a period of decline, and is now experiencing a promising revival. The country's favourable natural environment [2–3], coupled with lessons learned from past failures, provides a solid foundation for success. The current government-led strategy, encapsulated in the "Commercialization of Sericulture Technologies and Innovations" project, represents the most comprehensive and well-structured effort to date. By focusing on a complete value chain approach—from mulberry cultivation and cocoon production to local value addition and marketing—the project addresses the critical bottlenecks that previously stifled the sector.

The growing interest from foreign private investors is a strong vote of confidence and a key ingredient for commercial sustainability. To fully realize the potential of sericulture for job creation, rural income generation[10], and export earnings, the following recommendations are proposed:

i. Sustain Government Commitment: Ensure consistent and timely funding for the commercialization project to maintain momentum and build on the established foundation.
ii. Fast-Track Value Addition: Expedite the installation and operationalization of the planned post-cocoon processing facilities to transform bulky cocoons into higher-value silk

yarn and fabric locally.

iii. Strengthen Farmer Support Systems: Continue robust extension services, ensure reliable access to quality silkworm eggs, and develop innovative financing models for farmers.

iv. Finalize and Implement Sericulture Policy: The government, through UNCST and MOSTI, should expedite the development and adoption of a national sericulture policy to provide a clear regulatory framework and long-term direction.

v. Leverage International Partnerships: Continue active engagement with the International Sericulture Commission and partner with established silk-producing nations for continuous technology transfer and knowledge exchange.

With sustained effort, strategic investment, and effective partnerships, sericulture can indeed become a transformative agro-based industry, contributing significantly to Uganda's socio-economic development.

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