

# Internal Ex-Post Evaluation for Technical Cooperation Project (SATREPS<sup>1</sup>)

conducted by Kenya Office: February, 2026

Country Name	<b>Project for development of sericulture research by applying biological resources and molecular genetics</b>
Republic of Kenya	

## I. Project Outline

Background	<p>Kenya's main industry was agriculture, and there was growing interest in sericulture as a way to modernize agriculture and enhance its profitability. Sericulture was initiated through technical cooperation by Japan over decades beginning in 1972. However, progress was limited due to the lack of mulberry and silkworm varieties suited to Kenya's climate as well as the low level of sericulture and silk reeling technologies. As a result, both the quality and quantity of cocoons and raw silk produced stayed low. In addition, the genetic resources of wild silkworm, which were expected to contribute to development of new types of silk, had not been effectively utilized. To address these issues, the Kenya Agricultural and Livestock Research Organization (KALRO), in collaboration with Japan's National Agriculture and Food Research Organization and other partners, conducted a study in 2014 to assess the potential for producing high-quality silk. The study concluded that, if technical conditions were met in suitable regions, it would be possible to produce high-quality raw silk for export and to develop new silk materials, and the Government of Kenya established the National Sericulture Research Centre (NSRC) in 2015 to develop a technical base for sericulture and silk production<sup>2</sup>.</p> <p>Based on these situations, the government of Kenya requested the government of Japan to undertake a technical cooperation project, with the aim of breeding mulberry and silkworm varieties suitable for the local environment, effectively utilizing wild silkworm genetic resources, and strengthening NSRC's research and technological development capacities.</p>				
Objectives of the Project	<p>Through i) the conservation and characterization of mulberry germplasm from several Kenyan counties and the establishment of a gene bank, ii) the production of mulberry varieties and breeding lines adaptable to the conditions of candidate sericulture regions, iii) the development of new silkworm strains with high productivity and robustness, and improvement of rearing methods adaptable to Kenyan conditions, and iv) the characterization of non-mulberry silkworms and their silks, including their potential applications to new silk fibers and materials, the project aims at establishing a solid base of research and technology development for sericulture at NSRC, thereby contributing to the provision of improved sericulture technologies at NSRC.</p> <ol style="list-style-type: none"> <li>Expected Overall Goal: Basis for providing improved sericulture technologies is established at NSRC.</li> <li>Project Purpose: Firm basis of research and technology development for sericulture is established at NSRC.</li> </ol>				
Activities of the Project	<ol style="list-style-type: none"> <li>Project Site: Thika (NSRC)</li> <li>Main Activities: i) Establishment of a system for managing and conserving mulberry varieties, accessions, and their passport data, ii) Development of cultivation manuals for Thika, Kakamega, and Kibos, based on the evaluation, selection, and breeding of suitable varieties, iii) Development of new silkworm strains and development of cocoon and raw silk production capacity at NSRC, and iv) Ecological study on the collection of non-mulberry silkworms and exploration of silk protein materials derived from non-mulberry silks.</li> <li>Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <b>Japanese Side</b>                      1) Experts: 14 persons                      2) Trainees Received: 24 persons                      3) Equipment: Mulberry cultivation equipment, silkworm breeding/raising facilities, yarn manufacturing equipment, and others                      4) Local Cost: Costs for greenhouses and net rooms, sericulture room maintenance, thermostatic chambers, and others                 </td> <td style="width: 50%; vertical-align: top;"> <b>Kenyan Side</b>                      1) Staff Allocated: 21 persons                      2) Facilities and Equipment: Office space, laboratory, furniture, and cultivation plots                      3) Local Cost: Travel expenses in Kenya, costs for utilities, communication expenses (including Internet), and others                 </td> </tr> </table> </li> </ol>			<b>Japanese Side</b> 1) Experts: 14 persons 2) Trainees Received: 24 persons 3) Equipment: Mulberry cultivation equipment, silkworm breeding/raising facilities, yarn manufacturing equipment, and others 4) Local Cost: Costs for greenhouses and net rooms, sericulture room maintenance, thermostatic chambers, and others	<b>Kenyan Side</b> 1) Staff Allocated: 21 persons 2) Facilities and Equipment: Office space, laboratory, furniture, and cultivation plots 3) Local Cost: Travel expenses in Kenya, costs for utilities, communication expenses (including Internet), and others
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Project Period	(ex-ante) July 2016 – June 2021 (60 months) (actual) 2 October 2016 – 31 March 2022 (66 months)	Project Cost (Japanese side only)	(ex-ante) 604 million yen (actual) 372 million yen		
Implementing Agency	<ul style="list-style-type: none"> <li>Kenya Agricultural and Livestock Research Organization (KALRO)</li> <li>National Sericulture Research Centre (NSRC)</li> </ul>				
Cooperation Agency in Japan	National Agriculture and Food Research Organization (NARO)				

## II. Result of the Evaluation

1 Relevance/Coherence
[Relevance]
<Consistency with the Development Policy of Kenya at the Time of Ex-Ante Evaluation>

<sup>1</sup> SATREPS: Science and Technology Research Partnership for Sustainable Development

<sup>2</sup> "Raw silk" refers to silk thread as a product obtained by reeling from cocoons. In contrast, "silk production" encompasses a broad range of technologies and industrial fields related to silkworms, including silkworm rearing, silk reeling, and the development of silk materials.

The project was consistent with the development policy of Kenya at the time of ex-ante evaluation. Kenya's national development plan "Vision 2030" (2008-2030) aimed at transforming smallholder farmers from subsistence-based operations into commercial and modern agricultural producers. In line with this policy, the "Agricultural Sector Development Strategy (2010-2020)" was formulated, presenting a vision of "innovative, commercially-oriented, and competitive modern agriculture by enhancing the competitiveness, productivity, and commercial viability of agricultural products and agribusinesses".

<Consistency with the Development Needs of Kenya at the Time of Ex-Ante Evaluation >

The project was consistent with the development needs of Kenya at the time of ex-ante evaluation, which focused on establishing a system for producing high-quality raw silk and new silk materials. These needs included breeding mulberry and silkworm varieties suited to the local climate, utilizing wild silkworm genetic resources more effectively, and strengthening research and technological capacities at NSRC.

<Appropriateness of Project Design/Approach>

The project design/approach was appropriate. It aimed to disseminate the developed technologies to farmers in rural areas, which led to improved farming practices and the creation of alternative sources of income through cocoon sales. In addition, the expansion of mulberry cultivation and silkworm rearing provided employment opportunities, particularly for socially vulnerable groups such as women and youth.

As for the lesson learned from past similar projects, the SATREPS project<sup>3</sup> took into account the challenges related to the increased counterpart burden observed in the SATREPS project at KALRO Mwea and conducted training for research officers from KALRO Kakamega and Kibos so that they could independently carry out project activities in the target regions. As a result, local research officers became capable of addressing issues on their own without the need for NSRC headquarters staff to travel to the field, thereby minimizing project delays and unnecessary travel expenses.

No problem attributed to the project design/approach was confirmed.

<Evaluation Result>

In light of the above, the relevance of the project is ③<sup>4</sup>.

[Coherence]

<Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with the "Country Assistance Policy to the Republic of Kenya" (2012) at the time of ex-ante evaluation. Under this policy, one of key priorities was to address agricultural issues faced by small-scale farmers. In addition, the policy aimed to promote the development of the horticulture sector through technical cooperation and financial assistance, with a focus on enhancing agricultural productivity and market-oriented agricultural promotion.

<Collaboration/Coordination with JICA's Other Interventions>

No collaboration/coordination between the project and JICA's other intervention was clearly planned at the time of ex-ante evaluation and during the project period.

<Cooperation with other institutions/ Coordination with International Framework>

No cooperation/coordination with other institutions was clearly planned at the time of ex-ante evaluation or during the project period.

<Evaluation Result>

In light of the above, the coherence of the project is ②.

[Evaluation Result of Relevance/Coherence]

In the light above, the relevance/coherence of the project is ③.

## 2 Effectiveness/Impact

<Status of Achievement of the Project Purpose at the Time of Project Completion>

At the time of project completion, the Project Purpose was partially achieved as planned. "NSRC Research Plan" (2021-2025) was only drafted and not approved by KALRO by the time of the project completion (Indicator 1). Since the data collection on raw cocoon yield started in 2023, measurements for 2022 were not conducted, and accurate figures are unavailable. However, the average raw cocoon yield per egg exceeded 1.8g, which was confirmed to be consistent with the target level. Furthermore, in 2023, a raw cocoon yield of 55.63 kg/20,000 eggs was recorded. Based on these results, it is assumed that the raw cocoon yield in 2022 was also relatively high (Indicator 2). The quality grade of raw silk reached 4A, against the target indicator of 5A (Indicator 3). During the project period, 8 publications and 26 international conference presentations were produced, giving a total of 34 outputs compared to the target of 20 (Indicator 4).

<Continuation Status of Project Effects at the Time of Ex-Post Evaluation>

By the time of the ex-post evaluation, the project effects have been continued through NSRC's effective utilization of the key research outputs. NSRC staff have developed technology cards for the mulberry varieties, indicating their characteristics and potential on the mulberry gene bank database. These help farmers identify the mulberry varieties on their farms and select those best suited to their own environmental conditions for future expansion if necessary. Moreover, NSRC has propagated high-yielding mulberry varieties adaptable to diverse agroecological<sup>5</sup> and production conditions through cuttings and has supplied these seedlings to individual farmers as well as private companies. One of the private companies has already established approximately 20 acres of mulberry plantations and has plans for further expansion. NSRC has jointly initiated new research projects with several research institutions based on the outcomes of this SATREPS project. For example, NSRC has been working closely with the private companies to improve the spinning machine, making the spinning of yarn easier and faster to spin yarn from silk floss. This collaboration is expected to promote large-scale production of silk

<sup>3</sup> This SATREPS project, titled "The project on rice research for tailor-made breeding and cultivation technology development in Kenya" (2013-2018) aimed to establish a foundation for rice research and development in Kenya. Its purpose was to contribute to increased rice production in the country through the research and development of rice breeding materials adapted for Kenya, as well as cultivation technologies that enable the full expression of varietal potential.

<sup>4</sup> ④ : very high, ③ : high, ② : moderately low, ① : low

<sup>5</sup> "Agroecology" refers to the overall set of agricultural ecological and production conditions, encompassing natural environmental factors such as climate, soil, water resources, topography, and biodiversity, as well as cropping systems and agricultural production practices.

yarn. In addition, NSRC and the Pan African University Institute for Basic Sciences, Technology and Innovation<sup>6</sup> at Jomo Kenyatta University of Agriculture and Technology have concluded a research partnership. This collaboration has significantly advanced biomaterial research and the development of biomaterial processing methods, made possible through the joint use of research infrastructure and facilities.

Research related to the SATREPS project has continued even after the project completion. In particular, research on improving raw cocoon productivity has continued. NSRC recorded an average cocoon yield of 1.8g per egg at the time of the project completion, whereas in 2024 it reached 2.0 grams per silkworm egg (a total of 86.50 kilograms per 20,000 eggs), demonstrating greater efficiency. As a result, raw cocoon production has become more efficient, and the yield has significantly exceeded the target value at the time of the project completion. NSRC is currently undertaking efforts to standardize cocoon yield in preparation for future commercialization of sericulture. Separately, research on silk quality has advanced from producing grade 4A silk to successfully achieving its initial target of grade 5A. More recently, commercial production of silk of the same grade has been realized both by NSRC and by a farmer in Meru County. Further collaboration is underway with a farmer in Busia County on silkworm rearing, with the aim of attaining high-grade silk. In addition, NSRC continues efforts in processing, analysis, and grading to harmonize quality standards for commercialization.

As for the utilization of facilities and equipment such as automatic silk-reeling machine and cocoon dryer, most have been actively used. However, the ploidy analyzer<sup>7</sup> was introduced on a trial basis during the SATREPS project, and its license has expired. NSRC has requested KALRO's support to obtain a new license.

<Status of Achievement for the Expected Overall Goal at the Time of Ex-Post Evaluation>

At the time of ex-post evaluation, the Overall Goal has been achieved as planned. Originally, the number of extension officers receiving training in sericulture improvement techniques was originally targeted to increase by five, but 25 extension officers have already received training and enhanced their capacity. In addition, another 12 are expected to participate in the training program in the International Trade Center (ITC)<sup>8</sup>, starting in July 2025 (Indicator 1). The number of private companies receiving improved sericulture techniques increased by three, as planned. NSRC has transferred technologies to private companies, contributing to the commercialization of the silk industry through mulberry expansion and silkworm rearing. This has promoted stable production of high-quality cocoons and new market entry, fostering sustainable industry development. However, in some cases, the technologies have not been fully utilized by certain companies (Indicator 2).

<Other Impacts at the Time of Ex-Post Evaluation>

The facilities established and practical technologies such as a silk floss spinning machine developed by the SATREPS have been disseminated to the general households and farmers in remote areas who are interested in sericulture. As a result, the expansion of mulberry fields and silkworm rearing has created employment opportunities, particularly for socially disadvantaged groups such as women and youth in rural areas.

<Evaluation Result>

In light of the above, the effectiveness/impact of the project is ③.

Achievement of Project Purpose and Overall Goal

Aim	Indicators	Results	Source
(Project Purpose) Firm basis of research and technology development for sericulture is established at NSRC.	Indicator 1 Research plan of NSRC is developed based on achievements of the Project and authorized by KALRO.	Status of the Achievement (Status of the Continuation): partially achieved (continued) (Project Completion) - The research plan was drafted and not approved by KALRO due to internal procedures. (Ex-Post Evaluation) - The research plan was developed and approved by KALRO Headquarters in July 2022	Project completion report, Questionnaire to NSRC
	Indicator 2 Raw cocoon yield of at least 36kg/20,000 eggs is achieved at NSRC by utilizing new silkworm stains developed in the Project.	Status of the Achievement (Status of the Continuation): partially achieved (continued) (Project Completion) - The total yield of raw cocoons was not measured in 2022, as data collection began in 2023. Consequently, exact figures for 2022 are unavailable. However, the cocoon yield—averaging over 1.8 grams per egg—was confirmed to be consistent with the target level. (Ex-Post Evaluation) - Raw cocoon yield has gradually increased from 55.63 kg per 20,000 eggs in 2023 to 86.50 kg per 20,000 eggs in 2024.	Project completion report, Questionnaire to NSRC

<sup>6</sup> The Pan African University Institute for Basic Sciences, Technology and Innovation (PAUSTI) is a research and education institute in Kenya, focusing on advancing scientific knowledge and innovation across Africa. Among its diverse research projects, PAUSTI supports studies in sericulture, including the biology and sustainable production of silkworms such as the Eri silkworm.

<sup>7</sup> Ploidy analyzer is a device used to measure the number of chromosome sets (ploidy) contained in cells or tissues.

<sup>8</sup> International Training Center (ITC) is an international training institution specializing in sericulture and silk technology. It provides technical training for researchers, extension officers, and farmers of KALRO and NSRC on mulberry cultivation, silkworm rearing, cocoon quality evaluation, and commercialization (marketing).

		- NSRC is now working on standardizing cocoon weight to support future commercialization.	
	Indicator 3 Raw silk with 5A grade is achieved at NSRC.	Status of the Achievement (Status of the Continuation): mostly achieved as planned (continued) (Project Completion) - The quality grade of raw silk was achieved at the level of 4A, against the target indicator of 5A (Ex-Post Evaluation) - The ongoing research on silk grading at NSRC has advanced from producing grade 4A silk to successfully achieving its initial target of grade 5A raw silk. - More recently, commercial production of silk of the same grade has been realized both by NSRC and by a farmer in Meru County. - Further collaboration is underway with a farmer in Busia County on silkworm rearing, with the aim of attaining high-grade silk. In addition, NSRC continues efforts in processing, analysis, and grading to harmonize quality standards for commercialization.	Project completion report, Questionnaire to NSRC
	Indicator 4 The number of joint publications and international conference presentations in the related field is more than 20.	Status of the Achievement (Status of the Continuation): achieved beyond the plan (continued) (Project Completion) - 8 publications and 26 international conference presentations were produced, giving a total of 34 outputs compared to the target of 20 (Ex-Post Evaluation) - There have been 19 conference presentations and 2 publications since the project completion.	Project completion report, Questionnaire to NSRC
(Expected Overall Goal) Basis for providing improved sericulture technologies is established at NSRC.	Indicator 1 The number of extension officers who receive improved sericulture techniques is increased by 5.	Status of the Achievement: achieved beyond the plan (Ex-Post Evaluation) - Continuous training has been provided to extension officers on mulberry husbandry, silkworm rearing, and cocoon grading and marketing, and to date a total of 25 officers have received such training. - NSRC has conducted direct outreach to farmers, promoting farmer-to-farmer training on a need's basis. - Under a recent agreement with ITC, an additional 12 extension officers and farmers are expected to receive training through the ITC sericulture training program scheduled to begin in July 2025.	Questionnaire to NSRC
	Indicator 2 The number of private companies who receive improved sericulture techniques is increased by 3.	Status of the Achievement: achieved as planned (Ex-Post Evaluation) - NSRC has collaborated with private companies to expand sericulture in Kenya. - Under NSRC's guidance, the company has established 11 acres of mulberry plantations, set up a nursery with cuttings, and plans phased expansion of an additional 20 acres in western Kenya. - It has also purchased young silkworm and eggs and successfully conducted three rearing sessions. To ensure stable production of high-quality cocoons, it continues to work	Questionnaire to NSRC

		<p>in close collaboration with NSRC.</p> <p>- One private company has initiated sericulture on 300 acres after receiving technical input from NSRC, while another one engages seasonally with NSRC to support Eri silkworm production in Makueni County.</p>	
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### 3 Efficiency

The project cost was within the plan (the ratio against the plan: 61%) and the project period slightly exceeded the plan (the ratio against the plan: 110 %) due to the COVID-19 pandemic caused a delay of about five months in implementing collaborative research.

	Project Cost (Japanese side only, yen)	Project Period (months)
Plan (ex-ante)	604 million	60 months
Actual	372 million	66 months
Ratio (%)	61%	110%

Outputs were produced as planned.

In the light above, the efficiency of the project is ③.

### 4 Sustainability

#### <Policy Aspect>

The “Fourth Medium Term Plan” (2023–2028), which operationalizes Kenya’s national long-term development vision “Vision 2030,” provides a broad policy foundation for the promotion of agricultural diversification and the utilization of research outcomes to foster industrial development and employment creation in rural areas. The “KALRO Strategic Plan” (2023/24–2027/28) emphasizes the development, validation, and promotion of sericultural technologies. It further underscores the importance of advancing research on silk biopolymers<sup>9</sup> and related byproducts, with the overall aim of strengthening the sericulture subsector and contributing to sustainable agricultural development in Kenya. In parallel, the “Brief on the Sericulture Subsector in Kenya,” prepared by the Ministry of Agriculture and Livestock Development (MoALD) in collaboration with KALRO, remains at the draft stage. This draft policy brief intends to provide guidance for the promotion of the sericulture subsector in the country, supporting activities across the entire value chain so that sericulture development can effectively respond to the evolving demands of the industry.

These plans serve to support the continuation of research activities and dissemination initiated under this SATREPS project, and they are expected to be maintained going forward.

#### <Institutional/Organizational Aspect>

NSRC has been well equipped with research facilities, providing a strong institutional framework and foundation for the expansion and dissemination of outcomes from the SATREPS project. Furthermore, NSRC and ITC have signed an agreement to provide training to sericulture farmers and several extension officers in Western Kenya. ITC plans to purchase cocoons produced by these farmers, and this initiative will rely on the expertise of NSRC researchers and the use of its facilities. In addition, a private company involved in the silk production value chain, having strengthened its capacity through support from NSRC, has established silkworm rearing and mulberry cultivation facilities in partnership with the University of Nairobi and plans to commence joint research. Through these efforts, a foundation is being formed for the autonomous dissemination of the SATREPS project outcomes. At the organizational level, the “NSRC Research Plan” (2021–2025) included provisions for staffing arrangements, and these have been carried forward into the “KALRO Strategic Plan” (2023/24–2027/28), ensuring that the necessary personnel are secured.

In terms of organizational and institutional aspects, the relationship between NSRC and private companies as well as other organizations is expected to be maintained, and the researchers are likely to remain in their current positions in line with the “KALRO Strategic Plan (2023/24–2027/28),” ensuring a high level of sustainability.

#### <Technical Aspect>

Most of the KALRO staff trained under the SATREPS project have been deployed to NSRC, thereby forming the basis for continuous capacity building. The staff have continued to gain exposure to the silk industry through domestic and international programs such as the Indian Technical and Economic Cooperation, resulting in strengthened institutional capacity. For example, three NSRC researchers received post-cocoon training (2025)<sup>10</sup> in Bangalore, India, and two scientists underwent further training (2023)<sup>11</sup> on silk and the silk industry in Mysore, India. In parallel, NSRC researchers have continued to publish research papers and to participate in scientific conferences, which have further enhanced research capacity. These activities are expected to continue in the future.

Regarding research facilities and equipment, researchers who have received sufficient training operate and manage them appropriately in accordance with the prescribed operation and maintenance procedures, and regular inspections are also conducted. As a result, most of the facilities and equipment are maintained in good condition. These operation skills are expected to be further ensured through strict adherence to standard operating procedures and regular maintenance carried out by KALRO.

With the aim of enhancing the scientific literacy of government authorities, a system for systematically reporting progress to relevant bodies involved in sericulture activities, such as the Ministry of Agriculture and Livestock Development, is expected to be established under the “KALRO Strategic Plan” (2023–2028).

#### <Financial Aspect>

NSRC has not been able to secure sufficient financial resources for farmer capacity-building programs aimed at expanding sericulture domestically, and the budget is on a shrinking trend. In addition, even after the jurisdiction over agriculture was transferred from the

<sup>9</sup> Silk biopolymer refers to a bio-based polymer material derived from silkworm silk proteins, primarily fibroin.

<sup>10</sup> It is a four-week training program in which participants practically learn all processes from cocoon to silk products, using the latest technologies.

<sup>11</sup> It is a four-week training program designed to develop human resources capable of leading the development of the sericulture industry, through hands-on acquisition of all processes from silkworm rearing to silk processing.

national to the county governments, no clear budget allocations have been made at the county level for the expansion of sericulture activities. Under these circumstances, NSRC has been continuously submitting proposals to obtain donor funding; however, since many calls for proposals focus on food security, resource mobilization remains a major challenge. On the other hand, the budget for the operation and maintenance of the research facilities and equipment established through the SATREPS project has been secured.

<Environmental and Social Aspect>

No issue on environmental and social aspects has been observed, and it has not been necessary to take any countermeasures.

<Evaluation Result>

In light of the above, slight problems have been observed in terms of the financial aspects of the implementing agency. Therefore, the sustainability of the project effects is ③.

#### 5 Summary of the Evaluation

The project mostly achieved the Project Purpose to establish basis to provide improved sericulture technologies such as advancements in high-quality raw silk production and the achieved the Overall Goal for establishing firm of research and technology development for sericulture through dissemination of improved sericulture techniques to extension staff and companies beyond the plan. Given that a system for disseminating the SATREPS project outcomes has been established, the project is considered to have high sustainability.

Considering all of the above points, this project is evaluated to be highly satisfactory.

### III. Recommendations & Lessons Learned

Recommendations for Implementing Agency:

- For the wider dissemination of the research activities, collaboration with private companies is indispensable. KALRO has provided technical guidance to private companies in the past; however, some collaborations have been suspended. Moving forward, it is desirable for KALRO to re-engage with those companies whose collaboration has been interrupted, analyze the underlying factors behind the suspension, and promote initiatives aimed at encouraging their renewed participation.

Lessons Learned for JICA:

- In the country concerned, the agricultural sector falls under the jurisdiction of the county governments. Within this institutional framework, it was important to involve the county governments from the planning stage in order to disseminate and promote the project's initiatives and ensure their continuity after completion. Thus, in similar projects JICA should have included information-sharing activities with the county(local) governments at the time of project formulation.