RUTSIS

Reviving Uzbekistan's and Tajikistan's Sustainable Ikat and Silk Production

Рушди устувори истеҳсоли Абрешим ва матоъи Атлас дар Тоҷикистонва Узбекистон

Восстановление устойчивого развития атласа и шелка в Узбекистане и Таджикистане

Assessment Report

Central Asian Ikat

SERICULTURE VALUE CHAINS IN UZBEKISTAN & TAJIKISTAN

Assessment Report

Reviving Uzbekistan's and Tajikistan's Sustainable Ikat and Silk Production (RUTSIS)

April 2021

Acknowledgement

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Chamber of Commerce and Industry of the Republic of Tajikistan

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Tourism Development Centre, Republic of Tajikistan

Burg Giebichenstein University of Art and Design, Germany

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About the project

Tajikistan and Uzbekistan are linked by a long and common history, culture and religion. Since ancient times, the silk production and processing traditions of Uzbekistan and Tajikistan have shaped the Central Asian region, making the two countries an integral part of the “Great Silk Road”. Silk has remained a trademark of many contemporary home-grown designers and fashion brands in Uzbekistan, who use Central Asian Ikat, a unique textile, which is patterned by dyeing the threads before weaving. Having been separated from Western markets for over 200 years, high-end fashion houses have started to show increased interest in the unique indigenous, high-quality designs and colour combinations, of Ikat from Central Asia. Due to the continuous emigration and destruction of traditional textile production, much of the knowledge about traditional sericulture and Ikat textiles, in particular about unique Tajik customs and traditions, has been largely lost. Moreover, industrial textile production processes, especially dyeing methods, have replaced traditional textile production in Tajikistan and Uzbekistan, contributing to pollution of the environment and water sources of communities.

Project objectives
● Promotion of sustainable growth along the Great Silk Road in Central Asia ● Contribution to the revival and upgrade of local silk and Ikat value chains ● Integration of sustainable production approaches in an ethically and environmentally friendly way ● Strengthening of cross-cultural dialogue between Uzbek and Tajik societies ● Creation of new education and employment opportunities, safeguarding ancient silk and Ikat production techniques, and developing innovative sustainable design ● Enhancing the recognition of Central Asian sustainable silk and Ikat products in the international market

Project Duration: 2020-2023,

Focus countries: Republic of Tajikistan, Republic of Uzbekistan

Partners

adelphi Research gGmbH	Chamber of Commerce and Industry of the Republic of Uzbekistan
Chamber of Commerce and Industry of the Republic of Tajikistan	Centre of Handicrafts Development Margilan, Republic of Uzbekistan
NGO Tourism Development Centre, Republic of Tajikistan	Burg Giebichenstein University of Art and Design, Germany

SWITCH Asia

The overall objective of the EU funded SWITCH-Asia programme is to promote sustainable and inclusive growth, contribute to the economic prosperity and poverty reduction in Asia and Central Asia and to a transition towards a low-carbon, resource-efficient and circular economy.

Launched in 2007, the programme has achieved more than a decade of progress on SCP in 24 countries in the region.

Abbreviations

CCI TJK	Chamber of Commerce and Industry of the Republic of Tajikistan
CCI UZB	Chamber of Commerce and Industry of the Republic of Uzbekistan
EU	European Union
FAO	Food and Agriculture Organization
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GOST	Governmental Standard
MCD	Non-Government organisation “Margilan Crafts Development Center” Republic of Uzbekistan
MINTTJ	Ministry of Industry and New Technologies of the Republic of Tajikistan
MSME	Micro, Small, and Medium Enterprises
SCP	Sustainable Consumption and Production
SECO	Swiss Agency for Development and Cooperation
TDC	Non-Government organisation “Tourism Development Centre”, Republic of Tajikistan
UNIDO	United Nations Industrial Development Organization
UN ITC	United Nations International Trade Centre
UNESCO	United Nations Educational, Scientific and Cultural Organization

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Executive summary

The project RUTSIS promotes sustainable growth in Uzbekistan's and Tajikistan's sericulture through reviving and upgrading local silk and Ikat value chains. As the first public report of this project, this project maps the processes which define the sericulture value chains in the two countries and identifies challenges present in the silk and Ikat sectors, also with regards to sustainability in order to base future activities on these findings. The assessment was realized in cooperation with following partners: Chamber of Commerce and Industry of the Republic of Uzbekistan, Chamber of Commerce and Industry of the Republic of Tajikistan, Center of Handicrafts Development Margilan, Republic of Uzbekistan, NGO Tourism Development Center, Republic of Tajikistan and Burg Giebichenstein University of Art and Design, Germany.

The data collection was conducted between August and December 2020 and covered 116 interviews, among which 67 took place in Tajikistan and 49 in Uzbekistan. The interviews were based on a previously developed questionnaire that consisted of four modules. The first collected general information, the second focused on production related topics, the third targeted training provider institutions and the final module contained questions on sustainability. Respondents were 45 years old on average and the gender rate was almost even, with 57% male and 43% female participants. For the purpose of data validation, a focus group of local experts was regularly consulted until Mid-March 2021 to confirm interpretations and complement the data narratively.

An analysis of the value chain revealed that almost all farmers use mulberry tree feed for the silkworms, which they source from local providers or grow on-site at their silkworm farm. In Tajikistan, the majority (75%) are bought from governmental distributors (75%), while 22% are grown in-house. 76% of respondents stated to use the Chinese species, while only 22% use a Central Asian species. Tajik respondents that engage in yarn production revealed that a majority of raw silk comes from their in-house silkworm farms, while one third source it from local companies. In Uzbekistan, on the other hand, raw silk is mainly sourced from local companies (41%) and in-house (24%). In both countries over 60% of stakeholders use mixed input materials, while a minority is working with only one type of material in their facilities. During the dyeing process onion skins (19%), pomegranate rinds (25%), indigo (17%), madder roots (13%) and walnut husks (10%), are popular natural dye colours in both Uzbekistan and Tajikistan. In this context, 52% of the natural dyes are produced locally or self-produced, 35% imported and 13% are sourced at bazaars or local markets. Of stakeholders engaged in dyeing, 20% use only natural dyes, 28% use only synthetic dyes and 53% use both. Synthetic dyes are often imported from India, Turkey, Russia, Kyrgyzstan, China and Switzerland. Finished products are sold on different sales channels in these two countries. While in Uzbekistan the most important sales channels are the local markets (18%), tourists (18%), fairs (15%) direct sales to local people (12%), online (13%) and export (9%) in Tajikistan products are mostly sold on local markets (38%), export (23%), shops and resellers (8%) and tourist markets (8%).

On a deeper level, respondents were asked about the current challenges they face in the sericulture sector. Regarding early value chain processes, respondents often face difficulties in accessing enough: feed for silkworms, cocoons, silk yarn, raw silk, and dyes at adequate quality levels. Especially with regards to dyes, respondents explained that they cannot identify good natural dyes, nor use them effectively due to a lack of provided information on its use. Both in sourcing and in production processes, a lack of qualified partners and specialists inhibit the establishment of long-term work relationships. Silkworm farming facilities which are often family homes are moreover not ideally built for separating work and living areas, nor are they adequately equipped for manufacturing purposes. During the dyeing process respondents experience difficulties due to poor water quality. At the point of sales, both Uzbek and Tajik survey participants pointed out difficulties in accessing a wide range of sales markets. Marketing, logistics and packaging standards were stated as hindering factors for sale in both countries.

Other challenges identified were directly connected to social or environmental problems in the region. On a social level, Uzbek respondents were particularly aware of educational gaps, weak occupational safety, low wages as well as poor contractual conditions in the sector. In Tajikistan, educational gaps, poor contractual conditions and occupational safety were also mentioned. Consequently, participants in both countries stressed the importance of supporting local communities. While Tajik respondents additionally emphasized a need for fair payment, Uzbek stakeholders urged to improve the often unpredictable and short contractual conditions. On an environmental level, climate change was a topic that showed high awareness among Uzbek respondents, as well as water insecurity and lack of electricity. Tajik respondents were more aware of the impacts of pollution and hazards of chemicals used in the sector as well as biodiversity loss. The actually experienced environmental challenges focused strongly on water issues in Tajikistan and waste problems in Uzbekistan. The Covid-19 pandemic has additionally burdened the industry with reduced sales and forced shut-downs of production facilities.

In order to adequately address identified challenges throughout the project RUTSIS, a variety of suggestions were proposed for a way forward. Regarding difficulties in accessing various materials, the development of networks through a variety of stakeholder and match-making events are recommended as part of the project, for instance. To enhance the knowledge on traditional and modern processing techniques for silk and Ikat production, multiple trainings will be provided to sector stakeholders in both countries. Finally, to strengthen quality management, to implement sustainable practices, and to improve sales opportunities, guidelines including information on eco-labelling will be distributed and supported by trainings and marketing-related activities. The project will be carried out until spring 2023.

Part 1: Context and Objectives

Introduction

Since ancient times, the silk production and processing traditions of Uzbekistan and Tajikistan have shaped the Central Asian region, making the two countries an integral part of the “Great Silk Road”. Up until today, silk weaving remains a key part of the local economy in both countries, while silk products represent an important trademark of many contemporary home-grown designers and fashion brands, especially in Uzbekistan.

One of the most unique Central Asian silk textiles is called “abr” in Uzbek and Tajik. According to Professor Elmira Guel, Abr fabrics are Central Asian Fabrics using reserve dyeing to reach their characteristic blurry designs. Abr means “cloudy motive” or “clouds” in Farsi. Another theory from Prof. Rahimov says that “abr” comes from the word “ob”, which means “water” in Farsi (Rahimov R. 2006). In the 19th century, these fabrics were called “ob-a-rangdor”, which, when translated from Tajik, means “watercolour” or “colourful”. Until today, it is not clear which meaning the term “abr” actually refers to, but the most popular interpretation is rooted in a famous legend, where a weaver saw the mirroring clouds on a flowing river which inspired her to create these wonderful fabrics. The term “Ikat” comes from the beginning of the 20th century, when European researchers started to study the South-East Asian fabrics, mainly in Malaysia and Indonesia. The term is now used internationally for fabrics dyed with a reserve dyeing process. To produce Ikat fabrics, sometimes only the weft is dyed with this technique, sometimes only the warp and sometimes both threads. In Central Asia, for the production of “abr”, only the warp is dyed with this technique. The difference between the concepts of “abr” and “Ikat” is that “Ikat” is a wider, international term and “abr” is the term used by scientific researchers and the population concerning the Central Asian fabrics (Guel 2021).

The project RUTSIS promotes sustainable growth in the Central Asian sericulture and aims to revive and upgrade local silk and Ikat value chains. The project activities, which are reflected in this report, concern the first of a total of six action steps or “work packages” (WP). This first work package assesses silk and Ikat value chains, enhances supply chain linkages, and supports strategy development. This report in particular addresses the objective of developing a deeper understanding of sericulture and Ikat value chains in Uzbekistan and Tajikistan. Besides illustrating the current state of these value chains, it identifies prevailing raw material supply challenges, maps stakeholders along the value chain, and reflects on sustainable production issues. The report details the status quo of the regional silk sector and builds an important knowledge base for many of the following projects activities, which aim to improve the aforementioned sustainability issues and stakeholders support services.

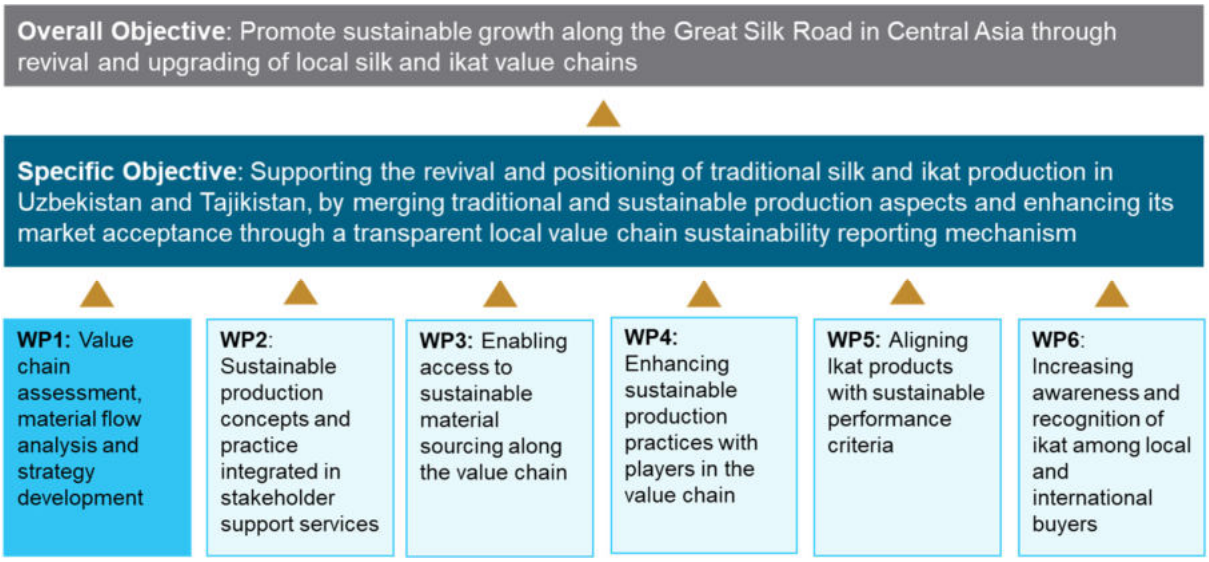

Figure 1 - Overview of project objectives and work packages

Regional Sector Overview

Abr Ikats of Central Asia

Abr weaving is an integral component of the original national cultures of Tajikistan and Uzbekistan. In the past, Khudjand and its suburbs were the largest centre of silk weaving in Tajikistan. Meanwhile, in Uzbekistan the silk weaving centres were: Bukhara, Samarkand and Margilan. Up until today, sericulture is a priority sector for development in both countries. Depending on the raw materials used, the product range of abr fabrics covers three types: 1) silk, 2) semi silk and 3) cotton abr fabrics. The names of the products are still in use in Uzbek and Tajik languages and are well known among the local population, as product descriptions mostly define the raw materials used and the colour or weaving type of the fabrics. In the 19th and 20th century, mostly “atlas”, “adras” and “shohi” abr fabrics were widely popular and replaced old types of abr fabrics presented in the attached Table 1 in Annex 1.

There are mainly two silk abr fabrics that need to be distinguished – kanaus (“shohi”) and atlas. Kanaus abr fabric (“shohi” in Tajik means “Shah's/ Tsar's”) was woven in Tajikistan and Uzbekistan in the following cities: Khudjand, Margilan, Kokand and Bukhara. The term kanaus indicates that clothes from this fabric were worn only by family members of the Emir. “Atlas” abr fabric (which means “smooth” in Arabic), as one side of atlas fabrics had a smooth and shiny surface, have emerged together with the craftsmen traditions of the population of East Turkestan in the Qin epoch (1644 – 1912), when there were 27 types of atlas. Now there are only 4 types of Uighur atlas left: 1) “kora atlas” (also called “daroi”): black colour atlas for older women, 2) “hodji atlas”: with yellow, blue, and purple colours for married women, 3) red atlas: for younger women and finally 4) “khan atlas” (also called “jakend atlas”): with multiple different ancient motives in black colour, which had 10 different types, whereas the most expensive are the eight waxed atlases, as the price was defined depending on the quantity of waxing.

Typical for Tajikistan “Khudjand atlas” is an abr fabric with motives and multiple colours. In the 19th century in Khudjand, the types of atlas which were woven included: 1) “shohsabz”, “bargi karam”, “jaudi-nusha” (Jewish patterns with yellow colours); 2) “khan atlas”, 3) “jakuria” (atlases with white motives on green or red background) and “bekasab” (atlas fabrics with lines and colours).

There are also some semi-silk abr fabrics worth mentioning, among which the adras type needs to be differentiated from the bekasab type. The term “adras” has been used in the weaving culture of the Tajiks for white and striped fabrics, or fabrics with flower motives with a silk warp and a cotton weft. According to Hakimova (Hakimova 2016) the etymology is connected with the word “ab”, which in Tajik means “quantity” and the word “rezidan”, meaning “colours”, so the term “adras” indicates: “defined quantity of threads for dyeing”. Regarding the second type bekasab, the term “kasab” (cutting) was defined in the 11th to 12th centuries as “light cotton fabrics”. The term “bekasab” means “without cutting”. There were different types of adras fabrics including: “adrasi kambari futto” and “buluti”.

In addition, two-coloured abr cotton fabrics were also produced, including the fabrics: “jalangdavron”, “kalambi”, “podshohi zangor”, “karalo”, “kuk-karga”, “shotir hana”, “kalami abra” and others. On cotton abr fabrics motives from the silk and semi silk abr fabrics were copied.

Tajikistan

Tajikistan is a land-locked country, covering a territory of 143.1 thousand sq. km of which 93% is mountain areas. Nine million people live in the country. The most commonly spoken languages are Tajik, Uzbek, Russian, Pamirian dialects and Kyrgyz language. Some of the most important natural resources include coal, oil, natural gas, iron, zinc, antimony, mercury, gold, tin, tungsten, boron, table salt, fluorite, precious and semi-precious stones, and aluminium. Important industries are mining, hydropower, textiles and agriculture (cotton, fruits, vegetables, silk, grain, tobacco). The sericulture industry has strong historical roots: mulberry, silkworm farming and silk processing are among the oldest occupations of the population. The climatic conditions of some regions, especially the Northern Sugd region in Ferghana valley, provide silkworms and mulberry trees with ideal living and growing conditions. Tajikistan follows a national “Programme for the development of the sericulture and cocoons processing for the years 2020 - 2024” to support the industry.

Under RUTSIS, stakeholders of the sericulture and kat sectors in Tajikistan were mapped, covering all four regions of the country in order to illustrate the different production focal points in the country. The map illustrated in **Fehler! Verweisquelle konnte nicht gefunden werden.** was developed by the local partners of the project in close collaboration with the Ministry of Industry and New Technologies of the Republic of Tajikistan, which is the ministry in charge of the business and policies development for the sericulture sector in the country. The map shows the regional coverage of the sector divided in the following stakeholder groups: 1) silkworm egg production, 2) companies disseminating silkworm eggs and farmers producing cocoons, 3) cocoon growing stations, 4) cocoon collection points, 5) companies processing cocoons, 6) raw silk and silk thread production, 7) dyeing facilities of silk threads and fabrics, 8) production of Ikats and silk fabrics, and 9) universities and scientific research institutes

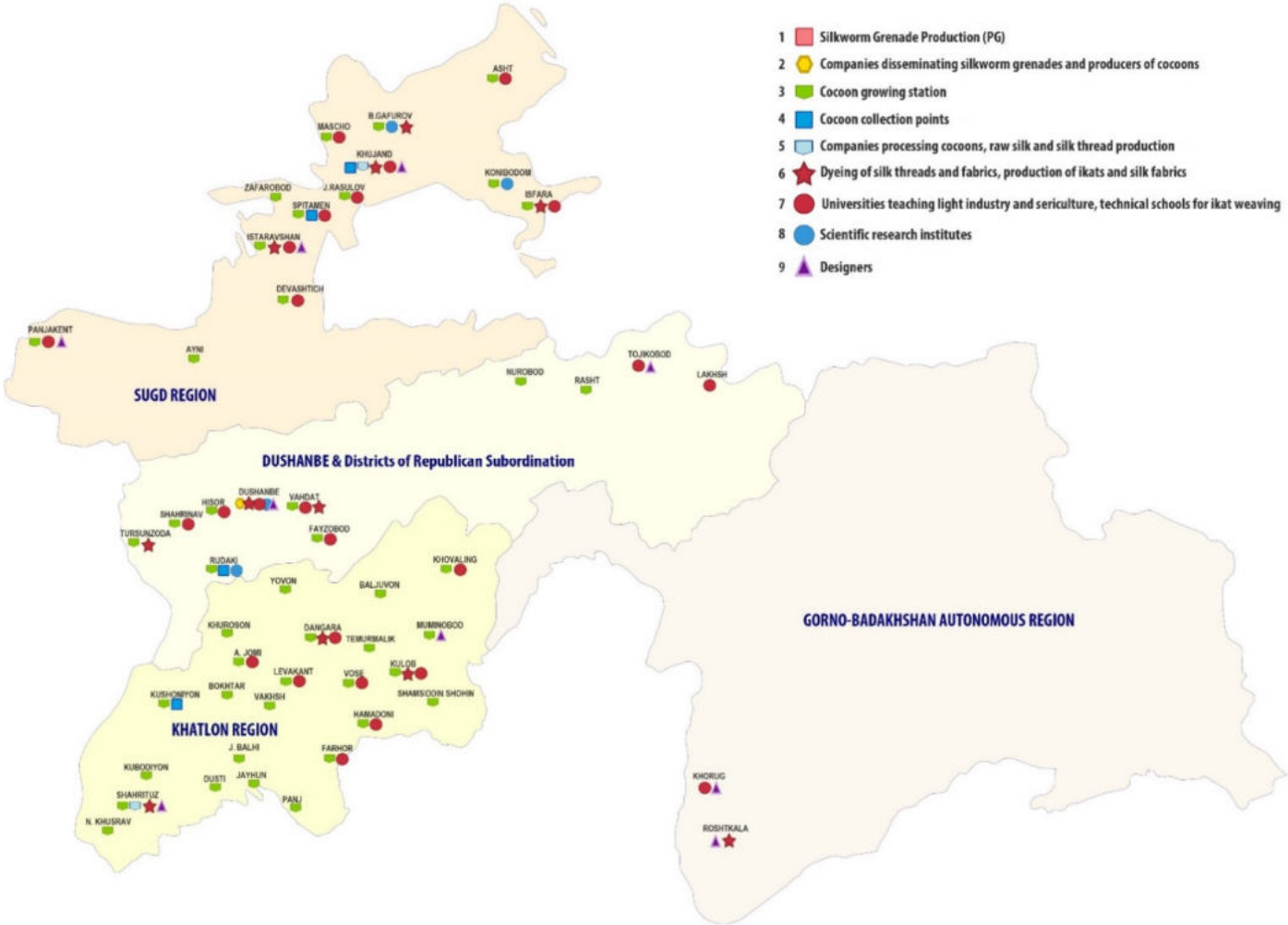

Figure 2 - Map of sericulture stakeholders in Tajikistan

Uzbekistan

Uzbekistan covers an area of 447.4 thousand sq. km and has a population of 34 million. The official languages of the country are Uzbek and Russian. Important natural resources in the country include natural gas, oil, gold, silver, uranium, molybdenum, tungsten, coal, copper, zinc, etc.

The development of sericulture in the Republic of Uzbekistan also boasts a long history. The practice of silkworm breeding and spinning of silk existed 4,000 years ago in the south of Uzbekistan, in the Ferghana Valley, as well as in the sources of the Zarafshan River. In the 1990s, the production of live cocoons in Uzbekistan reached 36,000 tons. Today, Uzbekistan is the third largest producer of silk fibres in the world, after China and India. Multiple clusters exist all over the territory of Uzbekistan, where experts, artisans and sericulture companies are based. These clusters have often been centres of artisanry since ancient times, such as the Fergana Valley and its famous Ikat production city of Margilan. Recently the numbers of sericulture factories in Uzbekistan are experiencing an upturn again due to the country's ongoing efforts to attract investments.

The stakeholder map for Uzbekistan below shows representatives that are currently involved in the sericulture- and Ikat sectors (Figure 3). It presents the geography of the sericulture and Ikat value chains in the country, including the following diverse stakeholder groups: 1) research institutions, 2) universities and education centres, 3) silk rearing factories and small producers, 4) Ikat producers (including producers of semi-silk Ikats), 5) silk carpet and embroidery producers, 6) national silk and Ikat related associations (only head offices presented in the map), 7) designers (fashion- and textile design private businesses), 8) mulberry farms, 9) cocoon farms and silkworm egg factories and 10) natural dyeing workshops.

Figure 3 - Stakeholder map of Uzbekistan's sericulture

Methodology

For the gaps and needs analysis of the sericulture sector in Tajikistan and Uzbekistan a survey was implemented from August 2020 to December 2020 in both countries. After desk research, both qualitative and quantitative research methods were applied. Questionnaires were developed by the project partners in the Russian and English language. They were developed in constant consultation with local partners and experts from both countries with weekly calls to enhance the knowledge exchange on both sides. Pre-tests were run before the official beginning of the survey, which took around three months in total. The survey covers all four regions of Tajikistan and selected regions of Uzbekistan. Interviews were conducted using focus groups, and by direct telephone as well as online interviews and discussions. Due to the differing level of value chain engagement of the stakeholders in the two countries, the survey target groups vary slightly. In Tajikistan the target group mostly comprised stakeholders from the first stages of the value chain, whereas in Uzbekistan the target group was more evenly distributed, including the fabric production.

The questionnaire consisted of four modules, namely:

- Module 1: General Information: from Question Nr. 1.1 - Nr. 1.10 (10 questions)
- Module 2: Producers: from Question Nr. 2.1. - Nr. 12.24 (24 questions)
- Module 3: Training Providers: from Question Nr. 3.1. - Nr. 3.11 (11 questions)
- Module 4: Sustainability: from Question Nr. 4.1 - Nr. 4.12 (12 questions)

The first Module collected basic and contact information from the survey participants, including information on profession, working place, age and foreign language knowledge. The second Module was specifically targeted at sericulture stakeholders, which were actively engaged in the production of silk, Ikats or similar silk-products including the process of dyeing and dyes/chemicals supply. This module also targeted questions on the work process, equipment and machines, as well as sales channels and sub-contraction. The third Module was targeted at training provider and traditional learning centres “Ustod- Shogird” (“Teacher - Student”) in both countries. Therefore, the results of Module 3 that targeted training institutions are less relevant for the purpose of this report but were collected for future analysis. Module four aimed to understand social and environmental sustainability challenges, as well as recent issues related to the COVID-19 pandemic and its impact on sericulture stakeholders. The questionnaire can be found in Annex 2 and includes information such as the questions used for the purpose of this value chain analysis.

Target groups of the survey included 1) micro, small and medium-sized enterprises (MSMEs), individual entrepreneurs, farmers and producers, (fashion and fabrics) designers, NGOs and (business) associations, 2) education centres and institutions, 3) local and national authorities, and 4) researchers and scientific workers connected to the Ikat/sericulture sectors in Central Asia.

In order to fill remaining data gaps a focus group discussion was conducted in March 2021 with experts from both countries and project staff. Guiding questions followed the structure of the value chain. The expert group consisted of Central Asian entrepreneurs and specialists, as well as local and national authorities involved in the silk value chain. In order to fill final gaps and for purposes of data triangulation, secondary sources were used.

Geographical Coverage of the assessment

The geographical coverage of the survey was partly based on clusters, which were identified prior to the survey. Data was collected in the following regions of the two countries:

In Uzbekistan: Ferghana region, Andijan region, Bukhara region, Jizzakh region, Namangan region, Navoi region, Samarkand region, Tashkent region, Xorazm region and Qashqadaryo regions were covered

In Tajikistan all four regions were covered by the current survey. These are: The region of Republican Subordination (RRP) including the capital Dushanbe, Sugd region, Khatlon region and the Gorno Badakhshan Autonomous region (GBAO).

Missions for data collection were organized by the local project partner Margilan Crafts Development Centre (MCD) in Ferghana, Andijan and Namangan regions of Uzbekistan, while representatives of the Chamber of Commerce Uzbekistan (CCIU) collected data in the rest of the Uzbekistan regions using direct interviews or telephone and online interviews.

In Tajikistan, representatives of the NGO Tourism Development Centre implemented multiple missions to the Sugd and RRP regions to collect data, reaching GBAO region through allied NGOs. The project team of the Chamber of Commerce Tajikistan implemented interviews in the Khatlon region and Dushanbe, mainly among private producers and members of the chamber.

Of Uzbek respondents who specified their home region, 29% were from Tashkent, 23% from Margilan, 17% from Namangan, 10% from Navoi, and 8% from Bukhara.

Of the Tajik respondents that specified their home region, 42% were from Khatlon region, 19% from Dushanbe and RRP region, 20% from Sugd region including: 5% from Istarafshan, 5% from Bobodjon Gafurov, 5% from Khudjandand and 5% were from GBAO region.

Respondents

The sample of the survey was compiled in a purposeful manner with the objective to, on the one hand, cover the most important sericulture clusters as described above and, on the other hand, to include a wide range of stakeholders across relevant value chain processes. As the project focus differs slightly in Uzbekistan and Tajikistan, the priorities of data to collect differed as well. As a result, the production of raw materials (such as cocoons and raw silk) is a focus area of the project only in Tajikistan, and, hence, this stakeholder group is of less importance in Uzbekistan.

On average, respondents were 45 years old with an age range from 26 to 74 years. A majority of the interviewees were able to speak both Russian and either Uzbek or Tajik languages, while few respondents additionally spoke English. 28% of the respondents were craftsmen or entrepreneurs, 27% were part of a private company, 20% were part of a government agency, 66 of the 115 respondents were based in Tajikistan (while 49 were based in Uzbekistan) and 57% of the respondents were male while the remaining 43% were female.

According to the survey, many of the stakeholders are engaged in fabric design (21%) as well as fabric preparation, such as painting (22%). Results from Uzbekistan show that the design (16%), finishing and embroidery of clothes or fabrics are also performed in the country, while few Uzbek respondents were engaged in the production of raw materials, in accordance with the preselection of focus areas of the project. In contrast, 35% of Tajik responses indicated that they were active in raw material production. Moreover, in Tajikistan there are more specified experts being engaged in only one of the processes, while in Uzbekistan it seems more common, that producers perform a variety of processes under one roof.

Part 2: The current State of Sericulture Value Chains

The results of the survey are presented along the lines of seven value chain processes, which follow each other consecutively. The processes are presented in Figure 4 and described in the beginning of each chapter. In addition, a more tabular overview of process steps can be found in Annex 3. Data from the survey, which were found suitable or complementing the value chain mapping, are presented in the context of their respectively related processes. The data content mostly concerns the sourcing of materials, as well as the type of material in use. While often representing standard procedures, regional characteristics specific to Uzbekistan and Tajikistan are highlighted in each process. The following figure represents the value chain processes for the preparation of Central Asian abr fabrics, excluding, however, the processes of clothes and products manufacturing.

Figure 4 - Sericulture value chain processes

A variety of materials are required for turning an animal product like silk into a fabric or even a wearable piece of clothing. Few manufacturers perform all steps of the value chain; rather, a large majority of manufacturers are specialized in one or various processes and source the material accordingly before processing and selling the finished or semi-finished products. As demonstrated in Figure 5, many materials are required along the value chain, among which most are natural, while dyes and finishing additives can also be synthetic, even though traditionally they are not.

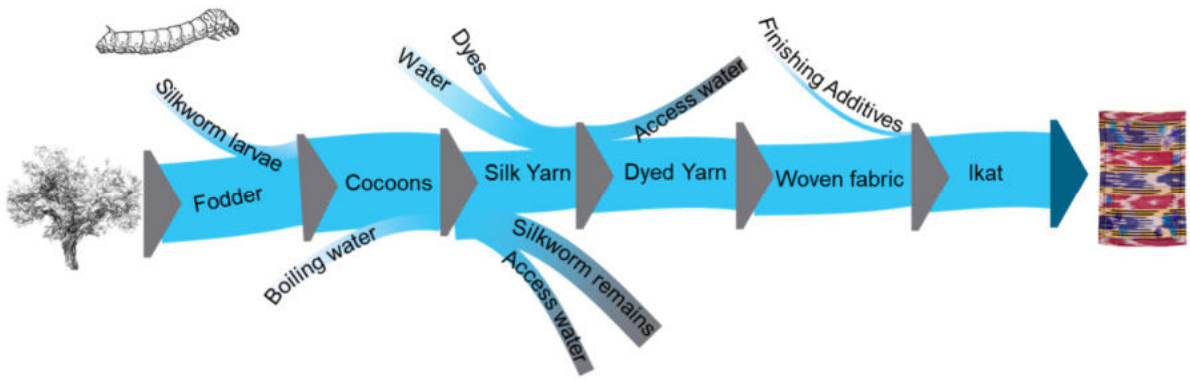

Figure 5 - Simplified illustration of material flows within the silk value chain

The survey shows that in-house production of materials traditionally plays a crucial role for sericulture producers in Central Asia, while local providers, such as neighbours, are also important trade partners for producers. In general Uzbek interviewees source materials mainly from their in-house production or by local providers. According to the survey, Tajik producers' source both in-house and from governmental suppliers.

An approximate gender distribution in the production steps in the sericulture and Ikat value chains was discussed for both countries during an online focus group, implemented with the Central Asian project partners and sericulture and Ikat specialists. In their opinion, female and male involvement in the production steps is more or less evenly distributed in Tajikistan, as whole families are involved, from cocoon production to weaving. Only the motive painting on fabrics, the so-called "abrband," is implemented by men. In Uzbekistan, cocoon production is also implemented by the entire family. Silk

threat production and weaving, however, fall more in the domain of women, whereas men are more involved in the painting of fabrics and the dyeing process of Ikat.

Mulberry Farming

Silkworm farms worldwide use mulberry leaves *(Morus)* to feed the larvae. The leaves are among the few types of plants on which the larvae feed, and the trees grow within a wide range of various climatic conditions (Datta 2000). The survey in Uzbekistan and Tajikistan confirmed that all producers who are active in silkworm farming use mulberry leaves as feed for silkworms. The trees grow mostly locally in respondents' own plantations. As a result, almost all interviewees produce the classic mulberry silk in contrast to other silk types, such as tasar silk, eri silk and muga silk.

Uzbekistan is well established in producing raw materials for the sericulture value chain. Feed is bought from various sources, including local providers, but also from own plantations. Concerning the initial value chain steps, the survey focused more on Tajik producers, where raw material production is less established as of today. In Tajikistan, on-site mulberry plantations that directly supply a silkworm farm are also common. Figure 6 provides an overview of mulberry sources for Tajik sericulture producers. According to the survey, 38% of the feed is grown in producers' own mulberry tree plantation. 31% are sourced from the nearby villages and another 23% from governmental suppliers. Local companies were not mentioned as a feed source.

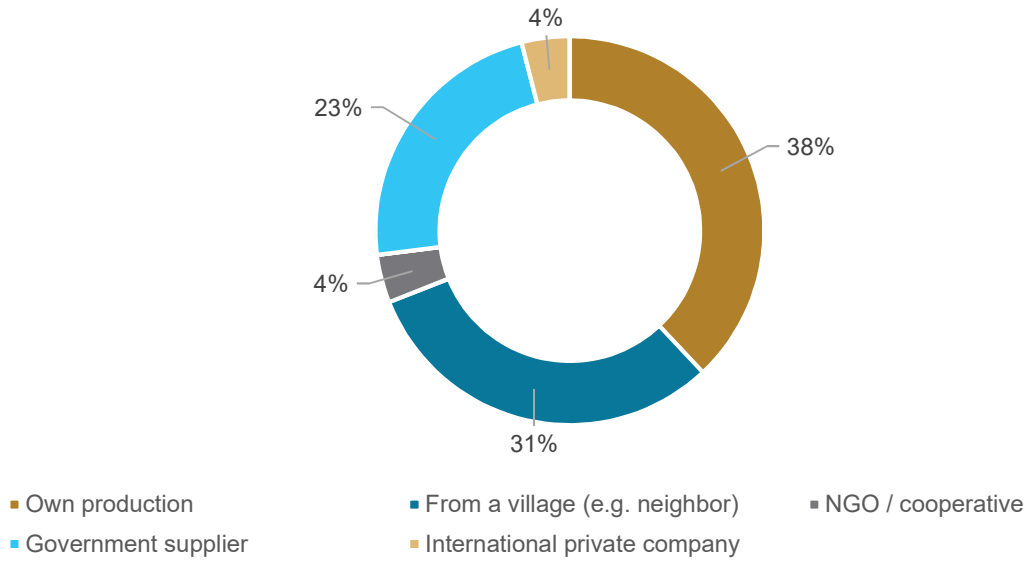

Figure 6 - Source of Silkworm Feed

A governmental programme for "Sericulture Development and Cocoons production in the Republic of Tajikistan" has been established in 2020, which focuses on developing mulberry plantations through the joint stock company on sericulture Pillay Tojik. Mulberry trees are planted on governmental lands for silkworm farming by employees of Pillay Tojik, which has branches in all of the districts of the country with agronomists. They plant trees, provide advice to the local community on request and check the state of the trees.

Farmers growing cocoons in Uzbekistan can receive benefits from the government and have a preferential tax regime. The national association for sericulture development in Uzbekistan

Uzbekipaksanoat provides mulberry saplings to their members free of charge. Uzbekipaksanoat is a newly established national umbrella association entity covering producers of raw silk, cocoons and silk fabrics, as well as researchers and craftsmen in Uzbekistan. More than 200 million mulberry trees have been planted with the help of the latter association. Another particularity in Uzbekistan is the existence of the cluster systems, where land belonging to the silk yarn production factories (clusters), can be leased to farmers growing mulberry trees. The association also provides workshops on the mulberry trees carrying techniques in Uzbekistan. Further details on governmental programmes supporting sericulture development in both countries are presented in detail in the Policy brief developed in the frames of RUTSIS project.

Silkworm Farming

A sericulture cycle is based on moth breeding of the species *bombyx mori*, whereas healthy moths are chosen prior to breeding. If matured, the moths are able to lay eggs from which larvae usually hatch after 10 days. Meanwhile, farmers need to either harvest or otherwise source mulberry leaves to ensure the nutrition of the silkworm larvae. They are continuously fed fresh and mulberry leaves for about 20-35 days (usually 24 days in Central Asia starting from End of March every year, according to the local experts from a focus group discussion), while going through five growth states, four of them completed by moulting. There is only one harvesting sericulture season in Central Asia. Air temperature needs to be precisely regulated during this period (eurasianet 2017). According to some survey respondents, cocoon farming was accomplished in separate facilities designated for silkworm growth during USSR times. Currently all producers are responsible for preparing their own facilities for silkworms. Many farmers use their own houses for this purpose. When reaching day 24, the larvae start spinning a cocoon, which allows them to undergo their metamorphosis into a moth under natural circumstances. The development of the cocoon takes around seven to nine days. Afterwards, cocoons are either processed directly or are delivered to official collection points for the next processing steps.

There are about 68 identified species under the *bombyx* genus. One of the most common ones used for sericulture today is the Chinese species (Datta 2000). As illustrated in Figure 7, the survey confirms that this is also the preferred species used in Central Asia. With multiple choices possible, 76% of interviewees responded that they are using the Chinese silkworm species when sourcing silkworm larvae, while only 14% of the respondents stated they use a species originating from Central Asia. The former consumes less feed and is therefore generally used more often in Central Asian sericulture. In Tajikistan, there are also silkworm species, developed in scientific research labs in Khudjand by the National Academy of Science of the Republic of Tajikistan. However, the productivity of these local experimental hybrid silkworms has not yet been tested.

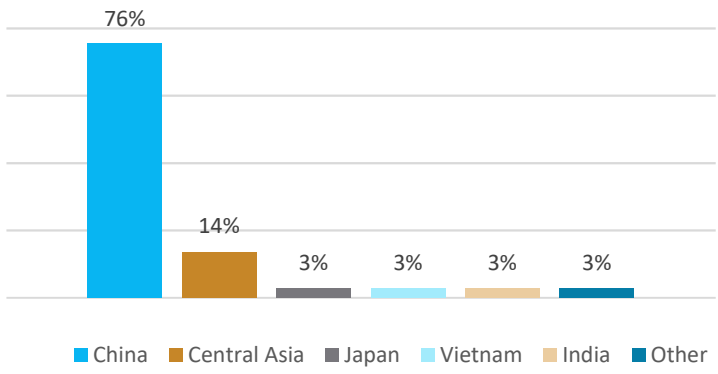

Figure 7 - Species Origin of Silkworms Used in Both Countries

Due to the fact that sericulture is considered an economic priority sector in both countries, governmental authorities are engaged along various steps of the supply chains. Silkworm eggs are therefore often distributed by regional governmental authorities among sericulture family businesses, which are then subcontracted by the government or by private companies to further grow the cocoons. In Uzbekistan, around 40,000 farming collectives are involved in such an agreement with an association or a governmental body (eurasianet 2017; Hurramov Sh. 2016).

In Tajikistan, purchasing from the government is also particularly common, accounting for 75% of silkworm larvae sources in the country, according to the survey. Besides sourcing from the government, Tajik respondents also mentioned sourcing from their in-house production, where 22% of the larvae is sourced. Village markets, local providers and international companies play a minor role in Tajikistan.

According to experts from the focus group discussion, there are some designated bodies which work closely together with governments that are responsible for the dissemination of larvae in both countries, namely Uzbekipaksanoat in Uzbekistan and Pillay Tojik in Tajikistan. Both entities import silkworms from China. Although private entities are also allowed to import larvae from other countries, for instance to Uzbekistan, the import via Uzbekipaksanoat is financially preferential, as they do not have to pay customs clearance. Moreover, as bodies like Uzbekipaksanoat are at the same time important buyers of cocoons, many producers purchase from the same body in order to ensure that their cocoons will be accepted. The situation is similar in Tajikistan, where the majority of farmers sells cocoons to Pillay Tojik.

Silk Yarning

To access the delicate silk threads, cocoons are first sorted according to various quality criteria, such as completeness or purity, and then degummed in 40°C water to remove sericin and impurities, as well as to loosen the fibres (national quality criteria for silk threads in Uzbekistan and Tajikistan are presented in the Policy brief on certification and ecolabelling). This process unwinds the filaments from the cocoons swimming in the warm water bath. One cocoon can unwind into an unbroken thread of up to 1,000 meters of silk. Multiple filaments are unwound jointly in order to form one single thread. Sericin waste-water, which remains after the process, can further be used for e.g. textile finishing agent, medicine or cosmetic products. Afterwards, the silk yarn is unwound from a small to a larger reel, while quality and uniformity of threads are re-controlled. A bath in acid water then separates additional sericin from silk fibre, thereby softening it. Before skeins are spooled onto thread reels again, they are squeezed and hanged for a period of time for drying.

Cocoons

Cocoons can generally be sourced from various local locations, regional sellers, governmental actors and international markets, or grown in-house. Regarding imports, China is one of the most common countries of origin, according to Uzbek respondents.

In Tajikistan, in-house production of cocoons plays an important role, with 30% being home-grown, according to respondents. Sourcing from local companies accounts for a further 30%. Governmental suppliers and international companies account for 20% each.

Governmental programs in Uzbekistan support yarn generation from cocoons. Further details on governmental programmes supporting sericulture development in both countries are presented in detail in the Policy brief developed in the frames of RUTSIS project.

Raw Silk

For producers from both countries engaged in silk or Ikat manufacturing processes, it is common to source the input material from a seller or market, as silk is rarely produced in-house. In Uzbekistan, this number is only 24% according to respondents, whilst 41% is sourced from local companies. Village markets, local sellers, governmental authorities and international markets only play a minor role (6% each). In Tajikistan, the distribution looks slightly different: 67% of silk is sourced from in-house production, and 33% from local companies, as shown in Figure 8. The survey results indicate that Uzbekistan follows a more diverse sourcing approach, but this conclusion could be biased by the selection of the respondents and therefore has to be confirmed during the course of the project. When sourcing raw silk, 90% of Uzbek buyers stated they purchase mulberry silk, while Tajik buyers use both mulberry silk and other types of silk (each 40%).

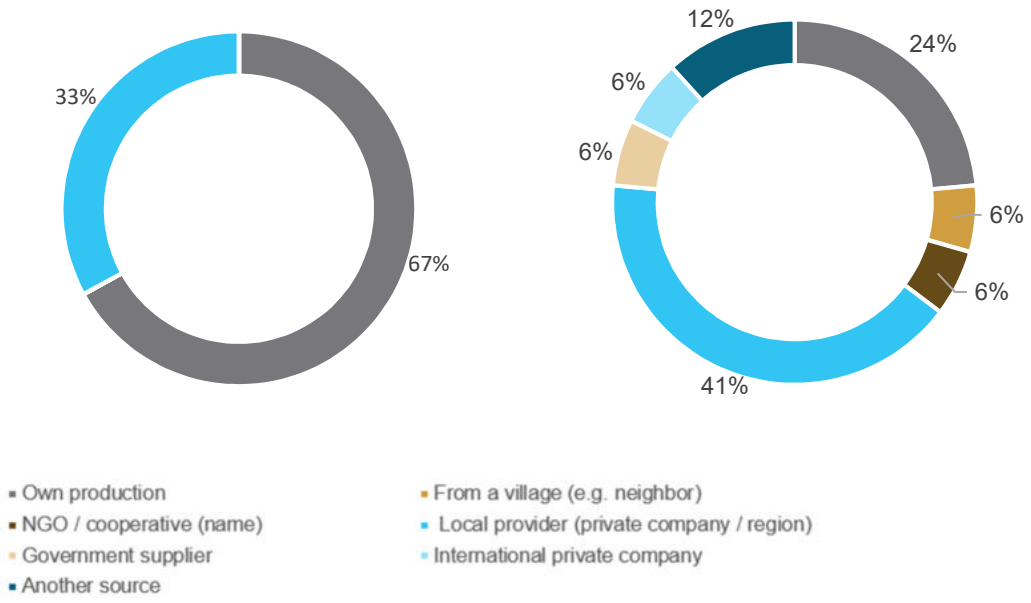

Figure 8 - Raw Silk Sourcing in Tajikistan (left) and Uzbekistan (right)

Silk yarn

During the yarning process, additional fibre materials can be added to the silk in order to adapt the characteristics of the yarn according to a product's desired features. In this context, 65% of the survey respondents stated they use a mix of various, mostly two or three materials, while only 35% are specialised in using only one type of material input. As illustrated in Figure 9, the regional differences in this regard are minimal.

Many respondents in Uzbekistan stated they work with silk threads, but in a majority of cases these only account for a small part of the overall production, making up less than 50% of the material mix. Based on these results, it can be concluded that Uzbek stakeholders often use a combination of silk and cotton inputs to generate their yarn. On the Tajik side cotton is also an important natural material input besides silk.

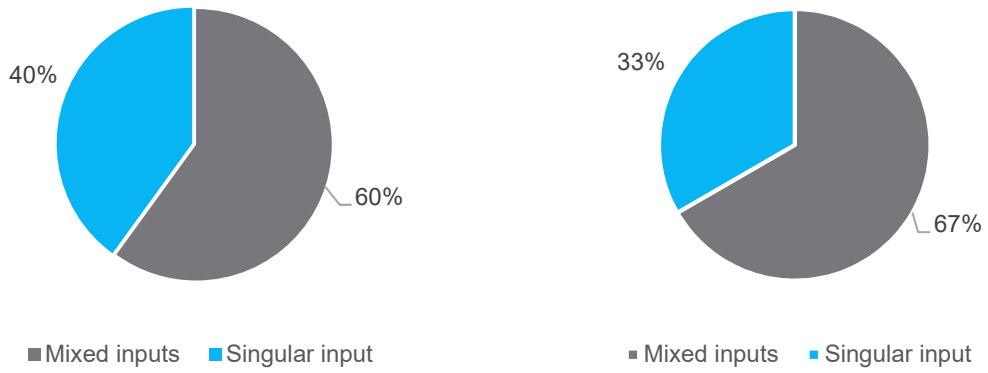

Figure 9 - Ration between Mixed and Singular Tajikistan (left) and Uzbekistan (right)

With processed silk threads, the sourcing practices of both Central Asian countries are similar to sourcing practices of raw silk. In Tajikistan again, in-house production and sourcing from villages are the most common forms. In Uzbekistan, 41% of silk threads are sourced from local companies, 15% are produced in-house, and 7% come from the village. For both countries it can be noted that materials for these first steps of the value chain are mainly obtained within the country, whilst imports play a negligible role.

Fabric Design and Silk Dyeing

Before silk threads are ready to be dyed, a pattern is designed and applied onto the warp using a special charcoal. This process is called “abrband” in Central Asia. The warp of the marked areas is then covered by tying the areas tightly together with either cotton threads or scotch tape in order to cover them and, thereby, to spare them from being dyed (Interview with an expert №2 from Ikat production site in Uzbekistan 2020).

The dyeing processes, which follow after, differ significantly depending on which dyes are used. For this reason, a distinction is made in the following section between dyeing with 1) natural dyes, 2) synthetic dyes, and 3) vat dyeing. Using natural dyes usually takes much more time compared to dyeing with synthetic dyes, because creating natural dyes is a complex process often performed by hand. In addition to the hot dyeing processes, vat dyes are used, which are mostly cold dyed. Among the vat dyes, indigo is most commonly used in both Uzbekistan and Tajikistan.

Natural Dyes

If a natural dye solution is applied, the warp is treated with a pre-mordant. According to the survey, alum is most commonly used as a mordant in both countries in the dyeing process for making abr fabrics in Central Asia (Khamadov A. 2020)[1]. For dyeing with natural dyes, the preparation of the dye bath is an

[1] Dyeing Book Margilan (UZ), Questionnaire 2.7: 68% are using Alum

important step. The process to make a dye bath of a natural dye differs depending on which plant is used. These are often dried and ground into powder or in a for rougher condition (bigger pieces) in nets. Dyeing is done in water over a temperature and time parameter adapted to the particular dyeing plant. When enough dye has dissolved from the dyeing plant, the dyeing solution is mixed with more water. In some dyeing processes, the original dyeing material is removed (e.g. with a sieve) before the yarn is dipped into the dye bath. As pictured with their respective colours in Figure 10, onion skins, pomegranate rinds, walnut husks and madder roots are mainly used in Uzbekistan and Tajikistan.[2] Sometimes additives are added to intensify or modify the colours, such as ferrous sulphate, for example, to change the yellow of the pomegranate rinds to greyish or black nuances. After the dyeing process the warp is stored in a dark cold place to dry for several days to improve the colour fastness.

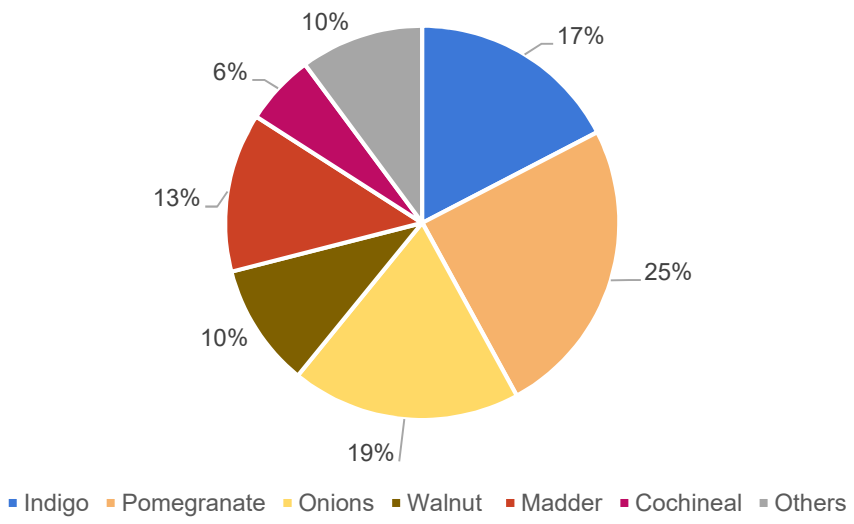

Figure 10 - Percentage Representation of Natural Dyes (in Original Colours) used in Uzbekistan

Rinds of pomegranate or onion skins are very frequently used for dyeing, as are walnut husks and madder roots. Madder root can be used to produce various shades of red. Fresh fruits, dried flowers, leaves and/or roots of barberry, safflower, henna, goldenrod or chamomile are less frequently used as dyes. For example, in Tajikistan, the root of the barberry, which can be found regionally in the mountains, is used for dyeing. The imported dye cochineal, which is laboriously extracted from the cochineal louse, provides a strong colour that can be used for high quantity material. Its generally high price prevents it from frequently being used in Ikat production in both countries (Interview with an expert №1 from Tajikistan; Interview with an expert №2 from Ikat production site in Uzbekistan 2020; Interview with an expert № 3 from Ikat production site in Uzbekistan 2020).

[2] Questionnaire 2.5: 100% use pomegranate barks, 100% use onion skins, 43,78% use madder roots, 25% use walnut barks

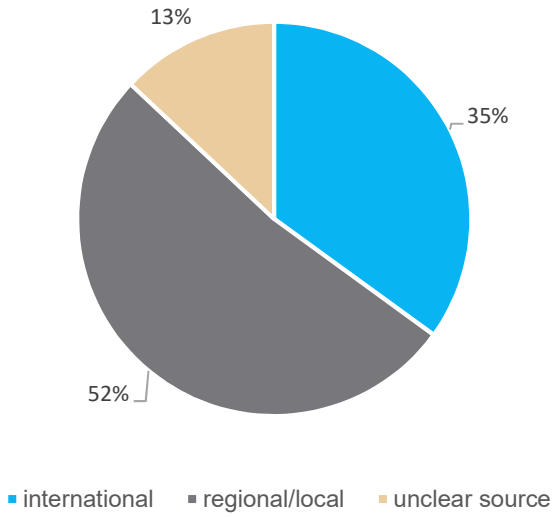

Figure 11 - Percentage Representation of the Source of Natural Dyes in both Countries

As shown in Figure 11, about 52% of the natural dyes are produced locally or self-produced. About 13% of natural dyes are sourced at bazaars or local markets, making it difficult to track a specific source. About 35% of the dyes used are reported to be imported from abroad. In Tajikistan, there is often no ready-made dyeing powder for natural dyes available. The plants/dyeing materials are collected (sometimes a year in advance) and then dried. For example, onion skins and pomegranate rinds are considered as cheap or even free dyestuff, but there is no organized collection and usage of these materials for dyeing.

Madder used to be a local dye plant, as it was imported during the Soviet Union from Russia, but the systematic cultivation of madder has almost entirely stopped over the last few decades. The plant is currently being cultivated again in small quantities in Uzbekistan. Today the majority of madder roots is sourced from Iran and Afghanistan and sold at local markets.

Synthetic Dyes

The process of dyeing with synthetic dyes differs slightly depending on the type of dye used. Among the respondents that shared information about their dyes from Tajikistan and Uzbekistan, 20% indicated that they used only synthetic dyes. 52% of the respondents stated they use both types of dyes as illustrated in Figure 12. The evaluation of these answers and additional interviews with the partners and experts revealed that the level of knowledge of dyeing processes varies widely. This is important, as the correct handling and accurate weighing and measuring of dyes affects their efficiency and impact on the environment. The evaluation of the questionnaires also shows that possibly different categories of dyes, such as reactive dyes and direct dyes, might be mixed to achieve blended colours (which is not recommended), as well as the use of dyes that are less suitable for silk.

The evaluation of the questionnaires revealed only a low level of information on the use and sourcing of synthetic dyes. In various conversations, it became clear that mainly acid dyes or substantive dyes (direct dyes) are used for silk. However, if reactive dyes are used there might be difficulties in creating the right conditions through a manual technique as best results are achieved by using a professional steaming machine.

The majority of synthetic dyes is imported from India, Turkey, Russia (Interview Uzbekistan 2020),[3] Kyrgyzstan, China and Switzerland (Khamadov A. 2020). Middle-sized Ikat factories and bigger businesses are able to order directly from dye producers abroad in larger quantities such as CHT (Bezema Colour Solutions Products) from Switzerland and Setas Kimya Sanayi a.s. from Turkey (Khamadov A. 2020). Smaller businesses or individual craftsmen mainly buy lower quantities of dyestuff and chemicals at local markets sold by individual entrepreneurs and stalls. Within this process of buying from wholesalers and repackaging into smaller amounts (usually 1 kg of synthetic dye powder) (Interview with an expert №2 from Ikat production site in Uzbekistan 2020)[4] a gap is partly observed in terms of the availability of professional information and dyeing instructions. One of the few brands that is resold at local markets in Tajikistan is the Indian company Cobra, which provides colour charts (Interview with an expert №1 from Tajikistan).[5] Often the type and quality of the dyestuff varies too much to design reliable samples. As a result, it is almost impossible for Ikat manufacturers to achieve stable colour results and buy unchanging qualities.

Vat Dyes

The most common vat dyeing in Uzbekistan and Tajikistan is indigo, for which natural and synthetic indigo powder is used. In Uzbekistan it appears more common to set up a vat with potassium carbonate (potash) and sodium hydrosulphide (Mirzaahmedov R. 2015), whilst in Tajikistan hydrosulphide and hydrocarbonate are more typical (Khamadov A. 2020). Among all interviewees that use natural dyes, 70,5% use indigo.

The dyeing process of indigo appears in a hybrid format in some cases meaning that it often needs to be combined with other substances in order to unfold its dyeing potential. Interviewees (from Uzbekistan) answered that they are sourcing indigo from India, China and Afghanistan, which indicates that the dye powder has been sourced from a natural origin as indigo commonly grows in these countries (Abdullaev, A., A. and Ibragimov, N. 2009). The vat is set up with chemical substances, such as potassium carbonate and sodium hydrosulphide or hydrosulphide and hydrocarbonate. A vat could be also obtained of pure natural origin using e.g. bacteria or sugar-based recipes to reach the fermentation process.

[3] Questionnaire 2.6 (UZ)

[4] Call 27.01.2021

[5] Call 27.01.2021

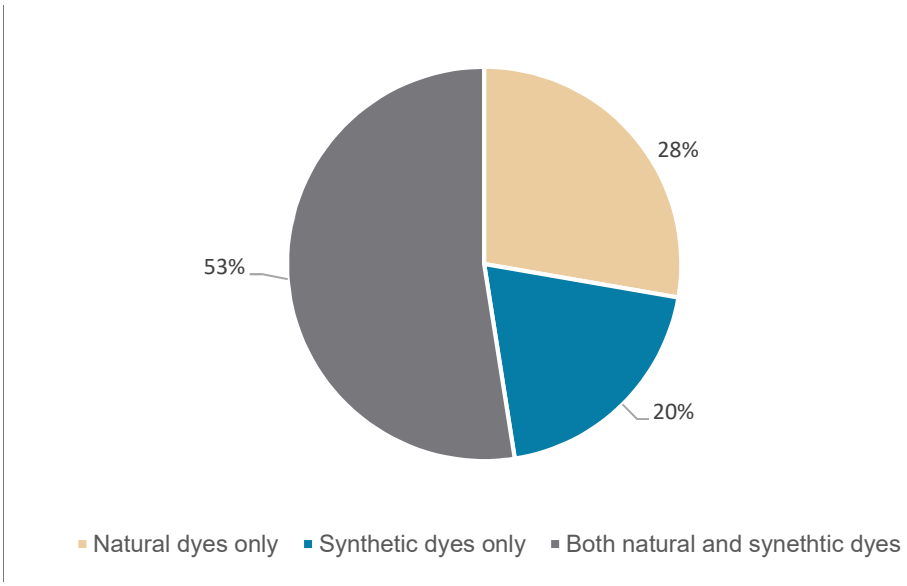

Figure 12 - Share of Dyes Used

Mordants

Alum is a very important material for the process of natural dyeing because any silk that is dyed naturally is boiled with alum first. Mordanting with alum is practiced intensively in both countries, compared to other mordanting methods. In both countries, the tannin-containing gall nuts of the pistachio trees are similarly utilized as a mordant. In addition to fixating the colour, it also allows for the creation of black tones. Some additives that can be used in natural dyeing irritate the skin (these include iron rust or ferrous sulphate). Therefore, there are experiments in Uzbekistan with alternative materials that naturally contain tannins. These tannins have a similar effect to metal mordants and support the absorption of the dye in cotton and silk (Interview with an expert №4 from Uzbekistan)[6]. Tannins are found, for example, in regionally grown gall nuts of the pistachio tree or (to a lesser extent) in the pomegranate peel. They can be used for colour changes (black colouration) or for dye fixation.

Additives and Quality of Water

Evaluating answers regarding additional chemical additives applied, results imply the use of bleaching agents prior to dyeing (answers, specified: hydrogen peroxide and concentrated sodium). In addition, the side effects of vinegar and potassium alum are indicated by some few interviewees as softeners that can be used before, during or after dyeing to fix the natural dyes.

The majority of respondents who were mostly Uzbek indicated that they source most of the chemicals and mordants needed in Uzbekistan. Only a few interviewees source chemicals from Russia, Turkey and China. In total, 25 interviewees that answered a question on chemical sourcing stated they source chemicals and additives, whereas most of them were from Uzbekistan. From the interviewees 26% are using acetic acid, 22% caustic soda and 19% potassium alum. Potassium alum is also mainly sourced locally; only one respondent in each country mentioned they obtain alum from China and Russia. Natrium carbonate, which is used by 10%, seems to be sourced entirely from Uzbekistan. It is unclear whether the substance is imported before being sold on local markets.

Although it is illegal to produce ferrous sulphate in self-production, there are a few cases that indicate this happens, possibly because it is not known that it is prohibited or since ferrous sulphate is difficult to

[6] Call 20.01.2021

obtain or too costly, especially for MSMEs (Interview with an expert №1 from Tajikistan; Interview with an expert №2 from Ikat production site in Uzbekistan 2020; Interview with an expert №4 from Uzbekistan).[7]

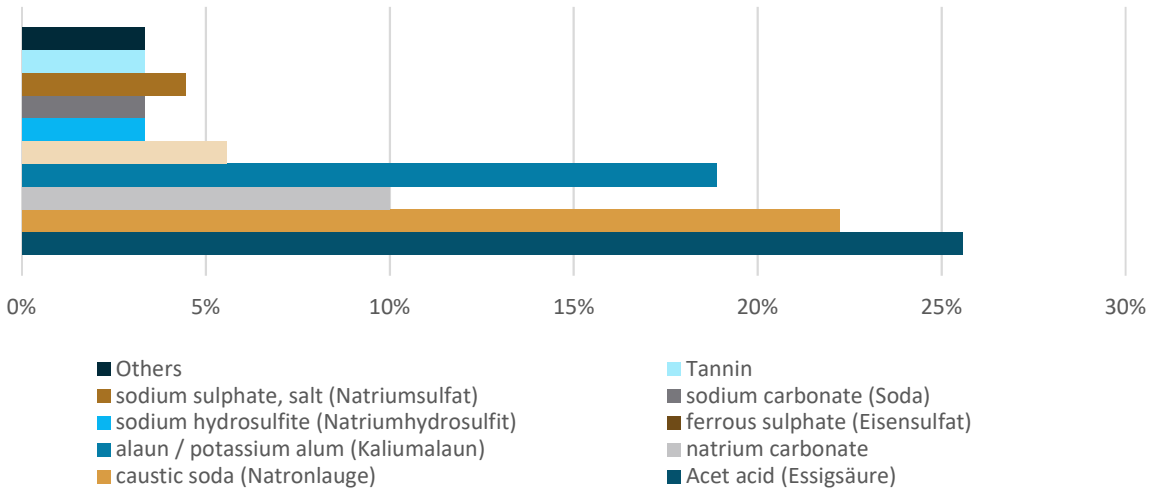

Figure 13 - Use of Chemicals for Dyeing (both Countries)

The quality of the water in both countries is very unsteady and depends on the season and the location, i.e. these factors may determine whether fresh mountain water or groundwater from the well can be used for dyeing. Often the groundwater contains a high percentage of iron, which reduces the dyeing quality (both synthetic and natural). For this reason, the water is neutralized with sodium before dyeing (Interview with an expert №2 from Ikat production site in Uzbekistan 2020; Interview with an expert № 3 from Ikat production site in Uzbekistan 2020).[8] In addition, the freshly dyed yarns are washed under a jet of water until no more colour molecules are released.

The question on water treatment facilities was included during the assessment in both countries. Few respondents addressed the question, but among the respondents from Uzbekistan, 30% stated to have the according treatment facilities.

Fabric Weaving and Product Finishing

A multitude of preparatory steps are required before weaving abr fabrics. First, the layers of warp need to be detached from one another and wound around a long stick. The end of a pattern is marked with a piece of thread before the warp is chained for transportation. Next, around 4,000 threads are counted and grouped. The heddles are made by tucking a thread around a small wooden tool. The heddles are then threaded first using a slick thread and then returned by a wooden stick, thereby dividing the warp into shafts. The number of shafts is defined by the type of weave pattern. This is followed by the reeding process using a sleying hook. Before beginning the weaving, the warp is finally knotted to the breast beam and tensioned with a brake. The warp's tension is secured with a 5 to 10 kg weight attached to the end of the warp, which is placed over the back beam. The weft yarn is wound onto smaller bobbins and inserted into hand shuttles. The weaving of Central Asia Ikats itself takes place on traditional wooden looms that are operated by hand, also known as foot-treadle floor looms. The weavers use a

[7] Call 20.01.21 and 27.01.21
[8] Call 13.01.21 and 20.02.21

flying shuttle to fasten up the weaving process. In addition, semi-automatic loom machines are used in some of the production sites. Woven patterns vary from plain weave to different satin variations. The type of weave used has only a small influence on the final product, as the main focus of Ikat fabrics is on the previously dyed patterns. The use of synthetic dyes gives strong colour results; therefore, plain weave is often used today, which may result in saving weft material and influences the fabric's density.

After weaving, the finished fabric is trimmed to the desired length and then washed to remove impurities. Different substances are commonly used as a finish. Formerly, egg-white was used and applied to the fabric's surface before being dried until silk threads absorbed all of the liquid. The finished fabric was folded and then beat with a wooden hammer. After the froth has been worked into the fabric, it is pressed and dried. Nowadays bone glue is more commonly used in the calendering process.

Weaving and finishing, as well as the preparation of the warp, can be performed with electronic looms; however, manual devices are still commonly used worldwide. According to collected data, the production facilities in Central Asia are only partly equipped with electric machinery. In Uzbekistan, 41% of the respondents work in a production facility, which consists entirely of manual work. The remaining 59% work in facilities that partly use electric machinery. In Tajikistan, the distribution is almost the same, with 43% working in manual and 52% in partly manual and partly electric facilities.

Commonly used electric devices include sewing and winding machines. Weaving looms and equipment used for the dyeing processes remain manual today. In Tajikistan electric sewing machines seem to be more commonly used compared to Uzbekistan, according to the survey. In Uzbekistan, manual looms and electric winding machines seem to be common types of equipment, but results could be biased due to the uneven group of respondents in the survey.

The majority of the equipment is self-constructed. In both countries, 69% of spinning devices, 84% of dyeing and measuring equipment and 62% of weaving equipment is self-built, according to the study's data. While uncommon in Tajikistan, in Uzbekistan equipment is sometimes sourced locally. Buying equipment internationally is very rare in both countries.

Sales Channels

As demonstrated in Figure 14, export markets have not yet reached great relevance; however, Russian, European and US American markets have already been partly targeted. In Uzbekistan 18% of producers' items are sold on the local market, an equal 18% are sold directly to tourists, about 15% are sold on fairs, and 13% are sold online. The most commonly used online platforms for sales are social media platforms such as Facebook, Instagram and the Russian speaking platform Vkontakte. Most Uzbek respondents have a multi-channel approach, using various sales platforms. Only 13% of the responses revealed a mono-channel approach. Although exporting is less relevant in Uzbekistan, as only 9% of responses were linked to this choice, the following countries were mentioned (in order of decreasing relevance): Europe (Belgium and Italy in particular), Russia, China, Turkey, India, USA, Canada, Korea and Japan. Social media channels are used particularly often for orders from international clients. Popular fairs in Kazakhstan and Kyrgyzstan are also used to address an international target group. In terms of international delivery, nearly half of Uzbek producers indicated they work with international logistic companies.

In Tajikistan, sales on local markets appear to be most popular, comprising 38% of responses. Exports account for 23%. Most Tajik producers use a multi-channel approach; however, 37% stated they pursue a mono-channel sales strategy, mostly by selling exclusively to locals. Countries mentioned as export destinations were (in order of decreasing relevance): Vietnam, Germany, USA, Russia, China, Switzerland, Kazakhstan and Afghanistan. In order to transport the items to international markets, 50% of Tajik responses revealed that the items are usually retrieved directly at the offices for further transport.

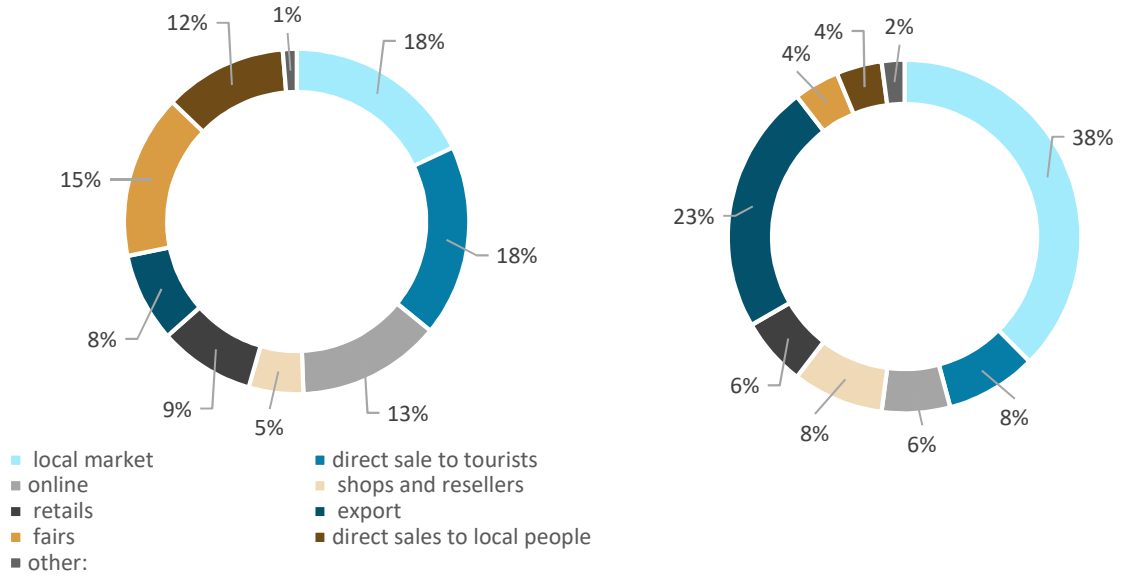

Figure 14 - Sales Channels in Uzbekistan (left) and Tajikistan (right)

Part 3: Problem Analysis

In this part of the report, survey findings on the challenges along the silk production value chain are described. It is divided into five sections, covering challenges regarding 1) sourcing, 2) production, 3) sales, 4) sustainability, and lastly 5) specific challenges concerning the recent COVID-19 pandemic.

It is important to note that not every interviewee provided answers for the following questions in the next subchapters, such that the percentage values indicated below do not always refer to the number of sums of actual respondents who provided answers. Moreover, answers for the survey questions were close-ended and often included multiple choices (multivariate).

Challenges of Sourcing

Establishing a consistent link with the aforementioned and upcoming processes is a major challenge for any stakeholder engaged in products manufacturing, including silk and Ikat. As described in Part 2, sericulture consists of a variety of complex sub-processes performed by individual and highly specialized craftsmen and -women. As the value chains are fragmented as a result, long-lasting relationships with suppliers and sellers are yet to be established for many of the stakeholders.

Growing Silkworm Feed

There are many ecological and economic values of mulberry trees, many of which have been known since ancient times, while others are still being discovered and explored (Jian et al. 2012). Exposed to environmental changes and unsustainable practices, growing silkworm feed can cause sericulture stakeholders a variety of issues. Providing enough quantities of mulberry leaves for their larvae is a challenge faced by farmers each year in Tajikistan. According to the survey, farmers have to constantly maintain the old trees while ensuring that new trees are available at the right time in order to keep the balance of the plantation. Farmers of this survey were unaware of trainings that would provide guidance or support in this regard.

Several of the Tajik farmers stated they experience imbalances in this area, causing a lack of feed for their silkworms. Others stressed that timely chemical treatment is important during autumn in order to sustain their farm. A lack of (quality) mulberry trees was also considered as one of the limiting factors in the Tajik silk production by experts in a focus group discussion. Due to the limited access to mulberry trees, farmers generally need a car in order to transport leaves, which implies increased costs and time needs. After the collapse of the USSR, governmental lands with mulberry plantations were allocated to some family farms as private property. At present there are at least two categories of farmers linked to the challenges of feed: i1) farmer possessing mulberry plantations (e.g. they either work in cocoon farming or not); and 2) farmers without mulberry plantations but who rear or are willing to rear larvae. Issues arise when a farmer who owns a mulberry plantation does not give permission to harvest leaves to farmers who do not own plantations of their own but who work with cocoons. The permission might be denied due to several possible reasons (e.g. the farmer harvests mulberry or uses trees as firewood etc.). According to an expert from the focus group discussion, new regulations, which could guarantee access to all mulberry trees regardless of whether they are on private land, are currently under debate. The future management of access rights of mulberry trees might possibly be transferred to Pillay Tojik. Details of how such a system could work and concrete rules are yet to be decided upon.

In contrast, all land in Uzbekistan belongs to the government, and land management is, therefore, different in nature. Farmers usually have lease contracts for 49 years; however, instead of paying for a lease, they are required to pay (reduced) taxes on the land. Otherwise, the feed base seems to be more

developed in Uzbekistan, where farmers in this industry receive governmental support and can lease lands from cluster factories for growing feed.

Finding Access to Raw Materials

One of the most important challenges for stakeholders in silk fabric manufacturing is building a constant supply chain for raw materials. This was supported by the survey, where 28% of the responses mentioned “access to raw materials” (e.g. dyes, raw silk, silk yarn or cocoons) as a critical factor in Uzbekistan and 14% in Tajikistan when asked what they most strongly require for sustaining their sericulture processes.

According to experts, prices for raw silk in both countries are dependent on international prices for silk, although they do not strongly deviate from international prices (China plays a big role in determining price rates).

Lack of Access and Information regarding Dyes

Dyes are another material of particular importance for Ikat production and are not always easily accessed. A lack of diversification among dye plants can lead to significant risks especially under changing environmental conditions. Under the consideration of environmental conditions of the region, it is not advisable to only focus on local dye plants and formerly cultivated dye plants but rather to consider experimentation with imported plants as well. Among various factors hindering this exploration, beyond the regional scope, are a lack of knowledge on producing natural dyes in general and a limited network of partners, which further limits experiments with imported or re-cultivated natural dye plants. Therefore, limited diversification could cause future obstacles within the two countries’ sericulture and Ikat production.

With regards to synthetic dyes, MSMEs face the significant problem of establishing a long-term colour chart, as they have to source the dye pigments from unregulated local markets and there is no guarantee that they will be able to buy the exact same dyestuff again. In addition, basic information and instructions on the dyeing process and the handling of hazardous substances, which are usually provided by the dye suppliers, are sometimes missing.

Building Supply Chains

Finding adequate supply chain partners is a major challenge in Central Asia, as previously established value chains have broken apart due to various historical and political occurrences. During the survey, 65% of responses in Tajikistan and 50% in Uzbekistan clearly stressed that the main challenge of finding value chain partners to re-build trade relationships and collaborations is a lack of national, regional and international networking events. In addition to the lack of access to a pool of partners, skilled and qualified labour supply also appears to be problematic in both countries, according to the survey results. An additional challenge is quality control. In the focus group discussion, experts agreed that it is important to have supply chain partners who meet high quality standards and that finding those partners may be difficult. Quality standards exist in the countries, but few producers seem to use, or at least communicate, them; however, this issue needs further investigation. Information on valid quality standards in Tajikistan and Uzbekistan can be found in the RUTSIS Policy briefs.

Challenges of Production

Lack of Specialists and Staff

In regards to production processes, the survey found that staff often lack access to advanced training opportunities, whereas a lack of education of staff and the lack of finding staff in general is more pressing in Uzbekistan than in Tajikistan. The issue of finding educated staff was relevant for 60% of respondents in Uzbekistan and 19% in Tajikistan. This difference may be connected to how problems along the value chain were prioritized when answering the survey and that other issues might simply be more pressing in Tajikistan. 24% of respondents in Uzbekistan and 4% in Tajikistan said that finding staff in general was problematic. Consequently, respondents in Tajikistan explained that specialist consultations for exploratory works are needed. The issue of education is present throughout survey answers.

Lack of Knowledge on Growing Silkworms

The survey results show that the annual mortality rate of larvae until the end of the cocooning process is on average 10% in Uzbekistan and 20% in Tajikistan. During a focus group discussion, experts stated, however, that the mortality rate of larvae should not exceed 10-15% if agrotechnical norms are maintained. The exact reasons behind higher mortality in Tajikistan are not identified; however, one interviewee in Tajikistan pointed out that losses up to 50 % were experienced and that chemical fertilizers applied to mulberry trees was the cause. Moreover, according to experts from a focus group discussion and an academic source, silkworms (up to 7-10%) in Tajikistan die due to incorrect feeding methods (Bazarovich 2020). Additionally, mortality could be partially explained by the conditions during incubation or transportation. Poisoning with pesticides appears to be another common problem, according to the survey results. Weather conditions or climate change are believed to be further reasons for larvae mortality in both countries. There are many crucial aspects for silkworm rearing and, in the past, most of the knowledge was passed down from generation to generation. Examples of such knowledge include high sensitivity of silkworms to any odours and their sensitivity to chemicals applied to plants in close proximity to cocoon rearing facilities. Interruptions to the traditional knowledge transfer has led to a lack of knowledge regarding these details in Tajikistan.

Facilities for Silkworms

In both countries, silkworm farms are often established in private family households, which can prove inconvenient, as the room occupied by silkworms must be renovated afterwards. Experts mentioned that families are not always able to regularly renovate because the rearing of silkworms does not cover the expenses. Tajik survey respondents further mentioned the limited availability of space in private houses as well as heating as further challenges. Space limitations require the minimization of materials used to rear the larvae. A lack of firewood (or other heating resources) and the challenge to keep the temperature constant for growing cocoons were mentioned in relation to heating.

Lack of Equipment

Lack of equipment (yarning machine) and the need for modernization of production equipment was of importance to 34% of the respondents in Tajikistan and 13% in Uzbekistan. Particularly in Tajikistan, 44% of respondents reporting that finding modern equipment with sufficient quality at an affordable price was a main issue with regards to procuring equipment. Import regulations and high transportation costs for imports were mentioned as further obstacles. During the civil war (1992 to 1997), existing equipment was destroyed. Self-built equipment has the advantage of functioning without electricity and not needing specialized technical support or big investments in maintenance. In Uzbekistan, 80% of the respondents said that they did not experience challenges in purchasing equipment.

Challenges of Dyeing

When asking participants about problems they have experienced in regard to dyeing, providing them with multiple possible choices, only Uzbek survey participants responded, of which 61% stated to have observed health risks through physical contact with dye and wastewater.

Around 33% of respondents face a problem with pre-water contamination, implying different levels of accessibility to high-quality water sources, which can translate into quality, cost or time disadvantages for producers with low access to clean water. Among respondents who shared their experiences with water contamination before the dyeing process, half also experience water pollution afterwards.

Several problems can arise in the dyeing process: incorrect dying techniques and the use of the incorrect amount of mordants or dyes (natural or synthetic) can lead to the insufficient absorption of natural dyes. If too much dyestuff is applied, the fibre cannot absorb it all, leading to the dye bleeding heavily when washed out. This, in turn, has adverse effects on the wastewater that is produced by the process.

Challenges of Sales

In the second part of the survey, respondents described overall challenges in the value chain, whereas some of the answers were related to the issues of sales (see Figure 15 below). Multiple answers were possible.

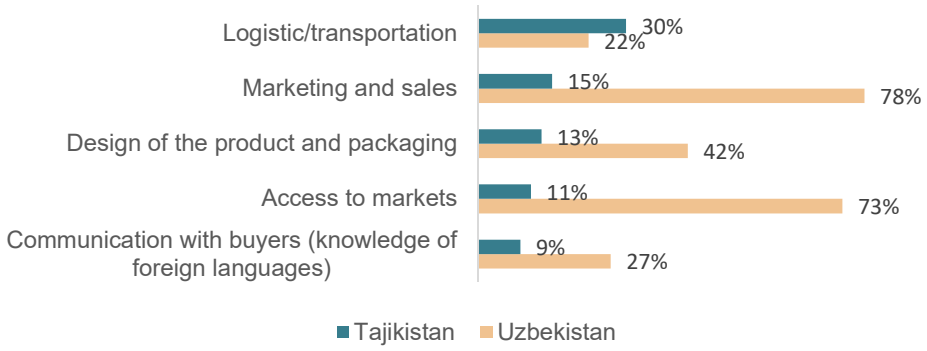

Figure 15 - Challenges of Sales of Production in Tajikistan and Uzbekistan

According to the survey results in Uzbekistan, the most important factor among overall challenges in the silk value chain is access to markets, which was raised by 73% of respondents. Marketing and sales are further pressing issues that were mentioned by 78% of respondents in a multiple-choice survey question. These aspects are perceived as challenging in Tajikistan as well. However, transportation and logistics issues appear to be even more relevant in Tajikistan. Another obstacle described by 27% of respondents in Uzbekistan was the language barrier in communication with foreign buyers. Problems related to logistics are experienced similarly in both countries.

As for Tajikistan, respondents mentioned that they must cover the costs of transportation. Additionally, about 42% of the respondents in Uzbekistan and 13% in Tajikistan perceive the product and packaging design as another challenge that hampers their sales opportunities. The design problem refers to end products, as craft and sericulture producers often do not have the required knowledge and opportunities for further education in contemporary and sustainable product creation and design. Furthermore, producers often lack collaboration with national and international professional designers and product developers due to the reasons described in chapters “Lack of Specialists and Staff” and “Building Supply Chains”. A big part of decisions connected to product sustainability are made at the product design

stage, where developers decide on the amount and quality of raw materials, dyes and water used for the product. Many products are currently sold unpackaged and unbranded, and packaging design is also a limiting factor for selling and marketing. As such, product and packaging development and design play a major role for long-term ecological sustainability and sales. Figure 16 displays the shares of sales challenges in each country.

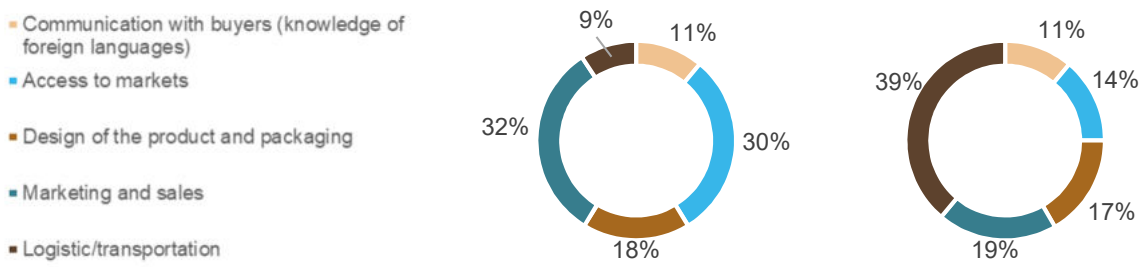

Figure 16 - Challenges of Sales of Production based on Shares in Uzbekistan (on the left) and Tajikistan (on the right)

Challenges of Sustainability

Despite being neighbouring countries and having a common history of silk production, the development and challenges faced by local producers in regard to sustainability differ between countries. In order to define what kind of sustainability challenges are found in the value chain, this question was included in the survey. This subchapter consists of four parts; it begins with general awareness on sustainability and is followed by the three pillars of sustainability: 1) economy, 2) environment and 3) society.

Awareness on Sustainability

In order to assess the awareness on sustainability challenges in silk production, several questions related to environmental, economic and social sustainability were asked. 68% of the interviewees in Tajikistan reported being aware of sustainability issues (ecological and social), whereas in Uzbekistan the share amounts to 34%.

In order to understand whether the stakeholders were confronted before with sustainability issues, they were asked if they had participated in sustainability workshops or trainings before. 15% of the interviewees were in Uzbekistan and one third in Tajikistan. In Tajikistan, respondents had participated in workshops organized by the National Academy for Agriculture, Jamoat (local municipal administrative body in Tajikistan), specialists from Dushanbe and governmental agencies. In Uzbekistan workshops were organized in the context of some projects implemented by GIZ, Institute of Arts and Material Culture of the Technical University of Dortmund, UNESCO and by a local craft master.

When assessing whether stakeholders include sustainability aspects in their production or trainings, 50% of the respondents from Uzbekistan confirmed the inclusion of sustainability principles in their work or trainings. The share was, however, higher among interviewees from Tajikistan, where it accounted for 85% of Tajik responses.

Economic Challenges

A variety of economic factors were brought up by respondents when they were asked about overall challenges of sustainability of the silk value chain.

The low prices for raw silk on the market is perceived as a major problem and, consequently, respondents in Tajikistan stated there is a need to increase the prices (36% of respondents), which would, hopefully, attract new cocoon producers to start working in the sector. Both countries' governments include major buyers of the raw silk, who set the prices in the market for silk cocoon purchase according to international price. Low wages, that were also indicated by 10% of the respondents in Tajikistan, might be connected to the previous challenge of the low prices for raw silk.

Due to the low economic incentives or benefits from growing cocoons for farmers, fewer families want to engage in silkworm farming, which was stated as a challenge affecting the supply chains. Besides a lack of economic viability, many people do not engage in growing cocoons, likely because the knowledge of growing cocoons was widely lost in Tajikistan.

Social Challenges

Social problems arising in the sericulture were one more aspect in order to gather a holistic picture of the silk value chain. The assessment of social aspects in the survey was divided into two questions: 1) awareness on sustainability challenges in general and 2) social challenges that particularly need improvement.

The majority of the interviewees in Uzbekistan (83%) and 40% of the interviewees in Tajikistan reported that they are aware that the lack of education possibilities in the sericulture sector is an issue for sustainable development. It has further been specified that these gaps in higher education surface due to the existence of only a few programs in universities on sericulture.

Both countries further reported on the need for improvement of working conditions in the sector (see Figure 18). Figure 17 illustrates the awareness in both countries on the described challenges. Poor contractual conditions, lack of occupational safety and low payment have been reported as issues for sustainable development of the sector. Two thirds of Uzbek respondents are aware that no occupational safety and low payments in the sector hinder its sustainable development and that the latter problem relates to the indicated importance of improvement in fair payment by almost one fifth of Uzbek respondents (see Figure 18). One third of respondents in Uzbekistan indicate poor contractual conditions as an issue. A lack of occupational safety, especially in Uzbekistan, may be linked to unpredictable demand in this sector (which is indicated in the challenges upon which to improve in Figure 18). In Tajikistan, one fifth of the respondents are aware of poor contractual conditions in the sector as an issue for sustainable development and 10% report on a lack of occupational safety. Even though there have been no answers with regard to the awareness on low payments and lack of health and social insurance in Tajikistan in this survey, the majority of Tajik respondents reported that fair working conditions and fair payment are social challenges in the sector that need improvement (see Figure 18).

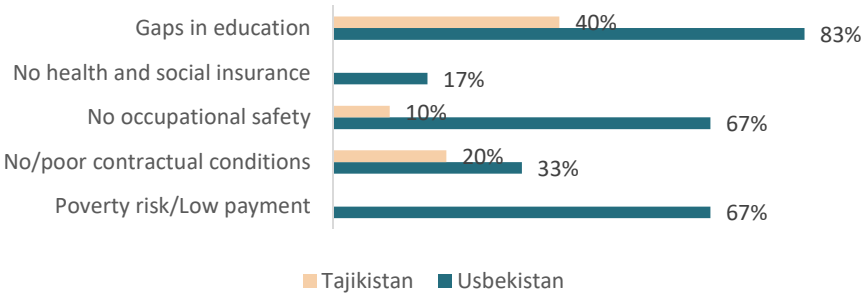

Figure 17 - Awareness on Social Sustainability Issues in Silk Value Chain

Concerning other social challenges that need improvement, the overall most pressing need mentioned was gaining more support among local communities in silk production, which was stressed by 73% of respondents in Uzbekistan and 46% in Tajikistan. The sector of sericulture seems to not have a positive reputation within local communities due to low working conditions (low payment, no occupational safety). Moreover, it was argued by 18% of respondents in Uzbekistan and 12% in Tajikistan that workers' safety in the sector needs to increase. Interviewees in both Tajikistan and in Uzbekistan indicated that the inclusion of disabled people needs to increase. A diagram showing social challenges that need improvement can be found in Figure 18.

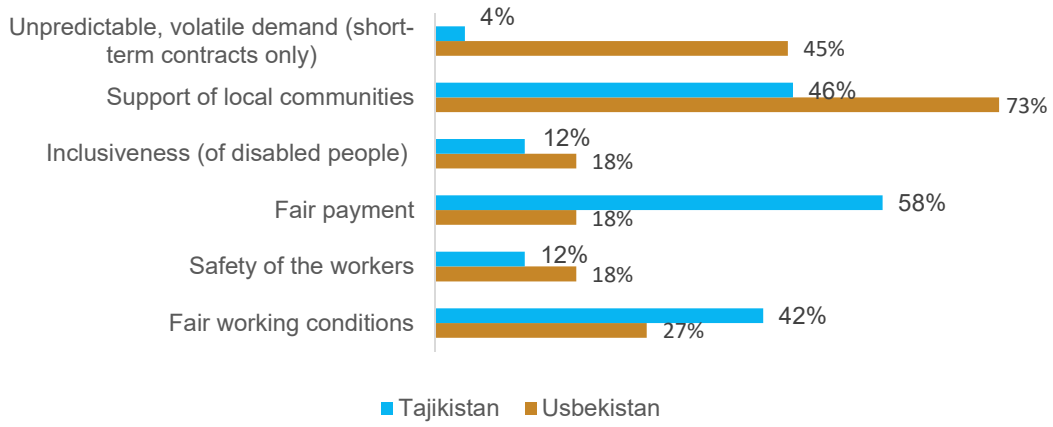

Figure 18 - Social Challenges Necessary to Improve in the Silk Value Chain

Despite the lack of indication on low payment from Tajik respondents in the previous question (Figure 17 - Awareness on Social Sustainability Issues in Silk Value Chain), fair payment (58%) and fair working conditions (42%) yet seemed to be a challenge of high importance for being improved. While in Uzbekistan the unpredictability in demand (volatile demand results in short-term only contracts) is a challenge, it showed little relevance in Tajikistan.

Environmental Challenges

The assessment of environmental challenges covered several areas, including 1) awareness on environmental sustainability aspects in sericulture (see Figure 19) 2) experienced environmental challenges in silk production (Figure 20) and 3) experienced climate change related challenges.

1) Awareness of environmental sustainability

As evidenced in Figure 19, the level of awareness of environmental challenges in Tajikistan differs in comparison to Uzbekistan. Respondents in Uzbekistan indicate a high degree of awareness on several environmental challenges, such as climate change, water insecurity and lack of energy. In Tajikistan there is also concerns regarding climate change issues, and other aspects, such as hazardous chemicals and pollution and land use and biodiversity loss, also seem to be prevalent.

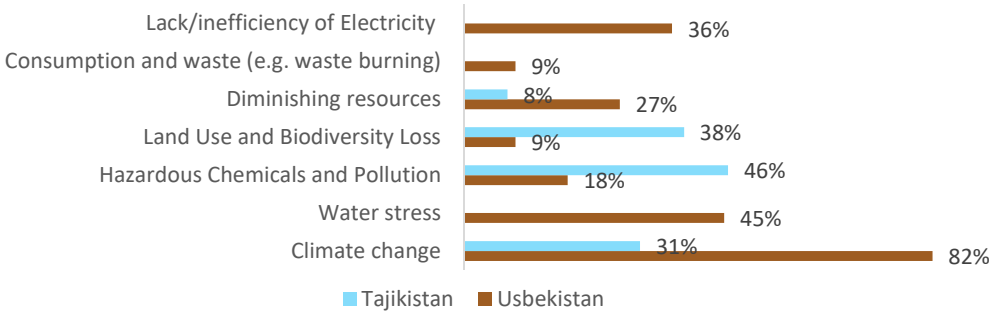

Figure 19 - Awareness on environmental challenges

The awareness on climate change is 82% in Uzbekistan and only 31% in Tajikistan. Climate change threats that have already affected the countries are explained below (under "3 - Experienced Climate change challenges"). Regarding water scarcity, 45% of respondents in Uzbekistan reported being aware of water stress problems (see Figure 19), while only 7% of respondents had encountered problems with lack of access to water (Figure 20). Tajik respondents, on the other hand, did not answer the question about awareness of water stress problems, though, interestingly, 83% of them indicated that they had experienced problems with access to water in the value chain.

Uzbekistan and Tajikistan are located on the Aral Sea water basin, which is fed by two main rivers: Amudarya and Syrdarya. Amudarya covers 81,5% of the territory of Uzbekistan (Frenken 2013). Uzbekistan uses about 52% of the Amudarya and Syrdarya rivers and Tajikistan 11%. Water use issues may differ, as Tajikistan is an upstream country and Uzbekistan is downstream and, thus, more dependent on its neighbouring upstream countries. Local and international experts note that water problems in Central Asia connect to multiple issues, among them the current ineffective use and management of water (Kayumov and Novikov 2014), the old irrigation systems and lack of current intergovernmental agreements for water supply.

Water availability is affected by climate change and the impact will increase with time, especially in Central Asia due to the partial dependence of water resources on glaciers. Climate change projections for 2050 suggest a potential decrease in the water flow in the Syrdarya river basin by 2-5% and by 10-15% in the Amudarya river basin due to glacial melting and changes in precipitation patterns and their intensity (Aleksandrova 2014). As the overall average temperature rises, glaciers melt and the accumulation of new ice does not replace the melted volume. According to some further climate projections, the amount of precipitation is expected to decrease in spring and autumn, whereas in summer and winter it will increase. It is anticipated that the peak discharge in non-regulated rivers will shift to earlier months of the year, which in turn will affect economic sectors dependent on water supply. Up to the mid of 21st century no significant changes in water availability are foreseen, but later on the situation will change along with the reduction of river discharge(Kayumov and Novikov 2014).

2) Experienced environmental challenges

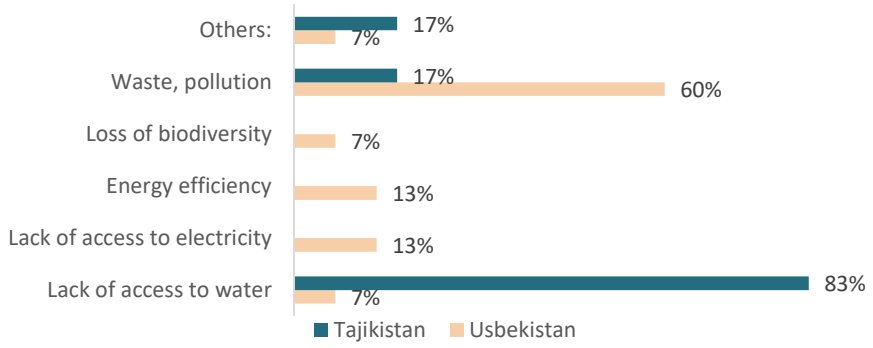

Figure 20 - Environmental Challenges Experienced in Silk Production

A larger environmental issue experienced in Uzbekistan is that of waste and pollution in production (experienced by 60% of respondents). An awareness on hazardous chemical and pollution was indicated by one third of respondents in Tajikistan and 18% in Uzbekistan (Figure 19). In response, respondents were asked whether they possess wastewater management facilities. None of the respondents from Tajikistan answered affirmatively, whereas 30% of respondents in Uzbekistan employed in silk production indicated they had them. The survey is not clear with regard to the environmental challenges experienced and the assessment needs to be continued here.

Across several questions (including that of awareness on environmental challenges), an issue of electricity availability came up as a concern in both countries. The answers show an experienced lack of access to electricity (13%) and energy inefficiency (13%) in the production facilities in Uzbekistan. Despite the lack of responses from Tajikistan in the survey regarding electricity, the problem was confirmed in the expert focus group discussion for both countries. Energy supply disruptions, however, happen on a usual basis in winter and less so in spring time, which does not harm the production to a significant degree, as spring is not the active season for silk production. Another problem in Uzbekistan was the minimal power infrastructure and the high costs of maintaining it (Kalankhodjaev et al. 2010).

3) Experienced Climate change impacts

Despite being aware of climate change issues (82%) in general (Figure 19), only 23% of respondents in Uzbekistan reported having experienced the consequences of climate change. However, the situation in Tajikistan differs significantly, as 62% if respondents reported having experienced climate change impacts and only 31% of respondents reported to be aware of climate change.

The challenges indicated by Tajik respondents most often referred to unusual climate outcomes, including high humidity, that has a negative impact on larvae growth. The other challenge regarded the fodder, as a rapid drop of temperature in spring when mulberry tree blossoms negatively affects the productivity of the tree leaves, deteriorating the food base of silkworms.

Experienced climate change-related threats in Uzbekistan also include crop shortage. One of the reasons for this are snowfalls in spring and late frosts. Other impacts of climate change include more frequent heat waves during feeding period, that may also negatively affect negatively food bases, making it more difficult to take care of larvae (e.g. feeding them more often) and potentially disturbing the larvae's ideal temperature (about 26°C), resulting in a need for additional resources and, as a result, higher costs. Climate change leads to more frequent extreme events such as droughts, frosts, etc., which have a harmful impact on the industry and are projected to increase with time.

Challenges of the Covid-19 Pandemic

As this survey was conducted during the last quarter of 2020, many of the currently experienced challenges are related to COVID-19. Survey participants were therefore specifically asked about challenges that have only recently occurred due to the pandemic. A reduced sale of products was generally perceived as a major challenge in both countries, accounting for 56% of responses from Uzbek producers and 33% from Tajik producers. Further, shutting down production facilities in the course of safety precautions was another challenge faced by both Tajik (35%) and Uzbek (31%) producers during 2020. In general, individual respondents highlighted that the pandemic has caused financial concern about the producer's sericulture activities.

While in Uzbekistan material supply has not suffered as a consequence of COVID-19 safety measures, 19% of responses by Tajik producers indicated this was a problem. Layoffs of employees has also not been a major issue in Uzbekistan, while it has been much more problematic in Tajikistan, as indicated in 12% of responses.

In an expert focus group discussion, which was conducted in the beginning of March 2021, Ikat producers provided an update on the state of sales and producers' ability to adapt the situation. In the beginning of the pandemic, designers and fabric producers stopped production. Producers in Uzbekistan who used to export and had their clients abroad are now reviving their work by creating web pages and social media accounts to increase sales. Producers who used to work for the internal market struggle even more. Before the pandemic they sold their products in fairs and to tourists, an option that has not been possible for some time.

Part 4 - Conclusion and Recommendation

The objectives of this report were to provide an overview of the sericulture in Uzbekistan and Tajikistan, to describe the current status of the sericulture value chains in both countries and to identify current challenges and possible opportunities for value chain stakeholders. Part 2 of the report provided insight into the manufacturing of Central Asian silk and Ikat products, covering processes in mulberry farming, silkworm farming, silk yarning, fabric design and silk dyeing, fabric weaving, product finishing and, lastly, the sale of products and semi-finished products. Part 3 identified multiple challenges within five areas: 1) sourcing, 2) production, 3) sales, 4) sustainability and, in order to integrate the temporal context of the study, it addressed 5) the recent challenges of the COVID-19 pandemic.

The findings from Part 2 and 3 of the report provide a foundation for the further course of the project RUTSIS – Reviving Uzbekistan's and Tajikistan's Sustainable Ikat and Silk Production. The publication does not provide recommendations for the continuation of the regional sericulture in Uzbekistan and Tajikistan. Potential ways forward can only be estimated, and only the next steps of the project are certain.

Sourcing related Suggestions

In general, different aspects have been addressed in the survey that require an improvement on the access to raw materials in the sericulture and Ikat sectors.

On the level of mulberry farming, respondents in Tajikistan engaging in early value chain processes have experienced a lack of access to mulberry feed or difficulties in growing their own feed. To address this need, capacity development of modern planting techniques and sorts of mulberry trees, that also address extreme weather conditions caused by climate change, might be an area of intervention (preferred schemes, tips, chemicals use). Within the RUTSIS project, trainings on different stages of the silk value chain are planned (e.g. in WP 2.1 and 4.1). The survey results will be integrated into the compilation of the needed training materials.

To face the challenges on the level of silkworm farming, especially in Tajikistan, capacity development activities on the incubation phase, larvae growing (including feeding) techniques and quality control of larvae and silk are required. Trainings in the project´s WP 2.1 and 4.1 could particularly be used for this purpose.

Besides tailored trainings that would improve access to raw materials in the long term, specialist consultation might be a bridging intervention to improve upon knowledge not only for mulberry farming, but also on other stages of the value chain in the short run. To improve on the availability of such consultations, the topic will be set on the agenda of country-level stakeholder consultation workshops (WP1.2.1), as well as on the agenda of cross-border networking events for stakeholder working groups (WP1.3.4).

Interviewees also reported issues on access to high-quality dyes. In this regard capacity buildings across the sustainable sourcing and production of natural dyes, as well as sustainable use of synthetic dyes, could have a positive impact in both countries. Moreover, diversification in planting natural dye plants (such as indigo) could increase the producer's resilience to changing environmental conditions as well as quality volatility. Some dye plants, that were already cultivated in Uzbekistan and Tajikistan, could be sustainably re-cultivated to enrich the local dye plant diversity (WP 3.1 and 3.2). Research on identification of additional potential natural dyes that could be grown in Central Asia and used by Ikat producers is already ongoing in the frames of RUTSIS project. Besides recultivation, sustainable ways of using plants waste for natural dyes purposes and collaborative engagement with agriculture

producers and stakeholders in forestry management could be applied, as well as capacity buildings on the production of natural dyes, their use, and the support of national educational centres for capacity building and dissemination of natural and chemical dyes can be supported (in WP 3.2.1; WP 3.2.2; WP 3.2.3).

Respondents that engage in Ikat manufacturing also specifically pointed to difficulties in finding high-quality silk threads, as well as both natural and synthetic dyes. A major problem in this regard is the lack of implementation of transparent and widely used quality standards that allow for the comparison of materials and justification of price differences. The introduction of quality standards, if applied on a wider scale, as well as networking events (WP 1.4) could enable Ikat manufacturers to find adequate sourcing partners that can ensure a consistently monitored quality under a widely applied set of criteria. The project aims to initiate such developments by compiling guidelines for the production and quality control of natural dyes on the one hand (WP 3.2), as well as on sustainable design, and quality control with special reference to Ikat on the other hand (WP 5.2).

In general, interviewees clearly stressed that a main challenge in finding value chain partners to re-build trade relationships and collaborations is a lack of networking events in the according country, the central Asian region. The RUTSIS projects addresses this issue: several networking (WP1.3.4) and business match-making events (WP1.4.1) are planned to foster collaboration possibilities in Central Asia.

Production related Suggestions

Respondents urged that the lack of access to training opportunities and the lack of skilled staff to work in sericulture. In addition, it was raised by respondents that silkworm growing is currently not performed at the highest possible efficiency, in part due to a loss of traditional knowledge and that modern approaches have not yet been implemented. The RUTSIS project aims to specifically address this issue with a variety of measures (WP 1.5, WP 2.2; WP 4.1 and WP 4.2). According to planned activities, educational information needs to be collected, including actual sources as well as a network of institutions that provide training (WP 1.5). Once publicly available, such databanks carry valuable information for stakeholders who seek access to educational opportunities. Further, the project foresees the development of materials and preparation of skilled master trainers for the implementation of multiple trainings, targeting both silk and Ikat producers (WP 2.1, W 2.2, WP 4.1 and WP 4.2).

Another area of improvement that surfaced during the survey was a lack of equipment in production facilities. In the case of cocoon farming, not only were the facilities themselves not built to be both worked and lived in, but also equipment was perceived as unaffordable or not in line with quality requirements. As pertains to the latter problem, suppliers of affordable equipment, an outcome that is in line with producers' needs, could be identified by facilitating a better network connection among supply chain stakeholders. The project aims to deliver several events to facilitate match-making of people and businesses engaging in the sector, which could also allow stakeholders to find adequate providers or constructors of equipment (WP 1.4).

In the Ikat production facilities many respondents stressed difficulties in the context of dyeing. Often producers were no longer able to produce at the desired level of quality, as they had to, for example, address market requirements, because they struggled with water contamination as well as a decreasing quality of dyestuff. Some of these issues could be resolved by monitoring and implementing sustainability indicators. Decreasing quality of dyes can, on the one hand, be addressed by match-making producers with suppliers of natural or synthetic dyes that are able to deliver the required results in the fabric (WP 1.4.). Along similar lines, independent dyeing centres would be useful, as they would allow for more direct contact between local vendors and foreign dyestuff suppliers while providing information and trainings for dyers and craftsmen. At the same time, guidance on quality control, as well as distributing best practice knowledge on optimizing colour results with sustainable dyeing techniques,

can support Ikat manufacturers in adapting to variations in the quality of dyes (WP 3.2; WP 4.1 and WP 4.2). For instance, modern approaches by the German company NIG (Nahrungs-Ingenieurtechnik GmbH, Magdeburg) could be introduced that can guarantee a relatively constant colour result via a particular extraction technique (Nahrungs-Ingenieurtechnik GmbH 2021). In combination with quality standards included in the sourcing-related part, the activities could help to install a coherent and transparent quality standard system in the sector.

Sales-related Suggestions

As producers in the sericulture and Ikat sector have difficulties finding or accessing various sales markets, a variety of marketing measures can be applied to increase their sales opportunities. First, a wider target group can be reached via online sales platforms. However, due to issues with electricity, internet connection, low digital literacy and language barriers to communicate with foreign customers, this might not be a viable solution for all producers. In addition, the logistics infrastructure in Tajikistan needs to improve in order to facilitate access to supra-regional markets.

Another option to access international sales markets is to adapt the product requirements according to international standards regarding design, packaging and labelling of the product. Especially relevant for the latter option, product labels would need to cover information on the content, country of origin of the product and, ideally, quality standards in order to inspire confidence and attract more potential buyers. The introduction of eco-packaging could particularly address target groups that are aware of sustainability issues and go hand-in-hand with the introduction of informational eco certificates for products. By applying some of these measures, as well as by increasing overall marketing activities, sales opportunities for the sericulture sector could be enhanced, which is one of the objectives of the RUTSIS project (WP 6.3).

To strengthen the appeal of the end products in the international and local markets, workshops on sustainable, zero-waste and contemporary fashion design will be held for local fashion designers and training institutions. The workshop will be consisting of international sustainable apparel product designers and preceded by an evaluation of local designs (WP 5.1 and 5.2). It will include a toolkit on the local languages that would help local designers to understand sustainable design concepts, which is a result of a direct collaboration between German and Central Asian designers and includes multiple further guidance sessions and online follow-ups for selected local designer and Ikat manufacturers in compiling a collection of sustainable/circular Ikat (WP 5.2.3).

Sustainability related Suggestions:

A lack of awareness on sustainability issues was observed in the course of the current survey, therefore grass roots activities in awareness rising are needed for example: information materials, workshops and trainings, might be already helpful. Relevant topics could include the importance of each component (economic, environmental and social) and of sustainability for humanity and silk producers. Stakeholders should be aware that sustainable production along the whole value chain is aims not only to improve the environmental conditions, but also strengthens the producer's resilience with regard to all three sustainability pillars. Target groups may include producers at different stages of the value chain as well as government authorities and academia.

As indicated earlier, awareness on sustainability varies both within different steps of the value chain as well as between countries in general. Therefore, awareness raising campaigns should be focused on different steps in each country. The campaigns should deviate in regard to the focus of the project activities, namely the need to focus on the initial stages (grass root) of the value chain in Tajikistan,

whereas in Uzbekistan, that a more sophisticated development of the sphere, the focus should be on improving production technologies, such as a reduction of environmental pollution, etc.

Sustainability challenges most critical for active intervention were related to the environmental and health aspects in the value chain. In particular, these challenges relate to the process of dyeing, the pollution it causes and the impact of chemicals on producers' health. An intervention that could solve these challenges is trainings on sustainable dyeing techniques that incorporate elements such as efficient water management methods that would reduce the problem of water pollution in washout. Among the planned actions is a training on the revival of natural dyeing techniques with an introduction to modern sustainable dyeing techniques (WP 3.2). This includes theoretical and practical activities and may additionally include aspects on pollution and efficient use of water. Moreover, techniques on safe dyeing and wastewater management could be explained in the aforementioned trainings. Techniques on safe dyeing are assumed to reduce the possibility of negative impacts of dyeing on health of Ikat producers. Another possibility to decrease water pollution impact from Ikat production would be to encourage the use of wastewater management equipment. As training providers are important facilitators in demonstrating the importance of such investments, the project aims to equip their facilities (WP 2.2.5) with wastewater treatment equipment. Demonstration of wastewater management facilities could show the importance of such tools for the reduction of water waste and encourage producers to implement these practices in their workshops. The latter could be complemented with the installation of the solar panels to demonstrate the potential independence of producers from electricity cut offs or to reduce their expenses and promote renewable energy.

In general, the goal should be to revive traditional knowledge on sustainability in sericulture and Ikat sectors instead of introducing new production methods. This is especially as traditional techniques incorporate national and regional specialties in Central Asia.

For more complex sustainability topics, such as water scarcity, different policy round tables planned in the project could be used to raise awareness. The concrete topics and possibilities could be discussed at an upcoming country-level stakeholder event (WG1.2.2). One possible session could structurally explain current project activities and goals for improving sustainability performance in the value chain.

The same applies for social and economic challenges. The survey could not clarify the main factors for low payment in the sector and bad contractual conditions. Further work packages will be used to clarify how the situation can be improved. The study tour to Northern Thailand that will be organised for regional stakeholder representatives (WP1.3.3) could help to receive new insights on how other markets for silk products are organised. The exchange with the stakeholders there could further include a discussion on social aspects.

Suggestions for Collaborations to foster the Sericulture and Ikat Sectors in Central Asia

Fostering collaboration and partnerships among supply chain stakeholders and beyond is an important area of intervention in order to tackle challenges along the sericulture and Ikat value chains of Central Asia, as presented in this report.

Dialog and collaboration with international stakeholders, especially with other international development partners, donors and their projects, active in the fields of sustainable development of agriculture would be crucial. Further education, economic development, support of women, forest management, legislation and sustainability are some of the focus areas for such dialogues. The RUTSIS project is open and actively seeking exchange of experience and collaboration with such actors and their projects for synergies in both countries. Informational exchanges for potential collaboration have been initiated, for instance, with the projects of the:

- Food and Agricultural Organization (FAO), project: "Support for Sustainable Sericulture in Uzbekistan"
- United Nations Industrial Organization (UNIDO), project: “Tajikistan Project on Carpet, Textile/ Embroidery Modernization”
- United Nations International Trade Center (UN ITC), project: “Ethical Fashion Initiative” (Uzbekistan and Tajikistan)

Further exchange is possible with projects from the German Society for International Collaboration (GIZ), the Swiss Agency for Development and Cooperation (SDC), the British Council and UNESCO in both countries, especially regarding actions in the fields of ecological sustainability, further education and safeguarding of non-material cultural heritage.

A strong network with national stakeholders in both countries is the foundation for successful and sustainable project outcomes. The RUTSIS project has already started a cooperation with following national stakeholders in Tajikistan:

- Ministry of Industry and New Technologies Tajikistan
- Ministry for Agriculture Tajikistan
- Committee for Forest Management Tajikistan
- Committee for Women and Family Affairs Tajikistan
- And representatives of the private sector who play a crucial role in the sericulture and Ikat development, as well as companies such as: “Pillay Tojik” and “Khudjand atlas”.

In Uzbekistan, RUTSIS has already initiated concrete collaboration plans with the Committee for Forest Management of the Republic of Uzbekistan and the National Silk Association of Uzbekistan Uzbekipaksanoat.

Contact with global private sector actors, such as suppliers of chemical dyes to Central Asia, as well as possible new export markets for sustainable products in Europe and Asia is another crucial point for the current project in order to seek sustainable solutions for the different challenges in the sericulture and silk value chains in Tajikistan and Uzbekistan, as presented in this report.

Annex

Annex 1

Table 1 - Types of abr fabrics in Khudjand, Bukhara and Margilan[9]

Type of abr fabrics:	Name	Types
1.Silk abr fabrics	Kanaus (shohi)	kukkarga, bunafsha, nushai atlas, bargi karam, abarduk, jakrang, abr, tirma,shoicha,
	Atlas:	bargi karam, zangor karga, zard, karga,sapsar karga, sieh, shohsabz, jak-bast, honatlas, honatlas, karga
2.Semi-silk abr fabrics	Adras (podshohi)	alchambar, akaz, bargi-karam, bekasab, buluti, bunafsha, gulaz, zangor, nagora, kushnagora, alifnagora, murgobi, pudanlon, pudsafed, sabzigulas, surh, humi, kambari hutto, shona, shohsabz, shohsabzi gulas, humi, hafarang
	Alocha (nimshohi)	zebak, kalami, barak, chimalocha, kazina alocha, bairak, misr alocha
	Bekasab	albasi shohdar, bodomcha, bumga, buhor, buduja
	Doroi	
	Bakhmal	
	Parcha	okarak
	Kalgai	
3.Cotton abr fabrics	Araalo:	jalangdavron, podshohi zangor, kuk-karga, shotir-hona kalami

[9] Hakimova 2016.

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Project: Reviving Uzbekistan and Tajikistan's sustainable IKAT and Silk (RUTSIS)

Thank you for participating in our survey as part of the RUTSIS SWITCH-Asia project. SWITCH-Asia is Promoting Sustainable Consumption and Production in Central Asia as well as many other countries and is directly managed by the Directorate-General for International Cooperation and Development of the European Commission.

Reference: EuropeAid/161614/DH/ACT/Multi

Survey	**Assessment of the sericulture and Ikat sector in Tajikistan and Uzbekistan**	
Project consortium	adelphi research gGmbH	Germany
	Burg Giebichenstein University of Art and Design Halle	Germany
	Margilan Crafts Development Center	Uzbekistan
	Chamber of Commerce and Industry of Uzbekistan	Uzbekistan
	Tourism Development Center (TDC)	Tajikistan
	Chamber of Commerce and Industry of the Republic of Tajikistan	Tajikistan

☐ Module 1 General Information (mandatory)

☐ Module 2 Producers (only if applicable)

☐ Module 3 Training Providers (only if applicable)

☐ Module 4 Sustainability (mandatory)

Questionnaire #: .....

Date of Interview: .... / .... / ....

Place: .....

Name of Interviewer:.....

adelphi

CHAMBER OF COMMERCE AND INDUSTRY OF UZBEKISTAN

TAJIKISTAN

MARGILAN

Chamber of Commerce and Industry of the Republic of Tajikistan

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MODULE 1: General Information

1.1 Full name:

1.2 Name of working place and your position:

1.3 Address including country and region:

1.4 Email Address/Web page/ Social Media of company or institute:

1.5 Telephone number/ Telegram/ Whatsapp/Viber:

1.6 Legal status of working place:

☐ Governmental institution ☐ School, university, college, VET
☐ Private company ☐ NGO ☐ Cooperatives
☐ Association ☐ Not registered

☐ Other: .....

1.7 When was your company/institute founded?

1.8 What is the number of employees?

1.9 Languages Spoken:

☐ Tajik ☐ Uzbek ☐ Russian
☐ English ☐ German ☐ Other: .....

1.10 Your Age:

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MODULE 2	Mapping of Material Supply, Production and Marketing				
2.1	Where do you source the raw material from?				
	Fodder	Larvae	Eggs	Raw silk	Silk threads
Self-grown	☐	☐	☐	☐	☐
Sourced in the village (e.g. neighbor)	☐	☐	☐	☐	☐
NGO/ cooperative (*specify name*)	☐	☐	☐	☐	☐ .....
Local supplier (*specify company region*)	☐	☐	☐	☐	☐ ....
Governmental supplier (*specify name of program/country*)	☐	☐	☐	☐	☐ ....
Other	☐	☐	☐	☐	☐ .....

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2.2	**What type of raw material do you source for rearing?**	Type of fodder (plant): ..... Silk worm (origin of species): ☐ Central Asian ☐ Japanese ☐ Vietnamese ☐ Thai ☐ Chinese ☐ Indian ☐ Other: ..... Name of species: ..... Type of silk: ☐ mulberry silk ☐ eri silk ☐ tushar silk ☐ muga silk ☐ Other: .....
2.3	**What main input do you use?**	☐ Raw Silk ...% ☐ Cotton ...% ☐ Silk threads ...% ☐ Ikat fabrics (silk) ...% ☐ Mixed threads ...% ☐ Ikat fabrics, mixed material ...% ☐ Others..... ...%
2.4	**What is the share of natural and synthetic dyes used for your products?**	Natural Dyes: .....% Synthetic Dyes: .....%

2.5 **Where do you source your natural dyes? Please give examples (e.g.: indigo, pomegranate, etc.).**

Product name (CAS number if possible)	**Type of dye** *(examples:)* • Vat dye • Hot dye • Cold dye	**Type of source** *(examples:)* • Self-grown • Sourced in the village/cooperatives • Local producer (Please, specify region) • International supplier (Please, specify country) • NGO/association (Please specify name)
1)		
2)		
3)		
4)		
5)		
6)		

2.6 **Where do you source your synthetic dyes (reactive dye, acid dye etc.) ?**

Product name (CAS number if possible)	Type of dye *(examples:)* • Reactive dye • Substantive dye • Acid dye	Type of source *(examples:)* • Local production • International supplier (Please, specify country) • NGO/association (Please, specify name)
1)		
2)		
3)		
4)		
5)		
6)		

2.7 **Where do you source other chemicals for dyeing** (mordants, metal salts, etc.)

Substance	CAS number	Source		
		Local producer (Specify region)	International supplier (Specify country)	Other
Acetic acid		☐	☐	☐ .....
Alaun (potassium alum)		☐	☐	☐ .....
Aluminum sulphate		☐	☐	☐ .....
Caustic soda		☐	☐	☐ .....
Ferrous sulphate		☐	☐	☐ .....
Natrium carbonate		☐	☐	☐ .....
Natrium sulphate (salt)		☐	☐	☐ .....
Potash		☐	☐	☐ .....
Potassium dichromate		☐	☐	☐ .....

Sodium hydrosulfite		☐	☐	☐ .....
Sulphuric acid		☐	☐	☐ .....
Tannin		☐	☐	☐ .....
Tartar cream		☐	☐	☐ .....

2.8 What parts of the value chain are you working on?

☐ raw material ...% ☐ spinning ...% ☐ spooling ...%

☐ fabric design ...% ☐ painting ...% ☐ dyeing ...%

☐ weaving ...% ☐ textile finishing ...% ☐ fashion design ...%

☐ Other (please specify): ☐ .....%

2.9 What is the average monthly volume of your production

Type of product (-group)	Volume	Unit (kg, m, pieces)

2.10 Do you subcontract parts of your production?

☐ Yes ☐ No

If yes, please specify type of subcontractors:

☐ Farmers ☐ Yarn producers ☐ Dyers

☐ Dye manufacturers ☐ Painters ☐ Weavers

☐ Sewers ☐ Sellers/Buyers

☐ Other (please specify): .....

2.11 To what extent are your processes manual or electric?

Manual processes: .....% of the production

Electric processes: .....% of the production

2.12 What type of equipment do you use?

Manual equipment:

☐ Hand loom ☐ Spinning wheel

☐ Warping reel/mill ☐ Dyeing equipment

☐ Other: .....

Electric equipment:

		☐ Reeling machine ☐ Warping machine ☐ Jacquard loom ☐ Other: ……
2.13	**Where do you buy equipment for your company (dyeing equipment, machines etc.)?**	Spinning equipment: ☐ Self-constructed ☐ Abroad (country,brand): …… ☐ Local (region): …… Dyeing and measuring equipment ☐ Self-constructed ☐ Abroad (country, brand): …… ☐ Local (region): …… Weaving equipment ☐ Self-constructed ☐ Abroad (country, brand): …… ☐ Local (region): ……
2.14	**Do you experience challenges in the procurement of equipment?**	Please describe challenges regarding the procurement of equipment and maintenance: …… ……
2.15	**Sales channels: whom do you sell your products?**	☐ Local market/bazar ....% ☐ Direct (to tourists) ...% ☐ Direct (to locals) ....% ☐ Shops and dealers ...% ☐ Wholesale: ....% ☐ online ...% ☐ Trade fairs, specify: ....% ☐ Export, specify ...% (fair, country, year): (country:) …… …… ☐ Others (please specify): …… ...%
2.16	**If you sell online, please specify the exact way and percentage**	☐ Company website (……%) ☐ Association website (……%) ☐ Social media: Facebook, Instagram, Vkontakte (……%) ☐ Telegram (……%) ☐ Others: …… (……%)
2.17	**Which are your targeted markets:** Please chose the	☐ Own country: ……, (……%) ☐ Central Asia, country: ……, (……%) ☐ Russia and CIS, country: ……,(……%)

	country and specify percentage	☐ China: (.....%) ☐ Europe, country: .....,(.....%) ☐ US: (.....%) ☐ South East Asia, country: .....,(.....%) ☐ Others: country: .....,(.....%)
2.18	**How do you get orders from international buyers (not tourism)?**	☐ Through intermediaries ☐ E-commerce (website) ☐ Trade fairs ☐ Buyer visits (in shop for example) ☐ Other: .....
2.19	**How do you ship your products?**	☐ Air with Couriers (TNT, DHL, other logistic companies) ☐ Shipping with container ☐ Pick up from your showroom/office ☐ Other (specify): ....
2.20	**Do you involve your family members in your activities?**	☐ Yes ☐ No
2.21	**Do you intend to continue your activities over the next three years?**	☐ Yes ☐ No
2.22	**What is most needed to sustain your company?**	☐ Training/Education of employees ☐ Communication with buyers (foreign language skills) ☐ Partners in the value chain ☐ Employees ☐ Quality management ☐ Access to raw materials ☐ Modernization (production equipment) ☐ Access to markets ☐ Better/supportive regulatory framework ☐ Product and Packaging Design ☐ Marketing and sales ☐ Access to infrastructure (electricity, water, internet) ☐ Logistics ☐ Other (please specify): .....
2.23	**What are some of the issues when**	☐ Lack of skilled partners in (specify role): .....

	looking for value chain partners?	☐ Transportation challenges (specify): ..... ☐ Not enough networking events in the country, Central Asia and international ☐ ICT challenges (internet and phone connection) ☐ Other (please specify): .....
2.24	**How does the COVID-19 break-out impact your company?**	☐ shortages in supply of materials ☐ reduce of production ☐ employee dismissals ☐ product sales Please, specify how: .... ☐ Other (please specify): ....

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MODULE 3	Mapping of Training provider institutes	
3.1	**What is your Educational Qualification**	☐ Secondary ☐ Vocational/technical, namely: ☐ University, namely: ☐ Other: .....
3.2	**What subjects/ knowledge do you teach?**	☐ Rearing ☐ Processing ☐ Dyeing ☐ Weaving ☐ Painting ☐ Other: .....
3.3	**Duration of training**	
3.4	**Number of students you teach**	Per year: ..... Total.....
3.5	**Do most of your students keep on working in this field?**	☐ Yes ☐ No If yes, how many continued to work in your company ..... and how many established their own production? .....
3.6	**Do you use training curricula and if yes, please explain which one?**	☐ Traditional Ustod- Shogir training ..... ☐ State defined curricula..... ☐ Curricula developed by your institution/ company..... ☐ Curricula developed by an international development organization..... ☐ Other: .....
3.7	**Do you produce (sericulture) items during the training?**	☐ Yes ☐ No If yes, which products? ☐ Cocoons ☐ Raw silk ☐ (undyed) silk yarn ☐ Natural dyes ☐ Naturally-dyed yarn ☐ Synthetically-dyed yarn ☐Adras (Ikats) ☐"Atlas" (Ikats) ☐ "Khan atlas" (Ikats) ☐ "Suzani" ☐ Silk carpets ☐ Fashion (Clothes) ☐ Silk Home Accessories ☐ Silk fabric (not ikat) ☐ Jewelry/Necklaces/Bracelets ☐ Mulberry cosmetics ☐ Mulberry tea, juices, sweets ☐ Others (please, specify).....

3.8	**Do you use teaching materials (books, textbooks etc.)**	☐ Yes ☐ No • If yes, which ones?.....
3.9	**Do you provide official certifications for trainings or a specialist diploma?**	☐ Yes ☐ No • If yes, which ones?.....
3.10	**In your view, what are some of the main challenges encountered in education in the sericulture / Ikat sector in your country?** *(Please grade the most important reasons from 1 to 5)*	☐ Lost knowledge on traditional sericulture/ IKAT production among the (young) population, local communities and private companies ☐ Not enough lectures and trainings about sericulture / Ikat sector in school and university curricula ☐ Not enough hours of practical education for gaining skills in sericulture/ikat production ☐ No recognition of the value of the non-formal transmission of the knowledge embedded in the sericulture / Ikat sector (Ustod – Shogir teaching method) ☐ No (not enough) appropriate educational and training materials such as books, videos, documentaries, manuals or brochures; ☐ No (not enough) appropriate technical equipment and workshop facilities such as looms, workshop equipment, computers ☐ Not enough cooperation with national and international research centers, scientists, universities ☐ Lack of governmental support, programs and policy on education in the sericulture/ Ikat sector in your country ☐ Not enough involvement of new technologies and digital solutions in the education of the sericulture / Ikat sector (online learning programs) ☐ No proper recognized certification for formal/ non-formal education in sericulture/ IKAT sector ☐ Others (please describe): ....
3.11	**What are the main needs for professional and institutional capacity building in the**	☐ Development of new/ update of old curricula and teaching materials for the sericulture and Ikat sectors

sericulture/ Ikat sector in your country? *(Please grade the most important reasons from 1 to 5)*	☐ **Making full use of information and communication technologies. Development of educational materials and trainings online:** e-books, videos, documentaries, manuals and conduct online trainings, webinars etc. ☐ **Training on commercial/marketing activities related to sericulture/ Ikat** ☐ **New types of teaching about sericulture and ikat in schools and universities fostering sustainability: development of new interdisciplinary scientific, technical and artistic studies**, as well as research methodologies ☐ **Trainings on the potential of the sericulture sector for sustainable tourism** and the impact of tourism on sustainable development of the communities, groups and individuals concerned. ☐ **Acknowledging the value of the non-formal transmission of the knowledge and skills embedded in the sericulture/ Ikat sector;** involving practitioners and bearers in the development of educational programmes and inviting them to explain their heritage to younger generation ☐ **Alternative and experimental practices by employing participatory educational methodologies for children, youth, adults and tourists in the form of games, summer training, open-days, visits, photo and video contests, sericulture/IKAT itineraries** etc. ☐ **Facility of workshops** (looms, workshop equipment, materials including dyes, computers) ☐ Others (please describe):

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MODULE 4 PART A: Sustainability in general

4.1 Are you aware of sustainability issues in the sericulture/Ikat sector in your country?

☐ Yes ☐ No

- **If yes, please choose and explain:**

……

Environmental

☐ Climate Change
☐ Water Stress
☐ Hazardous Chemicals and Pollution
☐ Land Use and Biodiversity Loss
☐ Diminishing resources
☐ Consumption and waste (e.g. waste burning)
☐ Lack/inefficiency of Electricity

☐ Other……..

Social

☐ Poverty risk/Low payment
☐ No/poor contractual conditions
☐ No occupational safety
☐ No health and social insurance
☐ Gaps in education

☐ Other ……

4.2 Have you ever received a training or workshop on sustainability issues in the sericulture/Ikat sector?

☐ Yes
☐ No

- **if yes: when? By whom? What was the topic?**

……

……

4.3 Do you incorporate sustainability improvement aspects in your training/production?

☐ Yes
☐ No

- **if yes, please specify which:**

Environment

☐ Water pollution prevention
☐ Energy efficiency
☐ Waste prevention
☐ Reduction of Packaging

☐ Other……

Social

☐ Fair Working conditions
☐ Fair Payment
☐ Child labor
☐ Gender equality
☐ Diversity (e.g. disabled people)

☐ Other:……

4.4	**Are you aware or use any certificates (e.g. sustainability label/certificate or quality certificate)?**	☐ Yes ☐ No If yes, please specify material/product and label/certificate: ....
4.5	**Do you have something important to add for us about the issues of sustainability?**	Please describe and justify (you can give many answers here): ....

------- ONLY APPLIES IF INTERVIEWEE ENGAGES IN PRODUCTION -----

4.7	**Have you experienced challenges in terms of climate change (crop shortfalls, unusual climate that endangers silk larvaes)?"**	☐ Yes ☐ No Please specify, which: ....
4.8	**What are some environmental problems you have experienced in the silk value chain?**	☐ Lack of Access to Water ☐ Lack of Access to Electricity ☐ Energy efficiency ☐ Biodiversity loss ☐ Waste, Pollution ☐ Other.....
4.9	**How high is the larvae mortality rate per season?**	☐ Below 10% ☐ 10-20% ☐ 20-30% ☐ over 30% Have you found reasons? If yes, please specify: .....
4.10	**What are problems you have experienced in regard to dyeing?**	☐ Effect of chemical on nature/biodiversity ☐ Health risks for workers in physical contact with dye/wastewater

		☐ Health risks for workers inhaling polluted/contaminated air ☐ Health risks for neighboring communities ☐ Lack of access to water ☐ Water Pollution previous to process ☐ Water Pollution after process ☐ Other.....
4.11	**Which kind of chemical additives are used in your production process besides dyes?**	☐ Bleach (specify):..... ☐ Lubricants (specify):..... ☐ Coating (specify):..... ☐ Softener (specify):..... ☐ Other (specify substance) .....
4.12	**Do you have wastewater treatment facilities?**	☐ Yes, water is treated before discharge (please specify): ..... ☐ No, water is discharged into water streams (e.g. river, lake) untreated
4.13	**What social challenges need improvement in the silk/Ikat production?**	☐ Fair Working conditions ☐ Fair Payment ☐ Safety of workers ☐ Child labor ☐ Gender equality ☐ Inclusion e.g. of disabled persons ☐ Support of local communities ☐ Unpredictable, unsteady demand (only short-term contracts) ☐ Other:.....

Annex 3

Table 2 - Process decription of Cocoon farming

Process name	Process description
Moth breeding	Healthy moths are chosen for breeding and laying eggs
Mulberry harvesting	Mulberry leaves are continuously harvested as feed for the larvae
Larvae Farming	Larvae hatch after 10 days. They are fed fresh and moist mulberry leaves and continue feeding for 20-35 days while going through five growth states, four of them completed by moulting.
Cocooning	After the silkworm is reaches its final stage (after 24 days according to experts from Uzbekistan and Tajikistan) days old it starts spinning a cocoon. The process takes 7-9 days (Bazarovich A. 2012).

Table 3 - Process description of the Yarn preparation

Process name	Process description
Sorting of silk cocoons/	Silk cocoons are sorted according to quality criteria
Silk scouring/ degumming/	Silk cocoons ('hard silk') are degummed in 40°C hot water to remove sericin and impurities and to loosen the fibres sericin wastewater can further be used for e.g. textile finishing agent, medicine or cosmetic products
Reeling	9 filaments are jointly unwinded from cocoons swimming in a warm water bath in order to form a single thread
Re-reeling	The silk yarn is again unwound from a small to a larger reel while quality and uniformity of threads are re-controlled
Silk washing/	Washing of silk in acid water to further separate sericin from silk fiber, thereby softening it
Squeezing and drying	The skeins of silk are squeezed and hanged for drying
Spooling	Silk skeins are spooled onto thread reels

Warping	Bundles of the warp are secured with a loose knot before taken down from the beam. Up to 40 threads are passed through the “Geleseblatt” and attached to the beam forming a 200 to 400 meters long warp.
Warp chaining	Warp is taken down from the beam and is secured by a specific technique (chaining)
Warp winding	The warp is wound in the length of a desired pattern repeat or size of cloth. The Bundles of the layered warp are secured with threads in order to fix it for the painting of the yarn.

Table 4 - Process description of Dyeing

Process name	Process description
Painting of pattern	Future coloured areas of the Ikat pattern are marked on the warp threads
Tying the yarn/	The warp is tightly tied with threads, covering the areas which are supposed to be reserved from dyeing
Preparation for dyeing	Before dyeing, the warp is soaked in water regarding the type of dye. If natural dyes are used, the yarn is pre-mordanted with alum and the dye solution is boiled at least one hour before the yarn is dipped into the dye bath.
Dyeing	Depending on the type of dye (synthetic or natural), the yarn is dipped into the dye bath, depending on how much time is needed for a particular colour (e.g. 1-2 hrs). The temperature depends on the type of dye, such as hot or cold dye, and the material itself for example silk requires mostly a lower temperature than cotton.
Rinsing	Dyed yarns are washed out under running water to remove excess colour pigment and prevent it from leaking out during subsequent washing
Squeezing and drying the warp	
Untying	

Table 5 - Process description of Weaving preparations

Process name	Process description
“Open-added”	The layers of warp are carefully detached from each other and wound around a long stick. The end of a pattern repeat (per layer) is marked with a piece of thread before the warp is chained for transportation.

Making the cross	Cross This step is important so that the warp threads remain in the original order. The warp threads are secured with a thread or wooden sticks.
Making heddles	4,000 threads are counted and grouped. The heddles are made by tucking a thread around a small wooden piece
Threading the shafts	The heddles are threaded first using a slick thread and then being replaced by a wooden stick. Hereby the warp is divided into shafts. The number of shafts is defined by the type of weave pattern.
Reeding	Using a sleying hook.
Beaming	The warp is knotted to the breast beam and tensioned with a brake. The warp's tension is secured with a 5 to 10 kg weight attached to the end of the warp which is placed over the back beam.

Table 6 - Process description of Weaving

Process name	Process description
Weaving	The weaving itself takes place on traditional wooden foot-treadle floor looms and semi-automatic shuttle loom machines operated by hand.
Throwing shuttle	The weavers use a flying shuttle to fasten up the weaving process (in case of using a traditional loom). The semi-automatic loom machines are controlled by weavers.
Weaving a pattern	Woven patterns vary from plain weave to different satin variations. During the weaving process the desired weaving pattern is controlled through the use of foot-treadles.

Table 7 - Process description of Finishing

Process name	Process description
Washing and trimming of woven fabric	The finished fabric is trimmed to the desired length and then washed to remove impurities and prepare it for the finish
Egg-white finishing	Whipped egg white is applied to the fabric's surface and then dried until silk threads have absorbed all of the liquid
Beating of the fabric	The fabric is folded and then beaten with a wooden hammer weighing 8 to 15 kg according to the length of fabric. While beaten the fabric is placed on a stone. After the froth has been worked into the fabric it is pressed and dried placed between two weigh down wooden panels. (MCI 2020)

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