



Research Article

Production Activities and Value Chain Analysis of Sericulture in Western Inner Terai Region of Nepal

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Keywords: Value Chain; Sericulture; bivoltine; cocoon; silk

Abstract

The study was conducted in Nov 2019 – Feb 2020 with the objective of assessing the whole value chain of sericulture products in the Western inner terai region of Nepal. The beginning of sericulture in the region was due to some personal interest but gained popularity and huge return and turned out to achieve the objectives of food security and source of employment. As per the finding and research, Bi-voltine Silkworm (*Bombyx mori*) was mainly reared which feeds upon the leaves of the mulberry plant. The interview result indicates that producers produce cocoon at an average of 30.05 kg per ropani in one production round and production was made twice a year. In this region, three marketing channels were identified (producer to the primary collector/small hand processor) and (producer to primary processor or reelers) and the producer himself as the processor and distributor. Producers sold the cocoon to primary collectors at NRs 500per kg cocoon which was 15% more than percent sales while selling to the government, fetching an average BC ratio of 1.3. Problems recorded as per farmers were lack of appropriate technology to widen the scope of sericulture and modern silkworm rearing techniques, lack of proper irrigation facilities, and governmental aids and support. This research will address various problems and make an emphasis to make regional sericulture production mature and profitable.

Introduction

Agriculture has been the major part of Nepalese economy as more than 65% of people are engaged in agriculture and it contributes 34% of total GDP (Chanotra *et al.*, 2019). Among the different agricultural products produced and exported from Nepal, silk is growing as a competitive one. In Nepal, for achieving higher economic growth, agriculture and sericulture should be taken into parallel with each other (APP, 1995).

Silk is an agro-based industry. It involves rearing of silkworm (*Bombyx mori*) of various varieties for the production of raw silk, in which the yarn obtained out of cocoons spun by certain species of insects. The major activities of silk comprise the cultivation of feed plants popularly called mulberry to feed the silkworms that spin and reel the silk cocoons and finally unreeling the silk cocoons for adding edges of products by processing,

weaving, and design. Sericulture has boundless advantages like high employment potential, provision of a platform for assisting rural economics, short gestation hence quick returns, women amiable and empowering occupation, eco-friendly and can stand out as an ideal scheme for weaker and vulnerable sections of society. Expectations for high-value bivoltine silk as a new non-traditional export product that aims to remunerate and improve the income of Nepalese farmers including small scale farmers and farmers along the perimeter are sky-high. The most important and beautiful benefit of silk is that it can be practiced on small to medium-sized land following marginality. In this regard, silk can be one of the income-generating activities for rural communities in the Deukhuri region (Shrestha *et al.*, 2012).

Silk is new agro-business technology for Dang and for various parts of the mid-hill region such as Dhankuta, Dhading, Palpa, Syangja, Parsa, Gulmi, Kavre that had been targeted as a tool for poverty reduction. 38 Districts of Nepal from Central Midlands of the Mid Hills altitude ranging from 750 to about 1500 meter, the slopes and valleys between the Mahabharata range and Shiwalik ranges (Kathmandu and Pokhara valleys) are declared to have topographic and climatic feasibility for sericulture. The Inner Terai region (Dang and Chitwan valleys) ranging from 100 to 750 meters are ideally suited for the development of the sericulture industry in Nepal as per various research and study were done by UNDP, FAO, JICA, and non-governmental organizations (GNRC, Sericulture) (Sattaur, 1994). But, in most of the regions, the sector is at the infant stage that requires focusing on both biological and physiological aspects. Since the sector has been untapped and lagged behind, research will be thoroughly conducted and hence fill the gaps existed. Hence, silk production and it's a promotion to enhance the income of low-level farmers, addressing and assessing the prevalent constraints in terms of production and marketing between all the actors should be conducted and this study was designed to assess the performances of silk production systems; to assess the status, opportunities, and constraints of silk production systems; to assess the marketing channel and constraints and opportunities of silk marketing (Madsen, 2012; Zheng & Chen, 2003).

Methodology of Research

Method of Data Collection

A purposive sampling technique was used to conduct the study with a sample size of 10 household involving in sericulture and, were interviewed. Following the sampling technique, the necessary data were collected by administering pretested questionnaire to members of Sericulture Development Division (SDD), Khopasi and a set of checklists and questionnaire to the selected respondents of study area for primary data collection. Pretesting was done by asking the initially designed questionnaire to some

elite sericulture farmers and governmental institutions of the study area and the suggestions obtained from them were considered into our final questionnaire. assesses the production system of silk, the study focused on inputs of production-to-production management using forward and backward interviewing techniques. Both quantitative and qualitative methodologies were used to collect information from different actors involved in the value chain analysis of sericulture. The selection of farmers was made purposively based on their participation in silkworm rearing in coordination with the experts of the Sericulture Development Division (SDD). Since farmers involved in this sector are not accessible, well registered, and sustainable in the work, 10 accessible and better farmers of the Gadhawa Municipality located in the Dang District of Nepal were selected and used for the assessment (Kaplinsky & Morris, 2000 & 2008). A marketing study was conducted from the farm gate to the end-user (the processor) of the product across the value chain (Akram 2016; Koju, 2015).

Key Informants Interview (KII), Field Observations, and Structured questionnaires were used as the primary source of information. A visit was also made to the Sericulture Development Division, Khopasi, Kavre. A set of questionnaires was prepared to address the area for mulberry cultivation, amount of silk produced in the previous year, the current market price, silk processing, and marketing channels, production and marketing constraints, and were asked to the selected respondents of the study area to collect the primary data. Secondary source of information was collected from SDD, Reports from Sericulture Association Nepal (SAN), rapid market appraisal with the competent traders, buyers as well as whole sellers, and desk reviews of published and unpublished research articles and pape NRs (Thapa & Ghimire, 2005).

Method of Data Analysis

SWOT Analysis

It is a strategic tool which is used for evaluation of position of a farm enterprise or a company for the clear manifestation of waves of both internal and external factors which eventually help or arrest the firm's growth or success. So, a SWOT analysis entails firm's strengths, weaknesses, opportunities and, threats. Both strengths and weaknesses are internal while opportunities and threats are external.

Indexing

After successive data collection from various sources, descriptive and quantitative analysis were done. Problems recorded in our study area were ranked accordingly with the use of index and scaling technique which provided the severity or extremities of the respondents towards our propositions. The intensity of productions and marketing problems related to silk and faced by the farmers were identified using three-point scaling technique comparing

severe, moderate and slight using score 3,2, and 1 respectively.

Formula for the index for intensity of various problems:

$$I_{prob} = \sum(S_i \cdot f_i / N),$$

Where, I_{prob} = index value for intensity of problem, \sum = summation, S_i = scale value of i^{th} intensity, f_i = frequency of i^{th} response, N = total number of observations (Fig.1).

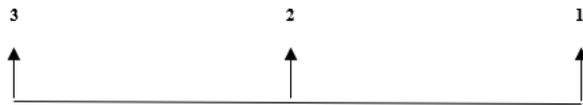


Fig. 1: Scale value for indexing of problems

In addition, different analyses were done to identify economies of production such as:

Gross margins

Total costs

B/C ratio

Results and Discussion

Benefit Cost Ratio

Benefit cost ratio is the indicator that is used to calculate the profitability analysis.

It is calculated by using formula: B:C ratio = Gross return/ Total cost. Average B:C ratio in our study area was found

to be 1.38, which shows the profitability in sericulture in that area.

Gross margin analysis:

Gross margin is the function of productivity, per unit price of output and total variable cost.

To calculate gross margin following formula is used:

$$\text{Gross margin} = \text{Sale margin} - \text{Variable cost}$$

Average Gross margin NRs per ropani in our study area is 8542.63 and NRs per kg is 128.77 is found.

Value chain map of sericulture

Value chain analysis highlights that goods and activities are produced by different sequential sets of activities. Graphical illustration of all components and the relationship between the components is performed by a value chain map shown in Fig. 2 (Kumar & Rajeev, 2016).

Current Market Channels of Sericulture

Channels of value chain include a chain of business through goods and services are passed until it reaches the final consumer. In our study area, we mainly found 3 channels of the value chain of sericulture among which the second one is highly practiced (Tesfa et al., 2014) (Fig.3).

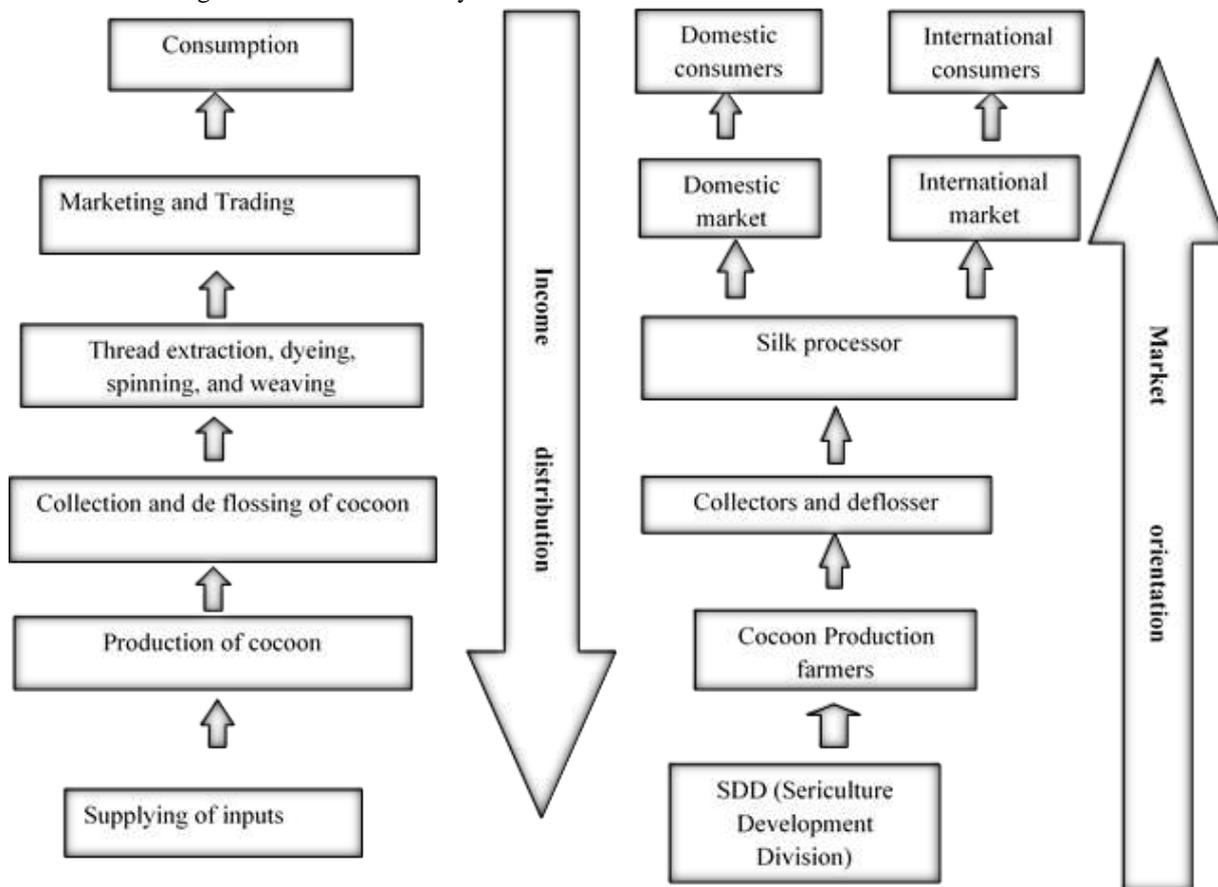


Fig. 2: Value Chain Map of sericulture. Adapted from Kumar & Rajeev (2016).

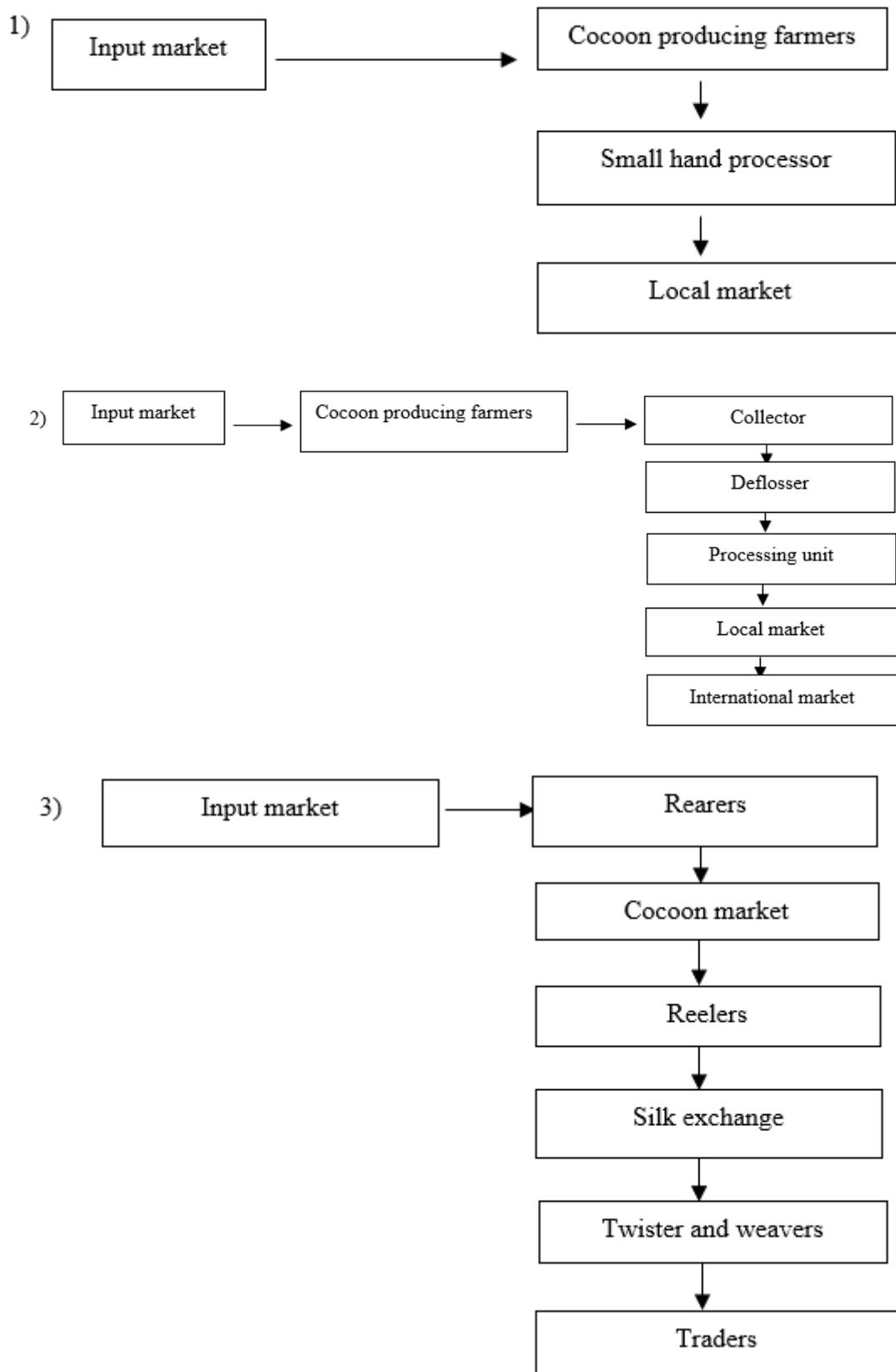


Fig. 3: Different value chain of silk in study area

Value Chain Perspective from Processing Factories

The value chain map consists of production and distribution processes involving input supply, production, transportation/collection, processing, grading, and packaging and marketing both for domestic and export markets (Fig.4).

The production process begins after the fresh cocoon is harvested. Once silk cocoons are harvested, they are collected by deflosser for making raw silk, which are then sent to the processing unit for silk products. The prepared silk products are then sent to the domestic market and international market.

Price spread of Silk

Price spread is defined as the actual price paid by consumers, price gained by producers, cost incurred and profit margin gained by different agencies (Table 1).

There is the vast difference between price paid by consumers and the price received by producers due to the

Price distribution among different processing units such as small hand processor, collector and deflosser, reelers, twisters and weave NRs.

Value Addition, Margin of Silk Different Chains

Table 2 shows the movement of silk was not confined in a single channel. Different channels were observed from the beginning of production to the final marketing with different value addition activities. Value addition is gradual process in which the products get better in each step and gets valued. The product will get enhanced in terms of quality, it's usage value and a raw product finally becomes

a finished goods. Several factors like processing, labor cost, designs, transportation affects the price of the finished commodity. These factors fix the price along with the profit margins (Fig 5).

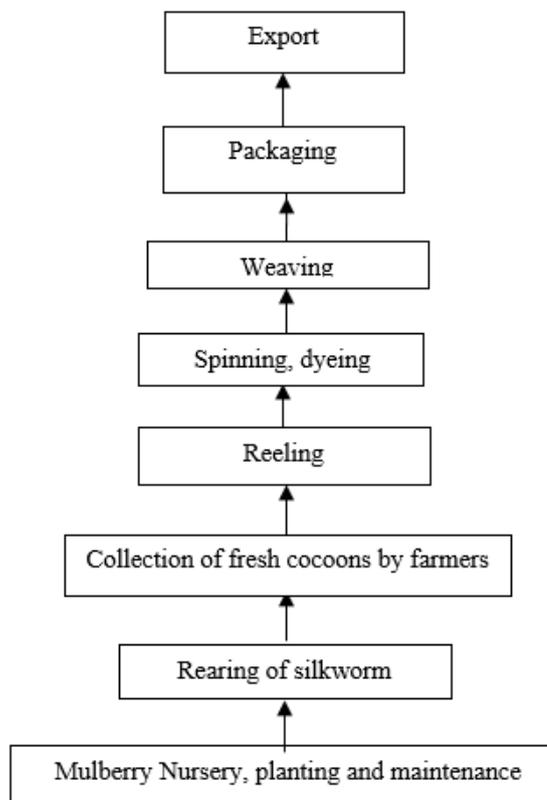


Fig. 4: Value chain of processing silk Source: Field survey (2020)

Table 1: Price spread of silk

Value chains	Local producers	Small hand processors	Collectors and deflossers	Reelers, twisters and weavers	Processing unit	Local market
1.	NRs. 500 per fresh kg cocoon	NRs. 4225 per kg dyed yarn	-	-	-	NRs. 4225 per kg dyed yarn
2.	NRs. 500 per fresh kg cocoon	-	NRs. 4225 per kg dyed yarn	-	Rs 9000 per finished product made out of 1 kg yarn	Rs 9000-25000 with 10% profit margin based on design of silk.
3.	NRs. 500 per fresh kg cocoon	-	-	NRs. 4550 per kg dyed yarn	Rs 9000 per finished product made out of 1 kg yarn	Rs 9000-25000 with 10% profit margin based on design of silk.

Source: Field survey, 2019/20

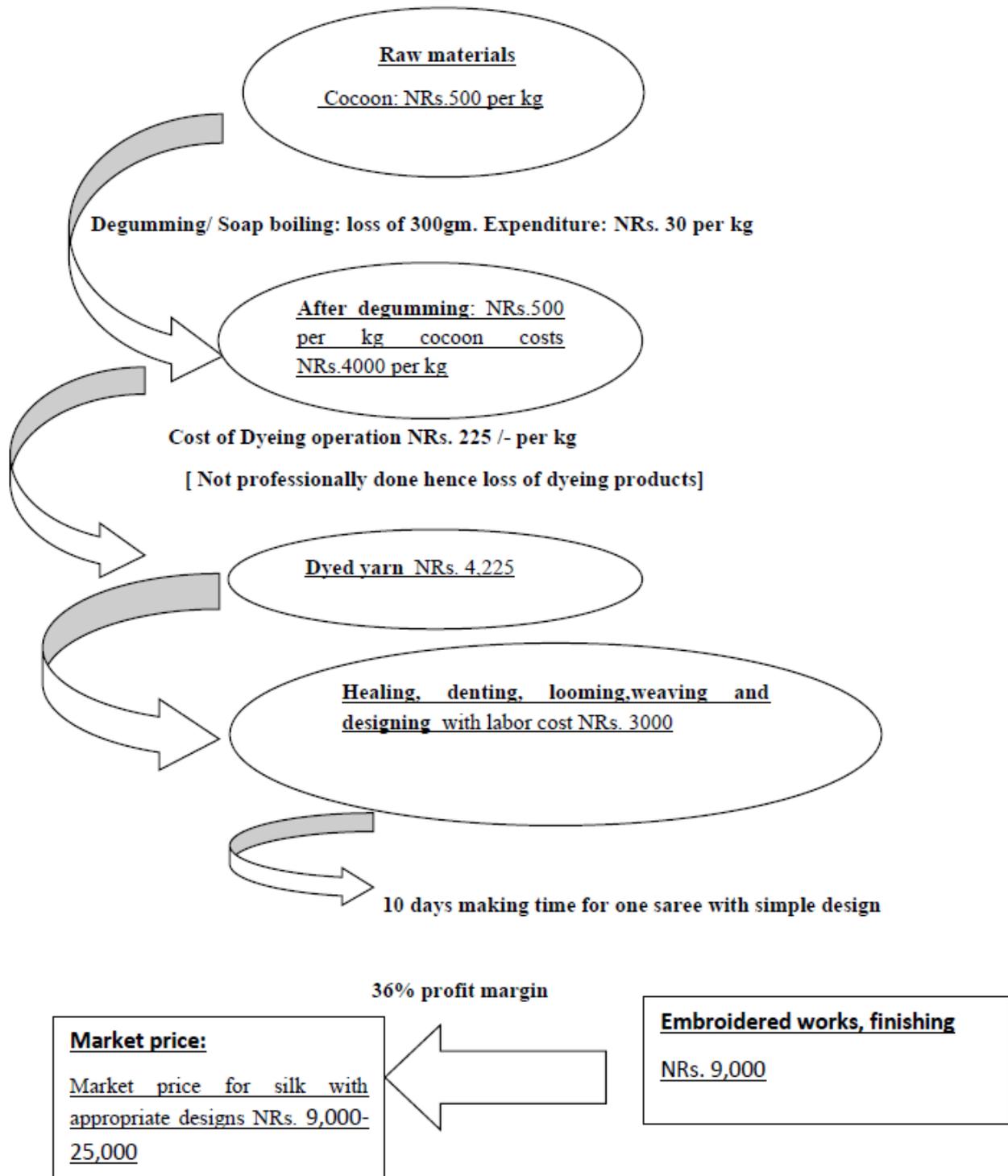


Fig. 5: Value addition of high value silk

Table 2: Value chain actors; their roles and responsibilities in sericulture.

Actors	Description
Input Suppliers	Input suppliers are the ones who supply all the essential materials or inputs required for the production process. Silkworm eggs, saplings of mulberry plant and different tools and equipments are the major inputs required. Eggs are solely produced and distributed to all the producers by government. Saplings for the production of mulberry plants are locally available in nurseries.
Producers	Producers are the actors who rear the silkworm eggs till it produces cocoon. They send the cocoons further for primary processing. Most of the producers here are of small-scale type. They produce cocoon and supply it to the primary process NRs. The rate is generally fixed by primary processors and it is slightly higher than that recommended by government.
Collectors/Primary Processors	They are the actors in value chain who collect fresh cocoon produced by producers for further processing. They perform the primary level of processing by reeling of fresh cocoon within 24 hours to produce silk which is stored for few months before it is sold to secondary processing facilities. Different operations are carried out by processors such as deflossing, spinning, to produce silk out of cocoon. Around 500 silkworms or 80kg of cocoons and 200 kg of mulberry leaves are required to produce 1kg raw silk. Per kg price of cocoon costs NPR 500. The end product, the raw silk filaments, are reeled into skeins which are packaged into bundles weighing 2-4 kg, called books. The books are further packaged into bales of 60kg and transported to manufacturing centeNRs.
Secondary Processors	They are the ones who buy raw silk from the primary processors and do further processing by dyeing the silk for preparing garents etc. Secondary processing includes spinning, degumming, dyeing, weaving. Silk clothes are the final product for export market. However, for domestic market raw silk undergo further processing called real silk fabric. Primary processing activities in Gadhawa is mostly carried out in Sunita Silkworm Rearing Pvt. Ltd. And for secondary processing, it is sold to various industries in Kathmandu. Main processing activities are reeling, thread extraction, dyeing, spinning and weaving. The technological support is also provided by Sericulture Development Division, Kavre.
Exporters	Exporters are the actors responsible for exporting the silk fabrics or products. Sericulture Association Nepal (SAN) is one of the major exporter unit. It does the processing and exporting activities. The raw silk is exported to Korean company where further processing is carried out and silk fabric is produced. Similarly, silk clothes are exported from Nepal to different other countries.
Wholesalers and Retailers	Wholesalers and retailers are the final actors linking the products to the consumers in market chain. Sericulture Association Nepal (SAN) which is one of the exporters, is also the wholesaler unit which processes the raw silk and distributes to the retailers at reasonable price. The retailers deal directly with the consumers i.e. the final product (silk products) is distributed to the consumeNRs.

SWOT Analysis

SWOT analysis highlights an overview of the cocoon production in the various stages of the value chain. It identifies all the strengths, weaknesses, opportunities and threats throughout the process. Strengths and weaknesses

encompass the internal factors whereas the opportunities and threats define the external factors related to the process. The SWOT analysis is displayed in the Table 3.

Table 3: SWOT analysis of sericulture throughout the production and marketing.

Strengths	Weaknesses
<ul style="list-style-type: none"> ● Climatic suitability. ● Increasing demand in local, national as well as international markets. ● Governmental assistance and support. ● Availability of land favorable for mulberry cultivation. ● Formation of Farmer’s Group and co-operatives for better production ● Availability of family labor. ● Trainings, seminars related to quality processing accessibility. ● Handmade silk products. ● Better channels and linkages for cocoon collection. 	<ul style="list-style-type: none"> ● Shortage of input supply. ● Lack of technical knowledge on production and management. ● Land fragmentation. ● Variation in silkworm quality. ● Decreased level of productivity. ● Less coordination among the development agencies. ● Shortage of water supply in different areas. ● Inadequate out-reach and follow-up of extension programmes. ● Inferior quality of processing machines. ● Less availability of expertise in marketing.
Opportunities	Threats
<ul style="list-style-type: none"> ● Better scope for the increment in production and productivity. ● Availability of land for sericulture in mid hills and inner terai. ● More interest of farmers towards silk. ● Growing demand in markets. ● Various institutions (public and non-governmental) working in this sector. ● Quality improvement in silkworm egg through university and governmental research. ● Availability of markets for selling fresh cocoons. 	<ul style="list-style-type: none"> ● Risks of pests(ants) and diseases(muscardine) infestation. ● Higher production cost. ● Uncertified silk being sold in market. ● Variation and inconsistency in volume and quality of production. ● Very less research in quality processing technology. ● Government monopoly in silkworm eggs production. ● Comparatively cheaper cocoons from other countries. ● Less price for other synthetic silk-like fabrics.

Problems Faced by The Silkworm Producers

Different production problems were perceived differently by silk growing farmers in the study areas. Financial problem got the first priority followed by problem of low technical knowledge, attack of insects (armyworm, stem borer) and occurrence of diseases (Table 4).

Table 4: Marketing problems faced by the silkworm producers

Production Problems	Index value	Rank
Insects and diseases	2.4	2nd
Low technical knowledge	2.1	3rd
Low Scale of production	1.8	5th
Climatic condition	1.9	4th
Financial problems	2.5	1st

Source: Field survey 2019/2020

Note: Scale value ranges from 1 to 3 where, 1=low, 2=moderate, 3=high

Marketing problems include lack of transportation as the main problem followed by monopoly in price fixation, lack of awareness to domestic consumers and finally absence of middlemen to ensure the consistent supply (Table 5).

Table 5: Marketing Problems showing index values and their ranks

Marketing Problems	Index value	Rank
Lack of transportation	2.4	1st
Monopoly in price fixation	2.3	2nd
Lack of awareness to domestic users	2.2	3rd
Absence of middleman to ensure the consistent supply	2.1	4th

Source: Field survey, 2019/20



Fig. 6: Series of production of silk product in our study area viz., silkworm eggs, feeds for silkworms (mulberry), cocoon, and silk products.

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