CHAPTER: 7

An Empirical Analysis on Income & Employment Generating Issues in Artisanal Silk Industry of West Bengal (A Case Study of Malda District)

7.1 Introduction

The preceding chapter elaborates on the successful increase in raw silk production in West Bengal, especially in mulberry variety with higher productivity. During 1980-2004, a positive annual growth of 4.16 percent was observed while the annual growth in mulberry area during the same period had been only 1.83 percent (Lakshmanan, 2007). This higher growth of production level over area of cultivation indicates a vertical growth of sericulture in the state instead of horizontal extension. It has also been noted that sericulture is practiced in few concentrated regions of West Bengal compared to other traditional silk producing states. As evidential support we can state that West Bengal has highest 'sericulture families per village ratio' i.e., 48.9%, while in Karnataka, Andhra Pradesh and Tamil Nadu this ratio is only at 14.29%, 13.32% and 5.26% level, respectively (CSB, 2003). This spatial concentration leads to the development of a particular region depending on this livelihood. Malda district is such region in West Bengal where a large number of rural and semi urban population is engaged with this vocation and which produces 75 percent of the state's production (Ali, 2008). This chapter is based on a field survey of certain sericulture rich villages in Malda district.

In the post globalised era while millennium development goals are emphasizing on inclusive development and rural income-employment generating issues are receiving top priorities to combat with inequality and poverty, this regional rural analysis is expected to add few important insights regarding these issues. The increasing popularity of sericulture has been attributed to its short gestation period and quick recycling of resources (Anantha Raman et al., 2007). Sericulture is also such a livelihood where the entire range of activities generates a moderate flow of income and creates employment opportunities for a substantial number of female labourers both inside and outside the domestic sphere. Women workers whether domestic or hired, play a very significant role in the activities spectrum as well as in decision-making of this household business. According to general perception, women's role is mostly confined to silkworm rearing, but in reality it goes far beyond this. Leaving the shackles of gender-stereotyping, women in sericulture often take part in mulberry planting, weeding, manuring, irrigating, leaf picking, leaf transporting and storage. In silkworm rearing, they are engaged in leaf-cutting, feeding, bed cleaning, worm spacing, mounting, harvesting and disinfections. Contribution of women labour is substantial in silk reeling and silk weaving, too.

The entire sub sectors, which include silkworm-seed sector, cocoon sector, post-cocoon sector, fall under the cottage and small scale sector. It particularly suits all those rural marginal farmers and artisans, who do not have sufficient funds for investment but need a higher return to combat against poverty. Compared to other traditional silk producing states like Karnataka and Andhra Pradesh, sericulture is still an unimproved rural based activity in West Bengal depending mainly on the flows of intergeneration skill of the rural artisans. Researchers opine that there exists a significant gap in productivity at farmers' level and yield potential in West Bengal (Bagchi et.al., 2008). Major reasons for low acceptance of the technologies were identified as inadequate linkage between scientists and farmers, the former being not in consonance with the farmers' need and non-compatibility with the total farming system. Corporate entry in this sector is still a distant dream and the authority support is at bare low level much less from its deserving threshold. Sericulture-artisans often go through multidimensional problems in the process of income generation, which will be empirically analysed in this chapter. However, the opportunity of the sector lies in its income effect associated with the large section of downtrodden artisans who could in turn generate a large

spillover effect in the society as a whole. Poverty and income inequality can be harnessed if expansion of sericulture can be sustained in the rural sector. As a matter of fact, it has been observed that in sericulture 57% of its final value is ploughed back to the primary producers (Gangopadhyay, 2008). Again, according to Mattigatti (2000), the price spread of sericulture goods accounts for 48.4% for the mulberry farmers-silkworm rearers, 17.7% goes back to reelers & twisters and 12.3% goes back to weavers and dyers. Thus sericulture supports in promoting the growth in income level of the excluded group and can be considered as an engine of inclusive growth in agro-based developing economy.

Employment generation is the other major potential of the artisanal silk sector especially in the rural unorganized sector. The farm and non-farm activity of this sector creates sixty lakh employment every year in rural and semi-urban India. The significant part of this employment generation includes its capability of transferring wealth from high end urban customers to poor artisan classes. In West Bengal, 1.14 lakh families are occupied with sericulture activities in 2339 villages during 2010-11 (DoS- Govt of West Bengal, 2011). During the five years of the Eleventh Plan (2007-12), the production of raw silk in West Bengal rose from 1660 MT to 1924MT showing an annual growth of 2.9 percent while the employment generation for the consecutive period shows a decline from 3.03 lakh to 2.71 lakh (http://seriwbgov.org). This rising production trend coupled with declining employment trends raises few queries which will be addressed in this chapter.

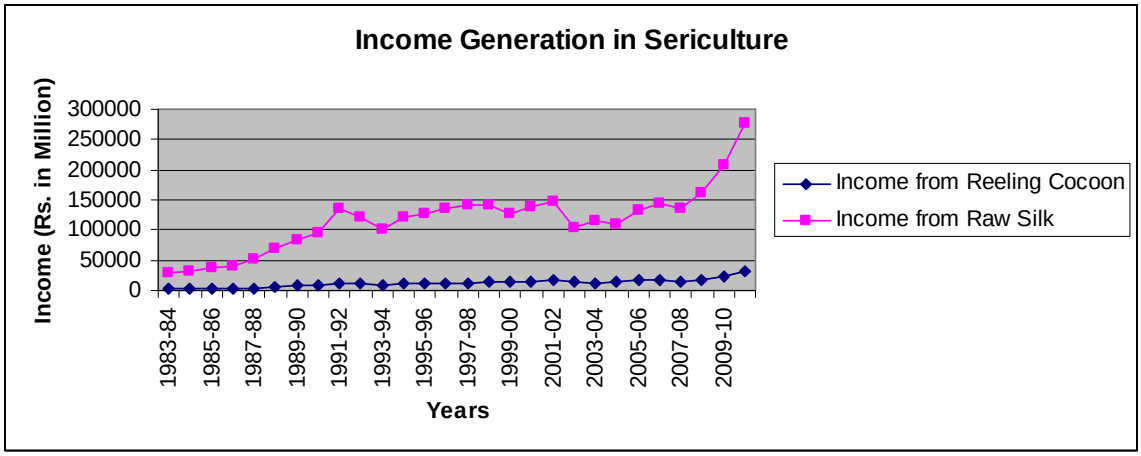
The prime objective of this chapter is to delve into various intricate issues of income and employment generation in the artisanal silk industry of West Bengal. Econometric analysis will help to identify the significant explanatory variables behind the income and employment generation of this artisanal silk industry in West Bengal. Multivariate regression analysis will be attempted on the data collected from certain sericulture rich villages in Malda district. These results will provide regional reflection as compared to that estimated on the basis of national level secondary data on silk production.

7.2 Income Generation Trends in Indian Sericulture in Pre & Post Period of Globalisation (1983-2011)

Sericulture is a vertically integrated industry where starting from mulberry cultivators and silkworm-rearers, different producers adds value in assembling the production up to raw-silk production. The raw silk is again transformed to soft-silk by dyeing and printing on it and ultimately the silk-fabric is sold as a semifinal/final product to the consumers in the market. However, domestic production data regarding reeling cocoon and raw-silk is widely available including its price variation. Place of raw-silk is also higher in the assembly-line compared to reeling cocoon. Therefore it may be assumed that value of raw silk is inclusive of the value of reeling cocoon. Therefore, in this section we will analyse the income generation trends of raw silk production, as it would automatically include the trends of income generation by the reeling cocoon production. Comprehensive and simultaneous data on price and output of both raw-silk is available for 1983-2011. The period is also significant in the sense that it can help us to compare the trend in the pre and post globalization period. Value of reeling cocoon production has maintained a horizontal trend, which implies that the reelers maintained a positional constancy during this period. On the other hand, value of raw silk has maintained a positive rising trend in the pre-liberalization period (i.e., during 1983-1991), while effect of globalization has blocked the rising trend and fluctuations were observed up to 2005-06 and thereafter the income generation in sericulture has taken a progressive trend (See Fig 7.1).

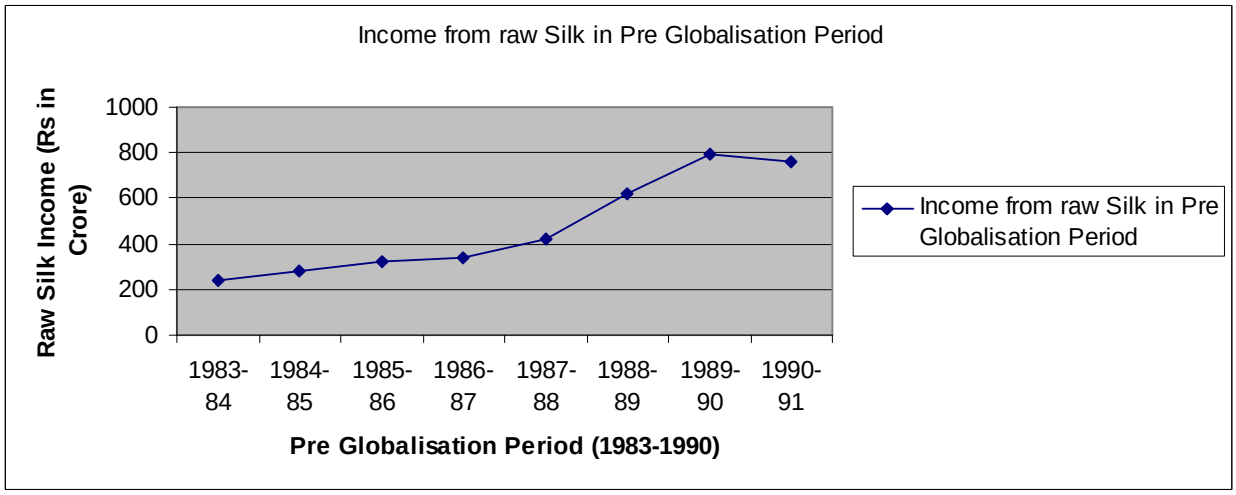
Rising trend in income generation from raw-silk production from the year 2005 onwards can be attributed to the rising prices of raw-silk, which is an off-shoot of antidumping regulations imposed by Government of India on imports of Chinese silk. This provided protection to a large number of silk rearers and reelers, though silk weavers have been adversely affected through the price rise of their raw materials, i.e., raw silk. However, the rise in income is responsible for increasing trends of both production of raw silk as well as prices of it.

Fig 7.1 Income Generation Trends in Sericulture in India (1983-2011)



Source : Central Silk Board, 1999, 2003, (online data)

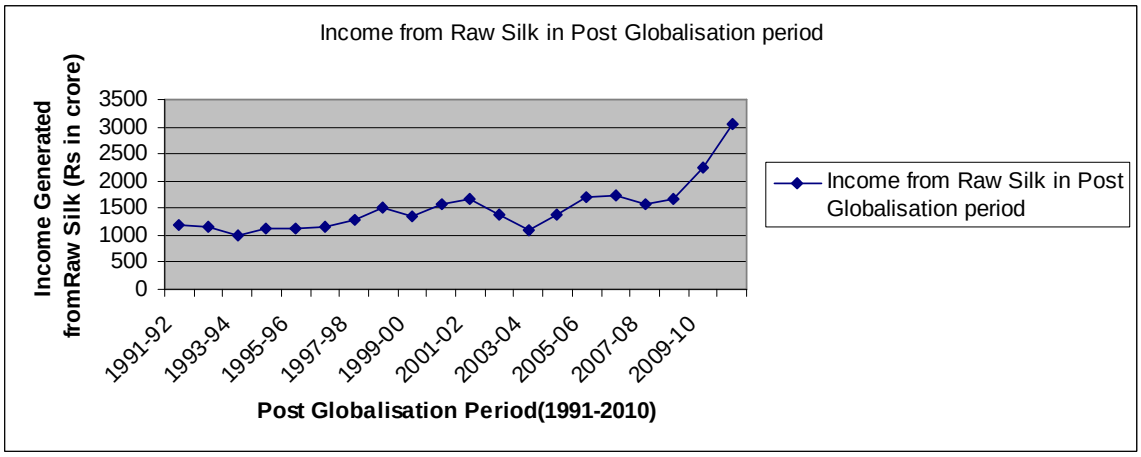
Fig 7.2 (a) Income Generation from Raw Silk in Pre Globalisation Period



The reasons for the rise in production again depends upon a host of factors like area of mulberry cultivation, amount of reeling cocoon production, price of reeling cocoon, and also on amount of raw silk imports. Raw silk is sold to the merchants and dyers and printers who manufacture the final good, i.e., silk fabric/ silk cloth. This part of activity is usually centered in urban and semi urban areas. Though the rising trend of income generation of silk fabrics over the years (1991- 2011) ensures the growing demand of the product in the society, the study primarily explains the factors behind this income generation through raw silk production. Raw silk producers are mostly concentrated in rural locations and any rising trend of income would signify a step forward towards poverty alleviation. The secondary national level time series data is available on silk production from Central Silk Board database as well as state level data for few years. On the basis of earlier hypotheses models of income generation will be constructed with the help of national level data. Against this background,

the field level survey would add some special insight which can be justified as influential-regional factors playing dominant roles during the process of income generation in artisanal silk industry.

Fig 7.2 (b) Income Generation from Raw Silk in Post Globalisation Period



CAGR (1983-1990) = 18.1% growth in income generation from raw silk
CAGR (1990-2010) = 5.1% growth in income generation from raw silk

7.2.1 National Level Model of Income Generation from Silk Production

On the basis of the available secondary data of 28 consecutive years (1983-2011), a model of income generation is constructed in this section. From the usual perception it can be assumed that income generated from raw silk production (Y) is dependent on certain variables like area of mulberry cultivation, price of reeling cocoon, quantity of reeling cocoon, amount of raw silk imports, number of persons employed in the sector. Mulberry leaf is food for silkworm and therefore higher the area of mulberry cultivation higher will be the raw silk production and its income. Reeling cocoon is the input through which raw silk yarn is produced through reeling, spinning, twisting and winding. Therefore a greater number of reeling cocoon will suggest higher raw silk and silk yarn production and higher associated income. Similarly, price of reeling cocoon is also a vital explanatory factor for income generated from selling of raw-silk. Again income from raw silk is also dependent on employment generation from sericulture as higher levels of involvement are expected to raise the level of income generation. Barring all these factors, imports of raw silk also have certain influence on income generation out of selling raw silk. Assuming a linear relationship between the dependent and independent variables, we may write up the following equation which captures the essence of income generation in this raw silk sector.

<u>Income Generation Model</u>

$$y = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2 + a_3 x_3 + \alpha_4 x_4$$

Where, y = income of the raw silk producers
x_1 = area of mulberry cultivation;
x_2 = price of reeling cocoon;
x_3 = quantity of reeling cocoon;

x_4 = quantity of raw-silk imports;

Regressing with Ordinary Least Square Method on the time-series data (1983-2011), with various combinations of predictors, the following econometric results are found. The F-statistic= 412.353 (with 27 degree of freedom), is found to be significant in the following model assuring goodness of fit of the model.

Table 7.1 Estimated Coefficients of Income Generation Model

Explanatory Variables	Estimated Coefficients	T	P- Value	Collinearity Statistics VIF
Constant	-52632.1	-4.629	0.00	
Area_ha (x_1)	0.174	4.759	0.00	1.149
Pr_RC (x_2)	1280.648	28.136	0.00	1.149

a Dependent Variable: INC_RS (Income from Raw Silk)

The Adjusted R^2 = 0.968, which explains around 97 percent data variation of the dependent variable can be explained by the regressors, which is quite satisfactory. The Durbin Watson Statistic = 2.25, which explains that no serial autocorrelation is present. The estimated regression coefficient shows no serious problems of multicollinearity, as the VIF (variance inflation factor) of all the coefficients are significantly less than 5. Thus meaningful econometric relationship of income generated from raw-silk production (INC_RS= y) can be traced only with Area of Mulberry Cultivation (AREA_HA = x_1) and Price of Reeling Cocoon (PR_RC= x_2).

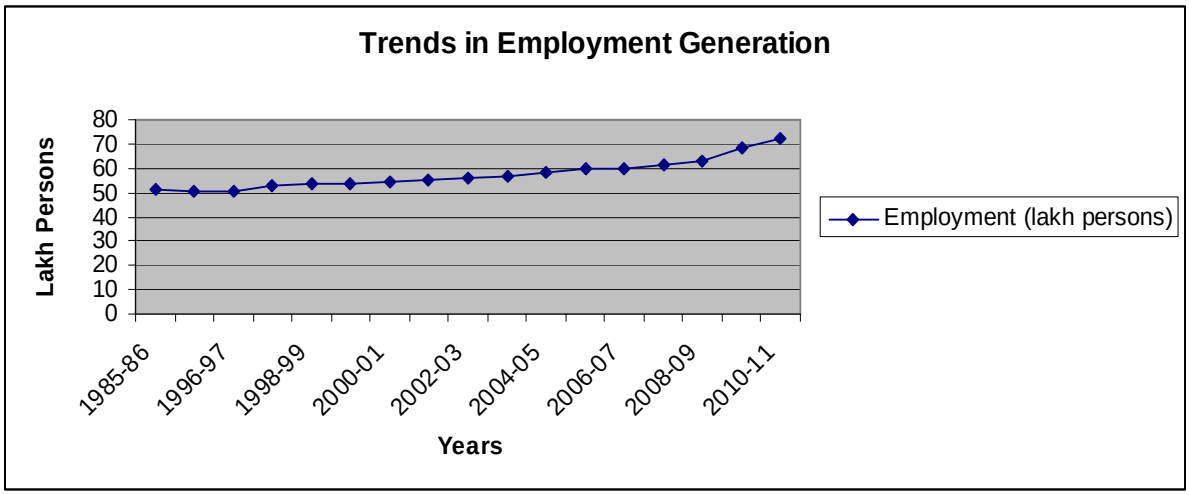
The above estimated regression equation signifies that in the absence of mulberry cultivation area and zero price of reeling cocoon, income-generation from raw silk is virtually negative. Though negative income generation is apparently unlikely to happen in real situation, but we can think about the loss of fixed cost for those farms whose production process has been ceased to zero. Despite producing nothing those farms earn negative income or loss. The intercept term explains that particular aspect for the sericulture farm. On the other hand, rise in mulberry cultivation area by 1 hectare would raise the aggregate income from raw silk production by 0.174 million, i.e., by Rs. 174,000, while rise in prices of the reeling cocoon will have greater impact on raising the level of income from raw silk production. If per kilogram price of reeling cocoon increases by 1 unit, the aggregate income from raw silk production will increase 1280 times. However, it should be kept in mind that price of reeling cocoon is a significant deciding factor for income generation in sericulture. The impact will therefore lessen if the price declines.

7.3 Trends in Employment Generation in Artisanal Silk Industry in India

The Statistics Biennial (CSB, 1986) data show an increase in employment opportunities in Indian artisanal silk sector from 16 lakh persons in the year 1979-80 to 51.52 lakh persons in 1985-86. The comprehensive and continuous employment statistics that is available from the period 1995-1996 onwards exhibits similar upward trend till date for the country (see Figure 3). The year 2006-2007 is marked as the level of employment in this artisanal industry reached its peak at 60.03 lakh persons; among which 47 lakh persons were sericulture farmers and the rest 13 lakh were engaged in off-farm activities (like, reeling, twisting, weaving etc.). This shows that sericulture generates more farm employment than non-farm employment opportunities.

Employment statistics also reveal that area of cultivation has started showing a declining trend from the mid 1990s. However, increase in land productivity (presumably due to irrigation or other technical innovations in cultivating high yielding variety mulberry cultivation) has helped to maintain the positive trend in output (see Figure7.4). A spurt in employment generation has been observed over the period 1995-96 to 2006-07. The output elasticity of employment has shown positive trend for most of the periods with aberrations in few years. This indicates that with a proportional increase in employment, there will be a proportional increase in output, but the value would never be greater than one.

Figure7.3 Employment Generation in Silk Production



Source: CSB, 2003, 2012

While Figure 7.4 depicts a moderately increasing trend in land productivity, Figure 7.5 captures the fact that labour productivity has experienced occasional ups and downs over the period 1979-80 to 2010-11. The output elasticity of employment in sericulture, on the other hand, is showing a downward trend with few spikes (see Figure 7.6). Thus, despite increase in the level of employment, sericulture output is not responding in significant proportions. This, in a way, establishes presence of over employment in sericulture sector, without any substantial marginal contribution. Rise in the level of land productivity and marginally declining trend in labour productivity actually result in fluctuations in output elasticity of employment. Elasticity of output never exceeded the value of unity, which confirms growth in raw silk was always less than that of employment generation.

Figure 7.4 Trends in Land Productivity of Raw Silk Production (1979-2010)

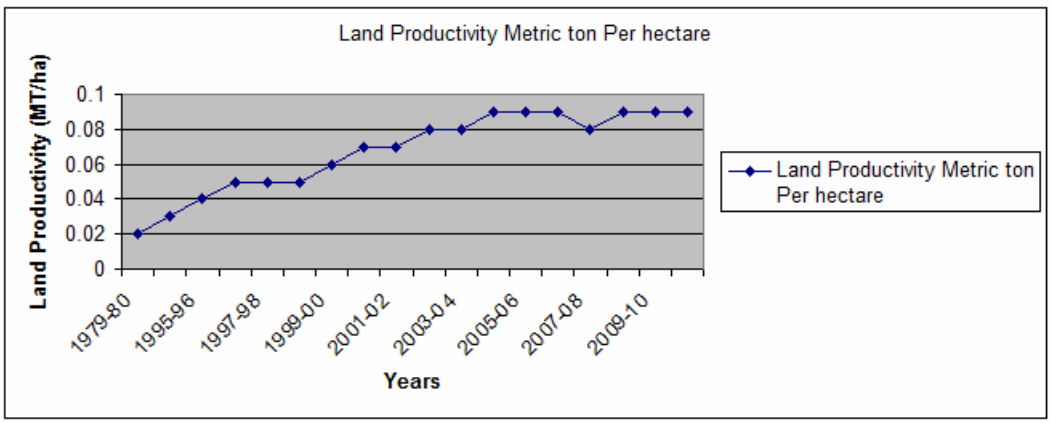


Figure 7.5 Trends in Labour Productivity (!979-2010)

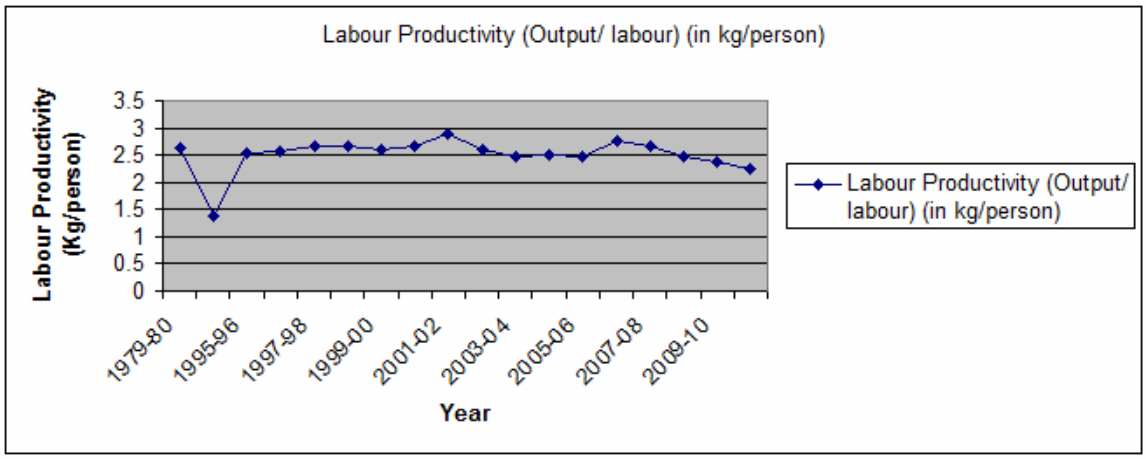
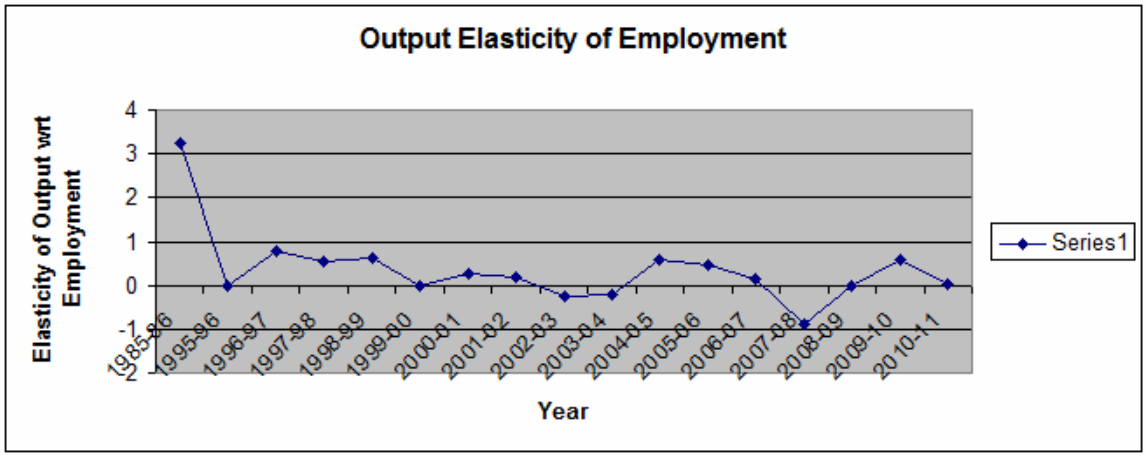


Figure7. 6 Trends in Output Elasticity of Employment (1985-2010)



7.3.1 Employment Generating Factors in Indian Sericulture

The primary goal of this section is to identify the major factors responsible for employment generation in sericulture sector. Sericulture is a vast sector and, therefore, before identifying the employment generating factors, the dynamism of the sector needs to be explained. Silkworm rearing and mulberry leaf growing are the essential components of work through which involvement of family workers and wage workers takes place. It has often been observed that the hectare of land cultivated for mulberry determine the level of raw silk production and hence it can be assumed as an influencing factor of employment generation in sericulture sector. Farmers, on the other hand, buy silkworm eggs (known as 'seed') either from private graineurs (licensed seed producers) or state grainages. It has been observed that in India, farmers are more dependent on private entrepreneurs for seed. Thus graineurs are crucial link in the production chain. The granieurs sell their seeds mainly to individual farmers, but sometimes they also sell these to brokers and reelers, who purchase in bulk for distribution among the clients. Thus, affluent middlemen are often observed to occupy a dominant position in the rural sericulture markets and, therefore, employments as well as production jointly become dependent variables on their level of activities. From supplying rearing trays (known as '*chandrikas*') to providing capital for constructing rearing houses, their involvement becomes dominant in all sphere of activities attached with sericulture.

After rearing comes the successive stages of production, i.e., reeling and spinning for silk yarn production. Reelers buy the silk yarn form the cocoon-market where the rearing farmers gather to sell their cocoons. The reeler's business is to unwind silk from the cocoons and amalgamate a number of filaments to form bells of yarn of desired thickness. This is done either on locally built simple machines (e.g., filature, charka) which produce a rough grade of yarn or on more complex machine and costly factory made machinery producing a superior quality. At one extreme, there are poor men running charka or cottage basin with family labour and, on the other , there exists wealthy rural merchant-run fifteen or more of the Multiend Machines drawing labour from the poor rural community. This production of silk is of higher quality and have a greater market for further transaction. Reeling units in this way may influence the level of employment generated in reeling sector.

Reelers sell out their silk yarn to weavers, who can again be classified into two types, besides independent weaver: (1) those who undertake weaving only (who comprise societies and the local private silk merchants); (2) those who own reeling units and also put out work to domestic weavers (who comprise the society). Hand-looms and power-looms are used as weaving equipment, depending upon the nature of financial as well as entrepreneurial capacity of the weaving firms. Hand-looms produce comparatively inferior grade of silk thread with higher level of thickness. Hand-loom production is less cost intensive which the poor rural artisans prefer to choose. Therefore, higher levels of employment generation are usually associated with hand-looms. In contrast, power-looms produce quality silk, but the labour saving method of production curtails the scope of employment generation.

7.3.2 Employment Boosting Model of Artisanal Silk Production

Employment aspect of the sericulture has essentially been dealt with by the Planning Commission and every year certain targets for both employment and output are fixed accordingly. An upward trend (see Figure 7.3) for all levels of employment generation by all types of silk production in India has been observed. On the basis of the available statistical data on production, employment and hectare utilization for mulberry cultivation a regression analysis of employment in artisanal silk sector on production, area, labour productivity and output elasticity of employment is undertaken here. Running OLS on the available data a model has been constructed for which the regression coefficients are explained below.

Table 7.2(a) Employment Generation Model in Indian Sericulture

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	d.f1	df2	Sig. F Change
1	.990	.980	.973	1.00003	.980	146.870	4	12	0.000

a Predictors: (Constant), Labour Productivity, Area of Mulberry Cultivation, Output Elasticity of Employment , Production of Raw Silk;
b Dependent Variable: Employment in Sericulture

Table 7.2(b) ANOVA of Employment Generation Model

Model		Sum of Squares	d.f	Mean Square	F	Sig.
1	Regression	587.514	4	146.878	146.870	0.000
	Residual	12.001	12	1.000		
	Total	599.514	16			

a Predictors: (Constant), Labour Productivity, Area of Mulberry Cultivation, Output Elasticity of Employment , Production of Raw Silk;
b Dependent Variable: Employment in Sericulture

The ANOVA exercise shows that "F" statistic in the model is significant, which ensures that the model is an appropriate fit and since the Durbin-Watson statistic = 1.961, it ensures that serial auto-correlation is virtually absent in the model. The Adjusted R^2 = 0.973, i.e. 97 percent of the data variation of the dependent variable (i.e., employment) is explained by that of the explanatory variables chosen for the model. The estimated regression equation is given by (estimated standard errors are given in the parenthesis):

Employment = 53.596 + 0.004 * (production) – 24.43 * (labour productivity)
(4.131) (0.00) (2.012)

(** 0.01 level of significance and *0.05 level of significance)

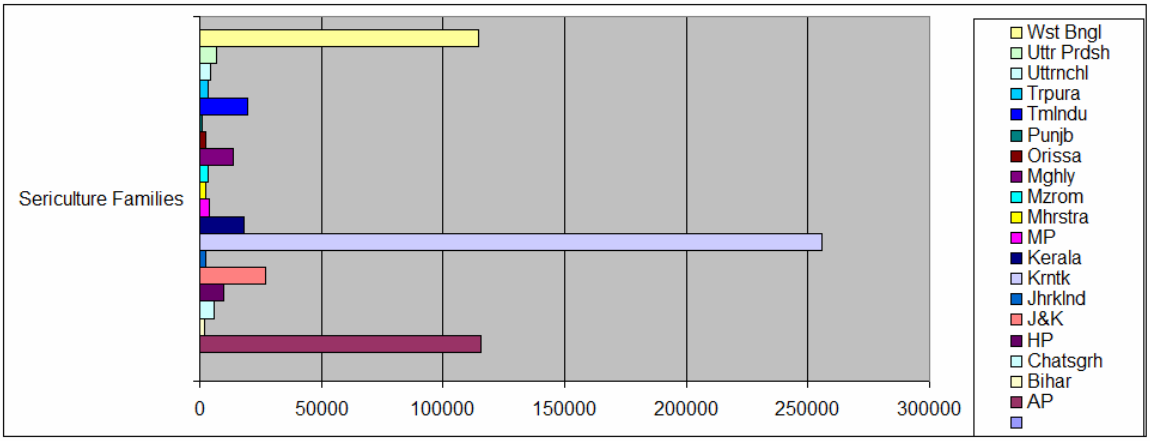
Low value of the standard error of the estimated coefficients suggests good specificity of the model. The proposed model shows that production and labour productivity are the significant explanatory factors so far as employment generation is concerned. The regression coefficient 0.004 of production indicates that for rise in one metric ton of raw-silk production, 0.004 lakh, i.e., 400units of employment will be created in the artisanal silk sector. The next significant regression coefficient is – 24.43 of labour productivity, which implies that if each person employed in sericulture is capable of producing an extra one unit of raw-silk, then there would be a substantial gross reduction in total employment by 24 lakh persons in the country. This can be justified with common logic as productive labour force actually declines the demand for further labour and that causes fall in level of employment.

The magnitudes of the other non-significant explanatory factors i.e., area and output elasticity of employment are positive and negative, respectively. Increase in area of mulberry cultivation raises the level of employment, but the rise in output elasticity of employment reduces the level of employment, which can again be logically explained. Output elasticity of employment rises with rise in labour productivity, and thus the inverse relation can be rationalized.

7.3.3 A Cross-section Model of employment generation in Indian sericulture

A study of state level data on sericulture statistics (2003) will bring to light the interstate variations in different sericulture parameters. Sericulture employment is significant in five traditional states, namely Karnataka, Andhra Pradesh, West Bengal, Tamil Nadu and Jammu & Kashmir. Besides these five traditional states, sericulture is also providing employment to some extent in the states of Kerala, Meghalaya and Himachal Pradesh. Department of Sericulture is trying to expand its arena beyond the traditional states, but its impact is yet to be realized and variation in level of employment is an indicator of that. Differences are there at the level of institutional facilities, finance, at market structure and so on. However, favourable climate and presence of generations of an artisan class constitute comparative advantage of these traditional silk producing states. Accordingly, an attempt is being made to identify factors influencing employment in sericulture in this section.

Fig 7.7 State Level Employment Situation in Sericulture (2003)
(Number of Sericulture *Families)*

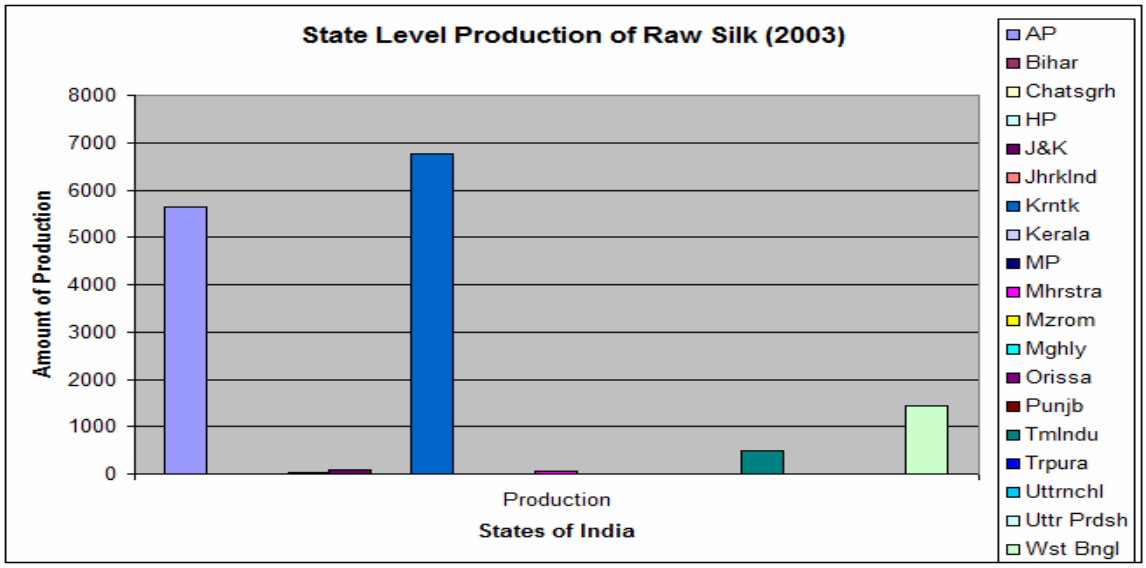


According to previous hypotheses, the factors expected to play significant role in influencing the level of employment in the sericulture sector are briefly summarized with some justifications:

- Raw Silk production: As production of raw silk increases, the level of employment is expected to rise. However, few levels of disparities are observed in this causal relation between level of production and employment between traditional and non-traditional states.
- Area: Higher area under cultivation refers to higher degree of mulberry production which, in turn, means higher silk production. In reality, there exists a strong correlation between production of raw silk and area of mulberry cultivation. Therefore, in order to avoid the problem of multi-collinearity, some precautions need to be adopted.
- Village: As sericulture is practiced in more and more villages, greater amount of employment generation is expected. This hypothesis has to be confirmed from the available data set. But again the impact of this variable is supposed to be captured by the production of raw silk.
- Grainage: Grainages are the centers where the silkworm eggs are produced by cross breeding using the latest technology. Higher number of grainages implies higher production and higher employment.
- Technical Service Centre (TSC): These centers provide technical facilities to the artisans. It helps in spreading technological innovations.
- Chawki Rearing Centre (CRC): These centers are the ones where rearing of young age larvae is conducted by trained technicians. This is an institutional facility provided with the requisite equipment for maintaining the optimum temperature and humidity. Mulberry leaf required for the young silkworm is obtained from a well maintained garden so that quality of the leaf is ensured. This CRC also raises the amount of silk production and thereby raising employment generating capacity of sericulture.
- Cocoon Market: The farmers harvest the cocoon and bring the same to government-cocoon markets for selling their produce. All the farmers are expected to have the updated information about the seed purchase and information for the purpose of further reference by the market while testing the cocoon for fixing the floor price based on the cocoon. When the farmers arrive at the market they are given a lot number and for every lot they offer bidding price. The raw silk producers (reelers) also come to the market for purchasing the

cocoon from sericulture-farmers. These reelers are also registered as raw silk producers. When the reelers arrive at the market and are desirous of participating in the bidding, they are required to pay some advance to the cocoon market before participating in the bidding. A well organized cocoon market always indicates large amount of cocoon exchange and higher amount of silk production thereof. In a way it also implies generation of higher employability in the sericulture sector.

Fig 7.8 State Level Production of Raw Silk (2003)



- Hand-looms: These are traditional ways of weaving silk. It mainly represents a cottage industry, giving scope to large numbers of poor unskilled silk artisans for earning livelihood. Therefore, number of hand-looms is often considered as determinant factor of employment.
- Power-looms: These are modern and also represent the same weaving section as handlooms. Power looms are labour saving and skill intensive compared to handlooms. The impact of powerlooms on sericulture employment would be an interesting point to note.
- Co-operative Societies: Cooperatives are institutional agency for providing credit to the poor sericulture artisans, as well as to help in selling the silk product. Higher number of co-operative societies is expected to raise the amount of production as well as number of employment in the sector.
- Cottage Basin, Charka, and Multiend Reeling Machines: These are the three reeling devices of extracting silk filament from cocoons. The sericulture farms often opt for an individual or combination of these machines to extract a single thread of silk with desired denier. The efficiency of the extracted silk depends upon the number of ends of the cocoon filaments it can combine to form a single thread. Multiend reeling machine is assumed to be a superior reeling devise as it can combine 10 ends against 6 ends in the cottage basin.

  Charka is, however, the most used reeling devise used through out the country. But, due to its technological inadequacies, quality silk can not be produced by Charka. The main reason why charka is still dominating is that bulk of raw silk produced in this

country is used by handloom sector where the cost factor of raw material has to be kept low. Besides, poor quality cocoon can be well reeled economically by charka.

The available cross-section data related to sericulture activities reveal a skewed distribution of all the parameters due to a substantial level of regional imbalance. In order to nullify this effect, an OLS regression with the log transformation of the variables is attempted here. After making necessary adjustments and then running a regression on "sericulture families" (i.e., a proxy parameter of employment), we test alternative model specifications. After eliminating a range of variables due to multicollinearity, a few significant variables which can explain the variations of the dependent variable is accommodated. Categorizing the three major sectors under sericulture and silk industry, into rearing sector, reeling sector and weaving sector, the following employment equations may be specified taking the associated explanatory factors of each sector. The log models represent the changes in each variable.

Log Models

ln (emp_seri) = c_0 + ln(area_ha) + ln(seri_vill) + ln (grainage) +ln(tsc) + ln(cocn_mkt)...(1)

ln (emp_seri) = c_1 + ln(cotgbasin) + ln (charka) + ln(multiend) …… (2)

ln (emp_seri) = c_2 + ln (handloom) + ln (powerloom) + ln (co-operative society)……. (3)

Table 7.3 Determinants of Sericulture Employment – Regression Results

Silk Sectors	Explanatory Variables	Model-1 (Equation-1)	Model-2 (Equation-2)	Model-3 (Equation-3)
Silk-Rearing Sector-1	ln (area_ha)	2.661(1.622)**		
	ln(seri_vill)	-0.079(0.209)		
	ln (grainage)	0.205(0.41)		
	ln(tsc)	0.02(0.197)		
Silk-Reeling Sector-2	ln(cocoon_mkt)		1.049(0.435)**	
	ln(cotgbasin)		-0.146(0.137)	
	ln(charka)		0.045(0.137)	
	ln(multiend)		0.128(0.161)	
Silk-Weaving Sector-3	ln(handloom)			- 0.098 (0.064)
	ln(powerloom)			0.559 (0.092)**
	ln(co-opsociety)			0.118 (0.087)
	Constant	0.752(0.24)	7.238(0.448)**	6.461(0.265)**
	F ratio	6.33	7.88	19.662
	R^2	0.725	0.693	0.797
	Adj R2	0.611	0.605	0.757

Dependent Variable: Employment of Sericulture Families- Sector- i (i=1,2,3)
(Figures in the parentheses indicate standard errors. ** Sig at .01 level; * Sig at .05 level)

The results of our regression exercise are reported in Table 7.3. Area under mulberry cultivation (area_ha), cocoon market (cocoon_mkt) and power-loom are three significant factors that influence the data variation in sericulture families. From table 7.3, it is seen, that 1% rise in mulberry cultivation area can raise the level of employment of sericulture families by 2.66%. Similarly, rise in employment of sericulture families by 1.05% is possible, if there is rise in cocoon market by 1%. And 1% increase in power-loom can raise the level of employment of sericulture families by 0.56%.

On the other hand, sericulture village, cottage-basin and hand-looms are found to have negative impact on employment of sericulture artisans. The spatial concentration of sericulture activity in each state reinforces that claim. Cottage basin and hand-looms are known to be labour intensive tools used for production of silk yarn and silk cloth respectively. Inverse relation between these age-old outdated implements and family involvement reveals a positive response (though not significant) towards technology driven growth.

7.4 A Case-study on Income & Employment Generation in Artisanal Silk Industry of Malda District, West Bengal

This section will attempt to delve into regional level analysis shifting the focus from national level to state of West Bengal so that location specific variables can be specifically identified and location specific issues can be chiefly addressed and diagnosed. The investigation will be carried out by analysing a cross section field survey data collected from few sericulture rich villages in Malda district. Malda district is noted for raw-silk production in West Bengal producing 75% of the state's raw silk. This is the reason why problems of silk farmers in Malda district solely can represent the artisanal crisis of the whole state. Again in Malda, eighty percent of the sericulture industry is confined to Kaliachak block (especially Kaliachak-I, Kaliachak-II). More than 20,000 acres of land are under mulberry cultivation and more than 60,000 families are directly or indirectly maintaining their livelihood from sericulture. Out of total sericulture farmers, reelers, traders, 80-85 percent belongs to minority community. Women play a vital role in this industry and 60 percent of the workforce belongs to minority community (Deputy Director, Reeling, 2010).

In 2010, Malda produced more than 1200 MT of commercial reeling cocoons, 1200 MT of raw silk and 450 MT of silk-wastes. The average turnover was in the tune of 115-120 crores of rupees per annum. Around ten years before that, i.e., in the year 2001-02 and 2002-03, the sericulture industry in Malda had faced a crisis due to inflow of large amount of high grade silk marketed at a low price. The mulberry cultivation was partly uprooted and 30-40% of mulberry field were planted with mango tree. From the year 2003-04, the industry again started gaining momentum due to increase in silk price. The year 2004-05 has been boon to sericulture industry when price of cocoon ranged from Rs. 80/- to 120/-. A poor farmer having a land of 20-22 decimal of mulberry land have received income of Rs. 3000 to Rs.3500 on an average per season. However, farmers and artisans are still practicing sericulture using rudimentary technology. This results in low productivity. Another important aspect is that though 80 percent of the primary production of sericulture, i.e., commercial cocoons is produced in Malda district, the reelers still procure a sizeable quantum of dry cocoons from Maharashtra and Jammu & Kashmir. The weaving sector in this district has not been developed so far. As a result, the reelers have to look forward to southern states, Benaras and Bhagalpur for the disposal of their processed yarn.

Encroachment of mango orchard is another threat to the sericulture farmers in Malda district. Big farmers with large land-holdings are having a tendency to convert their agriculture land to mango orchard. In 2001-02, twenty per cent of big sericulture farmers in Malda have been found to switch over to mango tree plantation (ibid, 2010). On the other hand, sericulture farmer having a small holding adjacent to mango orchard had no alternative than to plant mango trees in the field because the mulberry bushes were not receiving sunlight because of the shades from the canopy of the adjacent mango trees while the roots proliferation of the big trees along with the detrimental impact of insecticide accelerated the severity of the issue.

This is the way the big farmers and moneylenders of Malda are gradually encroaching the lands of small farmers by creating indirect pressure to convert their lands from mulberry plantation to mango orchard.

Multi crore industrial groups have entered in each and every pocket of sericulture belts and engaged particularly young women sericulture farmer in *beedi*-making industry. Tobacco is detrimental for the natural growth process of silk worm and therefore this also causes retardation of growth of mulberry raw silk in Malda district.

Sericulture sector is being controlled by few rich money lenders. They advance loans to the poor farmers and artisans not only for business purposes but also for consumption purposes. Due to inadequate supply of silkworm eggs from the government, the silk farmers are forced to procure eggs from open market with high price. This necessitates the presence of moneylenders in the absence of other dependable credit providing agency. On the other hand, poor reelers are not getting the market price of their yarn as a vicious cycle of exploitation is continued over seasons. The poor reelers-artisans are always at the mercy of these money-lenders for purchasing dry-cocoons and again for selling the yarn they produce. They are bound to sell the yarn at a lower price to these moneylenders. Money lenders are taking undue advantage of these artisans. It has been observed that nearly 10-12 crores of rupees are getting rolled as capital investment by Mahajans.

For the silk farmers, stability of price of cocoon is required for their own economic security. However, this price drops down when Chinese cocoon gluts the market worsening the situation of these poverty stricken farmers. Though anti-dumping law was imposed, still it enters into the market bypassing the sub-clause and again through different channels. Thus the fortune of the domestic cocoon producer depends on the import restriction as it can hardly withstand this severe under cutting of cocoon prices done by China. The government has on the hand, no stable system of controlling price of cocoons to save the interest of a large impoverished section.

Most of the rearers prefer rearing using cross-breed (CB) seeds. Multivoltine breeds (known as *Nistari)* are also widely popular and reared in Malda. The quality of multivoltine silk thread along with temperature tolerance leads to development of crossbreeds between multivoltine and bivoltine races. Higher filament always rationalizes the choice in favour of bivoltine races but weather condition in Malda does not permit this over sensitive race to sustain due to its low resilience power. Therefore, the cross-breeds take the centre stage and are largely accepted by the peasant-artisanal labourers in silk industry

Table7.4 Comparative Characteristics of Multivoltine & Bivoltine Races

Parameters	Bivoltine	Multivoltine
Egg-type	Diapause/ Non-diapause*	Non-diapause
Disease Resistance	Relatively Poor	Relatively Better
Temperature Tolerance	Absent	Present
Filament Length/ cocoon (m)	1000-1600	400-500
Average Filament denier	2.85	2.1
Reelabilty	91.25	79.3

Source : The Silkworm : Biology, Genetics and Breeding * delay in development in response to adverse environmental condition.

A large number of local breeders having licenses are capable of producing breeds by crossing Nistari females with bi-voltine males, which are quite popular among the locals. The returns are also higher for this race. However, scientific crossing is only viable with the CSB farms. Kaliachak is the single most important marketing hub for these cocoons in the entire district. In the district more than 60,000 families are engaged in silkworm rearing. They are either having separate houses or dwelling cum rearing house. They are usually harvesting five crops in a year for which disinfection of rearing and its all implements before and after each crop remains an emergent criterion. The government advises SHG (Self Help Groups) which can at least provide services to 200 farmers' houses with disinfectant materials. In this way, 4000 mandays can be generated with 30% services and each rearing house can accumulate one lakh income per annum (Deputy Director, Malda, 2005).

Reeling of Silk yarn in Malda is concentrated in Jalalpur under Kaliachak police station (De Sarkar et.al., 2013). However, the prevalent operation system is mostly traditional. The traditional system involves operating country-charkas used manually by hands. The charka basin is made up of brick and cement which is operated with the help of wooden rotating wheel. The cocoons are boiled in water and then reeled. The charka basin can produce 500-600 grams of yarn in 8 hours.

Relatively improved machines, namely Ghosh Machine and Roy Machines are used by co-operatives. It has five units and hence the production is much higher. These machines are used for high yielding varieties of cocoons which can yield silk yarn of uniform thickness and roundness. Filature basin is the most efficient basin out of all. The silk produced by this is of highest quality. The only state owned filature machine is available at Madhughat. The optimum production rate at this filature is about 800-850 grams of silk yarn.

Table 7.5 Progress of Sericulture in Malda District (2004- 2011)

Year	Production of reeling cocoon (MT)			Production of raw-silk (MT)	Production of Silk Waste (MT)
	Multivoltine	Crossvoltine	Bivoltine		
2004-05	6609.14	4948.62	1.30	1274	436
2006-07	4674	7292	-	1202	406
2007-08	3479.9	9702.4	-	1261	419
2008-09	2895	9393.4	-	1327.5	429.6
2009-10	921.1	11669.08	0.85	1357.8	439.29
2010-11	7.0	12675.19	11.25	1359.56	449.18

Source: Deputy Director (Reeling), Malda

7.4.1 Models of Income Generation in Artisanal Silk Industry of West Bengal

This section will deal with the primary survey undertaken in the course of this study. For primary survey certain sericulture rich villages were chosen from Kaliachak Block in Malda district of West Bengal. Raw silk production in Malda district is 75% of the state production and mulberry cultivation in Malda district is mostly localized in Kaliyachak-I and Kaliyachak-II blocks comprising 90% of the total mulberry cultivation area. Kaliyachak-I itself occupies 61% of the total cultivated area under mulberry in the district (See Ali et al., 2008). Twenty percent of total sericulture farmers of the district live in this block (Official Statistics, Deputy Director Malda, 2010). Stratified random sampling has been done to

choose the sericulture rich villages namely, *Gayes Bari, Sujapur, Mothabari, Marupur, Alipur, Sershahi, Feranchak, Joshkabil* from this block. Twenty five to thirty households involved with sericulture activities (mainly rearing and reeling) have been chosen from each village using stratified random sampling. Thus a total of 212 households constituted the sample size of this study. Respondents (who are silk artisans) were randomly chosen from those sericulture rich villages and were asked several questions regarding their livelihood and income generation. On the basis of their response, data was primarily collected and then tabulated. The primary survey was designed on the basis of apriori hypotheses to determine the factors influencing the income level of the sericulture households. To run the regression of annual income earned by the household on several variables on the basis of the hypothesis, OLS method was used using SPSS package. The regression result has been enumerated in Table 7.6.

Table 7.6 Results of Regression

Dependent variable: ln (Income)

Estimated Coefficients	B	T	Sig	VIF
Constant	2.654	5.204	0.000*	1.405
ln(cost of raw materials including implements)	0.712	15.184	0.000*	1.405
ln(loans)	0.037	2.270	0.024**	1.309
Ln(mandays)	0.160	1.711	0.089***	1.120

R^2 = 0.659, Adj R^2 = 0.654, F (df) = 134.51 (208)* ; *** sig at 0.10 level, ** sig at 0.05 level; * sig at 0.01 level;

Interpretation of estimated Parameters

In order to rectify the problems of heteroscedasticity the chosen variables in this model has been transformed into $\log_{naturals}$. The dependent variable Annual Income of sericulture family has also been log transformed, i.e., ln(Income). The chosen log transformed variables are cost of raw materials and implements, loans and mandays. The farmers with higher number of implements and raw materials are always observed to earn greater income. Similarly loan taking farmers are more often found to generate higher income and greater seasonal varities cropped by the farmer-artisans are expected to derive greater annual income. Based on these hypotheses an OLS regression is run on the predictors and the above estimated coefficients have been found.

The significant F statistic ensures the 'goodness of the fit' of the model. Adjusted R^2 indicates that 65 % of the variation in annual income generated by the sericulture family is explained by the assumed explanatory variables. The model is free from problem of heteroscedasticity as all the variables have been log transformed variables. The VIF values of all estimated variables are less than 5, which ensure absence of multicollinearity. From the estimated coefficients one can interpret that one percent change in cost of raw materials (including implements) results in around 0.71% increase in annual income, while similar level of increase in loan amount would increase approximately 0.04% of annual income of the sericulture family. Again if mandays are changed by 1% the annual income will also change by 0.16%.

The rich farmers, who are expected to bear higher production costs, would get higher returns as inferred by this specific model. This finding rejects the traditional claim that sericulture

activities are usually pro-poor. However, as most of the artisan-farmers in West Bengal are loan seekers due to their underprivileged economic backgrounds, the model provides a relief by ensuring that 'loan taking' is also income rewarding, although in a very small proportions. With poor economic background, dependence on loans for survival is common and therefore substantial change in income cannot be expected.

7.4.2 Models of Employment Generation in Artisanal Silk Industry in West Bengal

In this section employment generation models in artisanal silk industry will be built on the basis of primary survey data collected from sericulture rich villages in Malda ditrict. This is expected to enlighten those employment related issues which are specifically sensitive to this region in contrast to the national scenario. These location specific variables can help us to identify location specific problems and then the problem could be easily addressed from policymaker's perspective. The investigation will be initiated with the analysis of a cross section field data collected from the same sericulture rich villages, as we have indicated before, in Malda district of West Bengal.

The following factors have been primarily identified as influencing determinants of average employment generation in a domestic sericulture farm through out the year. The rationale for choosing these factors is also explained below.

- Household Size: It is an influencing factor for determination of level of employment in a particular domestic sericulture farm. Higher the household size, higher is the requirement of income generation as well as higher will be the capacity of potential employment.
- Mulberry Area: Mulberry leaf is food of sericulture worms and therefore higher mulberry area is indicating greater opportunity to raise sericulture and therefore employment level is expected to rise. However, in case of declining market price, there could be conversion of sericulture to other profitable cash crops or food crops which in turn would decrease the level of employment in sericulture farm.
- Years of Schooling by Head of the Family: Years of Educational background may affect the level of employment of sericulture farms. An educated family head may not be willing to employ his offspring in domestic work-activity and not for education attainment, thus resulting in fall in employment levels.
- Male Hired Workers: Hired male workers are important proponent of the level of employment in a sericulture farm. Male hired labour is more cost escalating and therefore rise in this cost signifies the intensity of the domestic farms in this sericulture business.
- Female Hired Workers: As sericulture sector is often known as women labour intensive sector, investigation can be made to test whether numbers of hired female workers have any impact on the total number of employment created in sericulture sector. Female workers are interpreted in numbers and this is a continuous variable.
- Man-days: It refers to the number of working-days created by a particular work. Higher number of man-days offered by a job also makes it more stable, assuring an average return throughout the year. Previous studies showed that sericulture activity offers higher man-days if rearing is practiced through out the year. One can hypothesize that greater level of employment is associated with higher man-days created by the activity.

- Cost of raw materials: When raw materials become dearer the domestic farms try to economize by expanding its activity. Thus the level of employment is expected to be positive with increase in raw materials.

Based on the above hypothesis a linear model has been built ,as following, and regression of 'Employment Level'(i.e., average employment level in a sericulture farm through out the year) will be run on the above explanatory variables.

Employment Generation Model

Employment Level = $\beta_0 + \beta_1$* household-size + β_2 * mulberry-area + β_3 * Years of Schooling by HOF + β_4 * Male_hired-labour + β_5 * Female_hired-labour + β_6 * Mandays + β_7 * Cost_rawmaterials

Ordinary Least Square method has been applied with SPSS package to regress 'Employment Level' on the said explanatory variables. ANOVA table shows us that "F" statistic of the model is significant which explains the goodness of fit of the model. The table also tells us that Adj.R^2 = 0.855, which means that 85.5 percent variations of the dependent variable is explained by the regressors. Observing the pattern of the plot of the 'predicted residuals' and the 'residuals', it has been inferred that no discrete pattern between them exists and that ensures non existence of heteroscedasticity. In the table 7.7(c), the values of VIF (which are all less than 5) ensure that multicollinearity problem does not exist in the model.

Table 7.7 (a): Model Summary

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
Model					R Square Change	F Change	df1	df2	Sig. F Change
1	.927	.860	.855	2.62	.860	177.441	7	203	.000

Table 7.7 (b): ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8521.103	7	1217.300	177.441	.000
	Residual	1392.641	203	6.860		
	Total	9913.744	210			

a Predictors: (Constant), Cost of raw materials, Mulberry area, Female hired-labour , School Education years of Head of the Family, Household Size , Mandays generated, Male hired labour

b Dependent Variable: Employment Level in Domestic Sericulture Farm

Table 7.7(c): Estimated Coefficients

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	3.610	.609		5.928	.000		
Household Size	.339	.055	.179	6.138	.000	.811	1.233
Mulberry area	-5.892E-02	.037	-.043	-1.596	.112	.970	1.031
School Education years of Head of the Family	-9.638E-02	.042	-.063	-2.316	.022	.926	1.079
, Male hired labour	1.071	.056	.645	19.231	.000	.615	1.627
Female hired-labour	.849	.083	.325	10.180	.000	.680	1.471

Mandays generated	-7.232E-03	.003	-.085	-2.627	.009	.659	1.518
Cost of raw materials	1.772E-06	.000	.042	1.344	.180	.721	1.388

[Dependent Variable: Employment Level in Domestic Sericulture Farm]

Interpretation of the Result

From the table of estimated coefficients (table 7.7(c) the following results can be inferred:

If number of households is raised by 10, then the average employment level in a sericulture farm would be raised by 3. Years of schooling by the head of the family discourages the level of employment in a sericulture farm. If school education is raised by 10 years, then the level of employment would decline by one person per farm. Again, addition in male hired labour will raise the average number of employment by one unit through out the year, while a rise in female hired labour does not increase the average level of employment in sericulture farm throughout the year in the same proportion. It has been observed that an increase of 10 female hired workers have the tendency to generate 7 numbers of average employment in a sericulture family. On the contrary, creation of greater man-days ultimately declines the level of average employment of a sericulture farm. If 100 more man-days are created there will be a decline in the level of employment by almost 1 unit (0.7 is rounded off to 1).

Barring the significant regressors, another determinant needs to be mentioned, i.e., mulberry area cultivated by a farm, which bears an inverse relationship with level of employment by a sericulture farm. Addition to mulberry area of cultivation induces the farm to shift his vocation to alternative return generating farm activities.

7.5 Conclusion

In the foregoing sections income generating potential and employment creating abilities in the artisanal silk industry has been discussed specially in the context of the state of West Bengal. The primary survey in sericulture rich villages of Malda district regarding these three issues provides sufficient insight to understand the situation of artisanal silk industry in rural West Bengal. The income generation process in rural sericulture has revealed the dynamism of the process of earning by the rural inhabitants. While in national perspective, area of mulberry cultivation and price of reeling cocoons have been deduced as significant explanatory variables for upward rising slope in the 'income generation curve', the primary analysis in the most sericulture rich district of West Bengal exposes that number of man-days generated from different phases of silk-worm rearing activity actually influence the total income generation, which is very much logically justified. On the other hand, loans taken by the household farms (mostly from *dadani* merchants) and cost of machineries and implements have a positive effect on income generation of the sericulture farms. This in a way establishes that rich farms who are expected to bear higher production cost have greater income generating power from this artisanal silk industry. The rural sericulture oriented villages are inhabited by small farmers with very little capital base and thus this result is barely relevant to them. This may perhaps justify the declining number of sericulture farmers in West Bengal during 2002-03 to 2010-11, which have declined from 110,000 to 92,200 (Ministry of Textiles, Sericulture, 2002-03, 2010-11). However, the results also shows that loan seeking farms can enhance their income, albeit marginally, in sericulture activities which is a sign of hope for a large chunk of artisanal farmers in West Bengal.

In employment perspective, West Bengal has comparatively higher "families involved per village" (48.9 in 2003) compared to other traditional states (Karnataka=13.3, Andhra Pradesh= 14.29). However, the recent statistics explain a declining trend in employment generation especially in the Eleventh Five Year Plan. Although higher levels of labour involvement do not necessarily imply higher level of production always, it does reveal the possibilities of positive spillover effect that creates positive externalities in turn. However, whether the spillover impact would be totally effective that depends on the gender perspective of this income and employment generation. Over the last decade, the growth in sericulture has declined in respect of involvement of villages and families in West Bengal , which is presumably due to primitive infrastructure and foreign competition. The primary survey analysis on Malda reveals that area of mulberry cultivation, educational background of family head and total man-days creation have inverse impact on the level of average employment generation in rural West Bengal. On the other hand, rise in household size and numbers of male and female hired labour have positive impact on the average level of employment generation in a sericulture family farm.

Under the Directorate of Sericulture every year certain targets have been adopted by the planners to augment the level of income and employment in this artisanal silk industry. However, difficulties lie in implementation of the stages. Increase in area of mulberry cultivation is shrinking in West Bengal, which can be considered as one of the major factors for the slow growth of sericulture in West Bengal. Improved mulberry variety is to be planted with greater care for manures and fertilizers. Innovations and technologies need to be directed so that more output can be produced in cost effective ways. Quality yarn needs to be produced by the domestic farms so that Chinese aggressive trade policies can be tackled. Irrigated lands have higher productivities and therefore greater stress should be given on expansion of the irrigation network. Cocoon markets are usually public market, though private cocoon-markets also exist on a wider scale. Enhancement in number of cocoon markets and power-looms can be done with a little effort from the government. Credit facilities to sericulture artisans need to be made at discounted rate so that poor farmers can easily adapt themselves with the rise in costs arising out of inflation trends.

Gender promotion and thereby social transformation along with poverty eradication is another major feature of this artisanal silk sector. The upcoming chapter will elaborate on gender issues in greater details.

Notes

1. This is evident from its highest average number of sericulture families per village i.e., 48.9% while in Karnataka, Andhra Pradesh and Tamil Nadu it is 14.29%, 13.32% and 5.26% respectively (CSB, 2003
2. See Gangopadhyay (2008): Silk Industry in India: A Review Indian Science & Technology; NISTDS, CSIR, New Delhi;
3. See the Keynote Address of Commissioner of Sericulture, Government of India (i.e., "Potential for Participation of Women in Sericulture Sector) delivered on National Conference on "Women in Sericulture" held at Mysore on 16th , 17th March, 200