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is important to fix the minimum wages to the labourers as well.

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SERICULTURE AS AN EMPLOYMENT GENERATING HOUSEHOLD INDUSTRY IN WEST BENGAL: A STUDY ON ITS CURRENT PROBLEMS AND PROSPECTS

CHANDAN ROY*, SANCHARI ROY MUKHERJEE and SANTANU GHOSH*****

Employment generation is one of the major potentials of Sericulture and Silk Industry in India. The farm and non-farm activity of this sector creates sixty lakh mandays of employment every year mostly in rural sector. The industry helps to create egalitarian distribution of income as it transfers greater share of its wealth from high end urban customers to poor artisan classes. In West Bengal, more than one lakh families are occupied with sericulture activities where Karnataka is the state with the largest number of families involved with sericulture. Despite having high level family involvement, West Bengal produces smaller quantities of raw silk compared to Karnataka as well as Andhra Pradesh. This paper investigates the reason of this low production and finds out that low productivity of land is no way responsible for that. Different Employment Models constructed in this paper suggest that 'area of mulberry cultivation', 'cocoon-market' and 'power-looms' are powerful factors in changing the level of employment, while the primary survey exposes factors like 'unitary household structure', 'income' 'years of education' and 'numbers of female in the household' as the significant factors in accelerating average employment per family. The spillover effect of this employment generation is studied at the end. The study finds that as a poverty eradication measure, sericulture fails to expand in rural West Bengal vis-à-vis the other prominent states. But income inequality is undoubtedly diminished with the practice in sericulture.

***Keywords*:** Sericulture, Employment, Silk, Poverty, Inequality

JEL Classification No: I32, J21,O13,

I. Introduction

Employment generation is one of the major potentials of the Sericulture and Silk Industry all over the world. The farm and non-farm activity of this sector creates sixty lakh employments every year mostly in rural India. The significant part of this employment generation includes its capability of transferring wealth from high end urban customers to poor artisan classes. Rural

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employment generation which has become the major focus of the inclusive development in all the developing economies in the era of post-globalization has received enormous scope of expansion under the sericulture industry in West Bengal as well as in few other states in India.

In West Bengal, 1.14 lakh families are occupied with sericulture activities in 2339 villages while Karnataka is the state with the largest number of families involved with sericulture. Andhra Pradesh and West Bengal are the close competitors so far numbers of family involvement is concerned. Despite having high level family involvement, West Bengal produces 1885 metric tones of raw silk while Karnataka produces 7360 metric tones of raw silk and Andhra Pradesh produces 5119 metric tones of raw silk. The primary objective of this paper is to trace the reasons for this low production of raw-silk in West Bengal and then to enquire the relation between employment and output and other factors. Whether the low production attributed to over involvement of family labour without any significant marginal contribution or there exists some hidden factors behind this low productivity, would be our chief point of quest. We would like to test the explanatory factors behind this employment generation both in state level as well as national level, in order to identify the significant regional factors which drive up the level of employment. The following sections have been designed to carry forward our analysis in desired direction.

II.Literature Review;

II. Productivity Analysis;

III.Employment Generating Factors : A National and State Level Analysis;

IV.Employment Impact of Sericulture on Rural Poverty, Income Inequality & Migration

V.Conclusion

II. Review of Literature

Vijaykumar et. al. (2007) estimate that one hectare of mulberry creates employment of 13-16 persons per year and their location specific analysis indicates that for a production of one kilogram of raw silk, 11 mandays are required which can, in turn, employ 30 mandays for production of silk fabric. However, from the current statistics (*Central Silk Board, Annual Report, 2009-10*), it has been observed that 16322 metric tones of raw silk is being produced by 68.17 lakh persons in India, which, on average, indicates 1 kg of raw silk can generate employment of 0.42 persons. This data inconsistency reflects the regional variations in employment generation. In other words, it exposes existence of heterogeneous nature of states which pulls back the average level of national performance in respect to land and labour productivity in sericulture

Gangopadhyay (2008), in his review of *Sericulture Industry in India,* has classified the employment generation pattern of the industry into two major types (Table – 1):

Table 1: Activity-wise Employment Generation in Mulberry Sericulture (per ha)

Activity	Man-Days	Man-Years
A. Mulberry Cultivation & Silkworm rearing		
a) Mulberry Cultivation	585	
b) Leaf/ Shoot harvesting	320	
c) Silkworm rearing	350	
Sub Total	1255 (19.5%)	5.020
B. Reeling of Silk Cocoon (@300mandays per 1000kg of reeling cocoons)	2250(34.9%)	9.120
TOTAL (A+B)	3535 (54.9%)	14.140
C. Twisting (@ 220gm of silk per man days)	432 (6.7%)	1.727
D. Weaving		
Hand-loom (@0.13kg/md)	438 (6.8%)	1.752
Power-loom (@0.31kg/md)	122(1.9%)	0.42
Sub Total	560	2.238
E. Printing & Dyeing (@40 man days for 40kg of raw silk)	95 (1.4%)	0.380
F. Finishing (@ 751 man days /40 kg of raw silk)	1784 (27.7%)	7.135
G. Silk Waste Processing (@18.775 man days per kg of raw silk)	26	0.104
Total (C+G)	2896	11.58
Grand Total	6431	26

Source: Central Silk Board, Bangalore , Gangopadhyay (2008) : Silk Industry in India - A Review, Indian Science & Technology (online)

(i) Direct Employment – (a) Mulberry Cultivation; (b) Leaf Harvesting; (c) Silk Worm Rearing;

(ii) Indirect Employment – (a) Reeling; (b) Twisting; (c) Weaving; (d) Printing & Dyeing; (e) Finishing; (f) Silk Waste Processing.The model chart of Activity-wise Employment Generation depicted by Gangopadhyay (i. bid.) is very relevant to our present analysis (Table 1).

Usha Rani (2007) has shown that 96.36 mandays of employment are generated from the establishment of one acre of mulberry garden for rearing 300 dfls (disease free layings) of silkworms in two months. She has also shown the female dominance in almost all work activities and few activities like cocoon-cutting, sexing and egg incubation are exclusively done by female workers. Banerjee (1990) also justified the reason of female dominance in sericulture by stating that silkworm rearing calls for intensive attention as well as mother's care, especially during the later stage of

larva. Identification of mature silkworms for putting in spinning trays requires a great deal of expertise, skill and intensive labour. Moreover, there is hardly any time specificity of this round the clock activity with intervals. These beget problems of getting hired labour and, accordingly, dependence on family labour increases. These are the reasons why female dominance in sericulture is so much prevalent in sericulture.

Hanumanappa and Erappa (1985) have shown how the employment and income generating potential of silk industry differs between traditional and non-traditional areas due to differing costs of mulberry leaf production and rearing of silk worms. Their analysis on silk reeling employment also reveals that dependence of family labour increased both in traditional and non-traditional belt in production. The demand for hired labour shows a declining trend in non-traditional region, while in traditional region it shows a marginal increase. On the other hand, the scope of hired employment opportunities expanded in the farm level outdoor activities of both the regions.

Employment opportunities have also been estimated by several researchers and field surveyors while comparing the employment opportunities generated by alternative crops. Activity wise cross-section analysis shows that sericulture opens up several channels of work-employability like, garden establishment, leaf production, silkworm rearing, and marketing of cocoon. Mulberry cultivation and silkworm rearing are conducted round the year. It is usually observed that five to six crops can be cultivated from one acre of mulberry gardening every year. On the other hand, many agricultural crops like paddy, sugar cane, turmeric and banana are planted and harvested once in a year and therefore could provide limited employment opportunities compared to sericulture.

A study undertaken in two districts of Tamil Nadu (Lakshman et. al., 2007) has particularly been very helpful to find out a way ahead of this analysis. Among the alternative crops sugarcane, turmeric, paddy, maize and vegetables were taken. It was inferred that among three annual crops (sericulture, turmeric, sugarcane), sericulture has the potential to create maximum employment opportunities. It generates highest man-days through out the year, followed by sugarcane, paddy, maize and vegetable.(See Table: 2)

Table – 2: Employment Generation in Sericulture: A Comparative Analysis
(Survey Area: Two Districts of Tamil Nadu, Traditional Belt of Sericulture)

Crop	Male Employment (man days)	Female Employment (man days)	Total Employment (man days)
Sericulture	186.2	345.8	532
Sugarcane	153.4	142.75	296.15
Turmeric	53.5	80	133.5
Paddy + Vegetables	91	222	313
Paddy + Maize	67.75	113.87	181.62

Source: Lakshman et. al. (2007), Indian Silk

It has also been estimated from that field study that of the 532 mandays, nearly 60% (i. e. 319.2 mandays) had been drawn from family labour; the remaining 40% of the labour force were, on an average, hired. Thus household sector itself becomes a source as well as supplier of workforce. This particular nature of sericulture helps the economy to combat the rural poverty, which is also another inherent feature of this developing economy. Gangopadhyay (op. cit.) has explained that 57% of the final value of silk fabrics again flows back to its primary producers and thereby transferring wealth from high end rich consumers section to poor artisans. However, variations in productivity may be witnessed across regions depending upon the nature of soil, climatic condition, rainfall, irrigation of that particular region. A study conducted in Maharashtra (Hajare, 2008) reveals that mulberry sericulture generates 170 man days, while alternative crop combinations like soybean-wheat, soybean –gram and cotton-pigeon pea generate 66, 61 and 65 mandays, respectively (see Table-3).

Usha Rani (op. cit.) has also made a brief account of comparison of labour involvement in sericulture and other activities/ crops. She explains that sericulture activity is generating an average of 481 mandays per annum while milk/ dairying(another common occupation for the low skilled labour) generates 217 mandays, followed by paddy (153 mandays), groundnut (135 mandays), ragi (110 mandays). These reviews help the present authors to find out the research gap of the employment related aspect of sericulture in West Bengal. The main

Table 3: Employment Generation in Sericulture: A Comparative Analysis

(Survey Area: Two Villages of Maharashtra, Non-Traditional Belt of Sericulture)

Location	Crops	Gross Income Generated (Rs)/ ha/ yr	Employment (mandays)/ ha/ yr
Khobana village, Maharashtra	Mulberry Sericulture	82315	170
	Paddy-Sunflower	33242	52
	Soybean-Wheat	23744	66
	Soybean-Gram	18995	61
Dhapewada village, Maharshtra	Mulberry Sericulture	87778	170
	Cotton + Pigeon pea	27633	65
	Soybean-Wheat	26008	66
	Soybean-Gram	21133	61

Source: Hajare et. al.(2008), *Indian Silk*, Vol.46. No.9

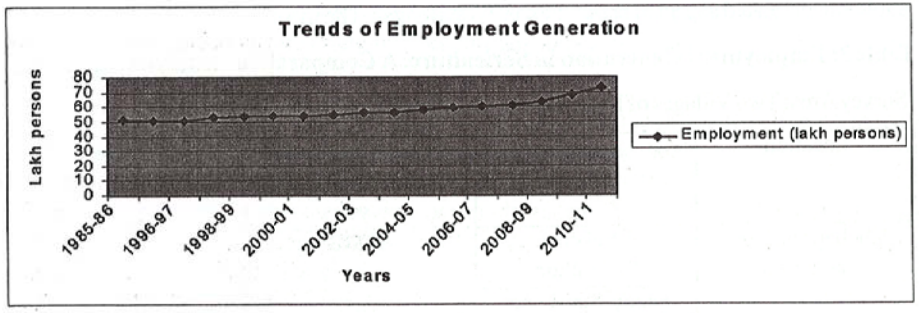
purpose of this paper is, therefore, to trace the state specific employment related issues in sericulture artisans and their subsequent employment impact on the sericulture artisans of in the state.

III. Silk Productivity Analysis

The Statistics Biennial (CSB, 1986) shows a jump of employment opportunities in sericulture from 16 lakh persons in the year 1979-80 to 51.52 lakh persons for 1985-86. However, comprehensive and continuous employment statistics, which is available from the period of 1995-1996 onwards, shows a positive upward trend till date (see Figure 1). In the year 2006-2007, it reached a peak of 60.03lakh persons of whom 47 lakh persons wee sericulture farmers and rest 13 lakhs were from off-farm activities (like, reeling, twisting, weaving etc.). This shows that sericulture generates more farm employment than non-farm employment opportunities.

From the employment statistics, it clearly reveals that area of cultivation has started showing a declining trend from the mid of 1990s. However, increase in land productivity (perhaps due to irrigation or other technical innovations) has kept the output at positive trend (see Figure 2). Employment generation has shown a positive spurt through out 1995-96 to 2006-07. The output elasticity of employment has most of the time shown positive trend with aberrations in few years. This indicates as the percentage of employment rises, the percentage of output level also rises, but the value was never greater than one.

Figure- 1: Employment Generation in Silk Production



Source: CSB, 2003, 2012

While Figure 2 depicts a marginal upward trend in land productivity, Figure 3 captures the fact that labour productivity has experienced occasional ups and downs during 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 fluctuations (see Figure 4). So, despite increase in 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 marginal declining trend in labour productivity actually result into fluctuating trend in output elasticity of employment. Elasticity of output never exceeds the value of unity, which confirms growth in raw silk was always less than that of employment generation.

Figure 2: Trends in and Land Productivities of Raw Silk Production

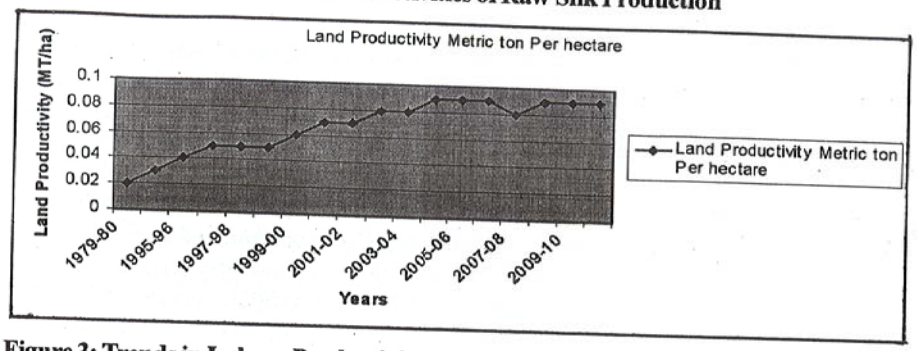


Figure 3: Trends in Labour Productivity

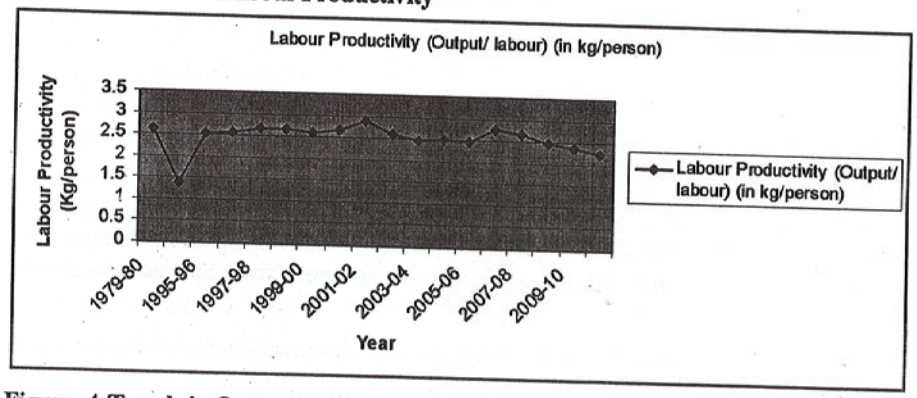
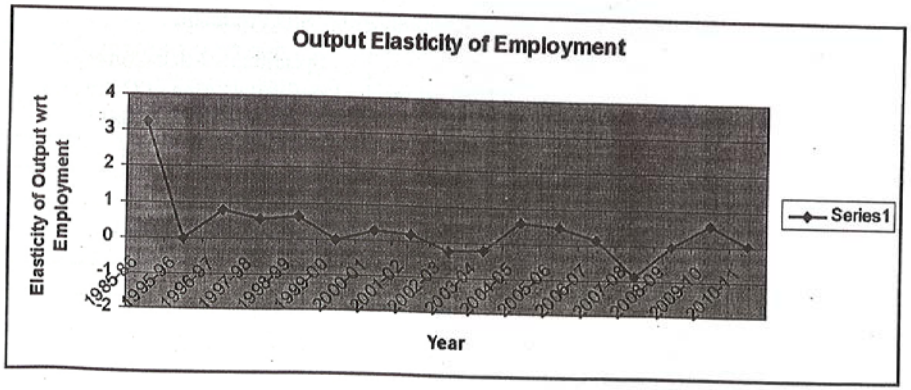


Figure -4 Trends in Output Elasticity of Employment



West Bengal versus Other States

Sericulture is traditionally being practiced in four states of India, namely Karnataka, Andhra Pradesh, West Bengal and Tamil Nadu. Karnataka is the largest raw silk producing state in India, followed by Andhra Pradesh, West Bengal and Tamil Nadu. While West Bengal is the third largest silk producing state in the country, Karnataka vests largest amount of land for sericulture followed by Andhra Pradesh, West Bengal and Tamil Nadu. In 2001, Karnataka vested 116,158 hectares of land for sericulture and produced 8728 metric tons of raw silk, while Andhra Pradesh, West Bengal and Tamil Nadu cultivate 52,225hctares, 18,794hectares and 13,096 hectares area of land for sericulture and produce 4775mt, 1407mt and 655mt of raw silk, respectively. There exists a positive correlation between area of mulberry cultivation (major food for the silk worm) and amount of raw silk production. However, the degree of variations may differ from state to state. For Karnataka, a significant correlation (at .05 level) is observed between area of mulberry cultivation and amount of raw silk production and Spearman's rank correlation coefficient is found to be 0.480.

A higher degree of significant association between area of land cultivation and amount of raw silk production is observed in Andhra Pradesh and the significant Pearson's correlation coefficient is 0.486 while Spearman's Rank correlation coefficient is 0.66.

For the third largest silk producing state, viz. West Bengal, the degree of association between the area of land cultivation and amount of raw silk production is even higher than the previous two states: Pearson's correlation coefficient is 0.709, while Spearman's rank correlation coefficient is 0.799.

For Tamil Nadu the correlation between area of land cultivation and amount of silk production is also significant: Pearson's correlation coefficient is 0.692, while the Spearman's rank correlation coefficient is 0.598.

Table 5: State Level Association between Cultivation Area & Silk Production

States	Pearson's Correlation Coefficient (Area of Cultivation, Silk Production)	Spearman's Rank Correlation Coefficient (Area of Cultivation, Silk Production)
Karnataka	0.480*	Insignificant
Andhra Pradesh	0.486*	0.66*
West Bengal	**0.709***	**0.799***
Tamil Nadu	0.692*	0.598*
* significant at 0.05 level		

* significant at 0.05 level

a) Karnataka versus West Bengal

The state wise comparative analysis between area of mulberry cultivation and amount of silk

production reveals that for state like Karnataka, the area of production is not that much important for raising its volume of production unlike the case of West Bengal. This indirectly indicates higher labour productivity and/or infrastructure facilities available in Karnataka vis-à-vis West Bengal. Here, we are making a comparative analysis of mean of Raw Silk Production and Raw Silk Productivity (land productivity) between Karnataka and West Bengal on the basis of the available statistics of these two states for last 22 time-periods. We choose two random numbers to identify these states, viz. Karnataka =1 and West Bengal = 4 and the available data help us to obtain the following statistical results which show that average land productivity of West Bengal remains much higher than that of Karnataka.

Table 6: Group Statistics Table (Karnataka versus West Bengal)

	State	N	Mean	Std. Deviation	Std. Error Mean
Land Productivity	1	22	44.94	16.39	3.49
	4	22	57.92	14.49	3.09

However, employment in sericulture depends upon productivity of land as well as labour, other than climatic factors. By productivity of land, here we imply amount of raw silk produced by feeding the mulberry leaves (to the silkworm) grown in one hectare. Silk is extracted from the cocoon of silk-worm which eats this mulberry leaf as its food. Karnataka is the largest silk producing state in India and, therefore, silk productivity (kg/ha) needs to be compared in order to compare the degree of potential employment generating capacities in these two states.

The above Table, containing descriptive statistics, for Karnataka and West Bengal, shows that average land-wise silk productivity is higher in West Bengal (57.92kg/ha) than Karnataka (44.94kg/ha) and Karnataka's performance also witnesses greater variation than West Bengal.

Table – 7(a), on the other hand, gives the result of the comparative analysis of the land-wise productivity in these two states. Here, we get results of two tests: Levene's test for Equality of Variances and t-test for Equality of Means. A higher value of significance (0.06 > 0.05) associated with the Levene's Test tells us that two groups having equal variances and, therefore, null hypothesis of equal variances is true. Hence, the statistic associated with the assumption of 'equal variances' should be used for the t-test for Equality of Means.

Table – 7(a): Group Statistics and Independent Sample Test (Karnataka and West Bengal)

	State	N	Mean	Std. Deviation	Std. Error Mean
Productivity	1	22	44.94	16.39	3.49
	4	22	57.92	14.49	3.09

	Levene's test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	d.f	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	3.730	.060	– 2.782	42	008	– 12.97	4.66	– 22.38	– 3.56
Equal variances not assumed			– 2.782	41	.008	– 12.97	4.66	– 22.39	– 3.56

The t-test result shows – 2.782 with 42 degrees of freedom. The corresponding two-tailed p-value is 0.008, which is less than 0.01. Therefore, we can reject the null hypothesis at 1% level of significance, which means that the average productivity of these two states significantly differ. However, we are interested in knowing the statistical significance of lower land productivity in Karnataka than that of West Bengal. Then the null hypothesis would be as following and we need the p-value of one-tailed test.

$H_0 : 0.01 \geq 04$

$H_1 : 0.01 < 04$

The one-tailed significant value or p-value can be obtained by dividing the two-tailed value by 2.Thus the one-tailed p-value in this case would be 0.004 , which is less than 0.01. Therefore, we reject the null hypothesis even at 1% level of significance and conclude that average raw silk productivity (land-wise) in Karnataka is lower than that of West Bengal.

b) Andhra Pradesh versus West Bengal

Similar type of exercise can be done with the second largest silk producing state, i.e., Andhra Pradesh vis-à-vis West Bengal. We can identify Andhra Pradesh as 2 and West Bengal as 4 and the available statistics regarding the two states may help us to compare the means of

their land-wise productivity in raw silk.

Table 7(b) shows that the average per hectare productivity of raw silk is closer to equality in Andhra Pradesh and West Bengal, though Andhra Pradesh produces higher amount of raw silk compared to the latter. The Levene's test tells us that two states have unequal variances as the level of significance associated with F statistic is less than 0.01 and therefore the null hypothesis of equal variances is rejected. The t-test result (associated with equal variances not assumed) shows p-value 0.394 which is higher than 0.05, this means that the null hypothesis of equality of means is accepted. Therefore, so far as land wise productivity is concerned we cannot claim any substantial level of difference between the average productivities (land-wise) between Andhra Pradesh and West Bengal.

Table 7(b): Group Statistics and Independent Sample Test (Andhra and West Bengal)

	State	N	Mean	Std. Deviation	Std. Error Mean
PRODVTY	2	22	52.60	24.97	5.32
	4	22	57.92	14.49	3.09

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	d.f	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval Of the Difference	
									Lower	Upper
PRODVTY	Equal variances assumed	15.926	.000	– 0.863	42	0.393	– 5.31	6.16	– 17.74	7.11
	Equal variances not assumed			– 0.863	34	0.394	– 0.5.31	6.16	– 17.83	7.20

c) Tamil Nadu versus West Bengal

Tamil Nadu is another traditional state where sericulture is being practiced, though production-wise its rank is lower than West Bengal. We intend to make a comparative analysis and repeat the same statistical exercise with respect to Tamil Nadu (Table – 7(c)]. Levene's test indicates that the two states are having unequal variances so far as their per hectare productivities are concerned (as the p-value of F-statistic is low, we reject the null hypothesis of equal variances). The t-test result (with equal variances not assumed) shows t-statistic of – 3.304 with 39 degrees of freedom. The corresponding two-tailed p-value is 0.002 which is less than 0.01. Therefore, we can reject the null hypothesis of equality of

Table – 7(c): Group Statistics and Independent Sample Test (Tamil Nadu and West Bengal)

	State	N	Mean	Std. Deviation	Std. Error Mean
PRODTVTY	3	22	41.01	19.13	4.08
	4	22	57.92	14.49	3.09

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	d.f	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
									Lower
PRODTVTY	Equal variances assumed	8.653	0.005	– 3.304	42	0.002	– 16.91	5.12	– 27.23
	Equal variances not assumed			– 3.304	39.125	0.002	– 16.91	5.12	– 27.25

means. However, we are interested to know the comparative level of efficiency of kg/ha productivity between these two states. Therefore, the null hypothesis and alternative hypotheses are as follows:

$H_0: 03 \geq 04$; $H_1: 03 < 04$

The one-tailed significance value can be obtained by dividing the tailed value by 2. Thus, the one tailed p-value in this case would be 0.001 which is less than 0.01. Therefore, we reject the null hypothesis at 1% level of significance and conclude that the efficiency or per hectare silk productivity is higher in West Bengal than in Tamil Nadu.

Summary Result

On the basis of ANOVA exercise we can infer that per hectare silk productivity of West Bengal is greater than Karnataka (the largest silk producing state) and Tamil Nadu and almost equivalent to Andhra Pradesh. Therefore, low production rank in raw silk of West Bengal cannot be attributed to the low productivity of land and hence labour productivity and employment need to be analyzed. In the next section, we will make an overall analysis of different silk producing states of the country and try to find out the significant factors behind the employment generation in sericulture sector of West Bengal. As the purpose of our ongoing analysis is to search the employment generating potential factors, we would like to make (i) national level and (ii) state level analyses. Sometimes, the region specific issues dominate or outweigh certain gross factors, which are relevant at national level. Therefore, by doing these two exercises we can find out the gap between these specific issues.

IV. Employment Generating Factors: National Level Analysis

Our main goal in this section is to identify the major determinants which are actually responsible for the 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 initial 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 level behind 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 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, employment as well as production jointly become dependent variables on their level of activities. Starting from supplying rearing trays (known as 'chandrikas') to providing capital for constructing rearing houses, their involvement becomes dominant in 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 constructed machines with greater simplicity (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 the one extreme, there are poor men running charka or cottage basin with family labour and, at the other end, there is wealthy rural merchant-run fifteen or more of the Multiend Machines drawing labour from the poor rural community. These productions of silk are of higher quality and have 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 in to 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 equipments, 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 level of employment generation is 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.

A Periodic Analysis of Employment Trends

Employment aspect of the sericulture has essentially been felt by the Planning Commission and in every year certain plan targets both for employment and output are being fixed accordingly. The trends show a moderate upward tendency (see Figure 1) including all levels of employment generation by all types of silk production in India. On the basis of the available statistical data on production, employment and hectare utilization for mulberry cultivation we attempt to run a regression of employment in sericulture farm on production, area, labour productivity and output elasticity of employment. Running OLS on the available data we construct a model, whose regression coefficients are explained below.

Model Summary

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
Model					R Square Change	F Change	d.f1	df2	Sig. F Change	
1	.990	.980	.973	1.00003	.980	146.870	4	12	0.000	1.961

a Predictors: (Constant), LBPRDCTV, AREA, ELASTICT, PRODUCTN;

b Dependent Variable: EMPLOYNT

ANOVA

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), LBPRDCTV, AREA, ELASTICT, PRODUCTN

b Dependent Variable: EMPLOYNT

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 being shown 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. Our proposed model shows that production and labour productivity are the significant explanatory factors as far as employment generation is concerned.

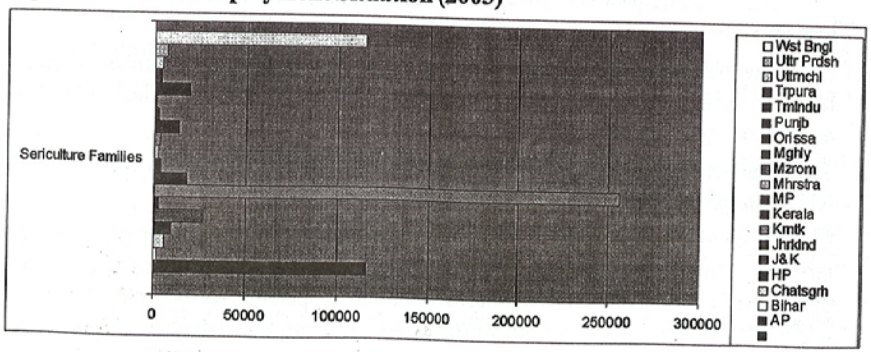
The regression coefficient 0.004 of production indicates that for rise in one metric ton of raw-silk production, 0.004 lakh, i.e., 400, employment in sericulture field will be created. The next significant regression coefficient is –24.43 of labour productivity, which implies that if each person employed with sericulture can be 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. For a given volume of production, rise in labour productivity always reduces the gross the level of employment.

The magnitude of the other non-significant explanatory factors, 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 is logically justifiable. Output elasticity of employment rises with rises in labour productivity, so the inverse relation can be rationalized.

A Cross-section Analysis of Employment in Indian Sericulture

A state level data on sericulture statistics (2003) helps us to conceive the ideas of wide interstate variations of different sericulture parameters. Sericulture employment is significant in five traditional states, namely Karnataka, Andhra Pradesh, West Bengal, Tamil Nadu and Jammu & Kashmir. Besides these four traditional states, sericulture is also employment generating to some extent in the states like, Kerala, Meghalaya and Himachal Pradesh. Department of Sericulture is trying to expand its arena beyond the traditional states, but impact is yet to be realized and a large amount of variation in level of employment is an indicating factor of that. Differences are there in the level of institutional facilities, finance, and market structure and so on. However, favourable climate and presence of generations of artisan class constitute comparative advantage of these traditional silk producing states. Accordingly, an attempt towards computing the employment influencing factors will make the study exhaustive.

Fig 4: State Level Employment Situation (2003)

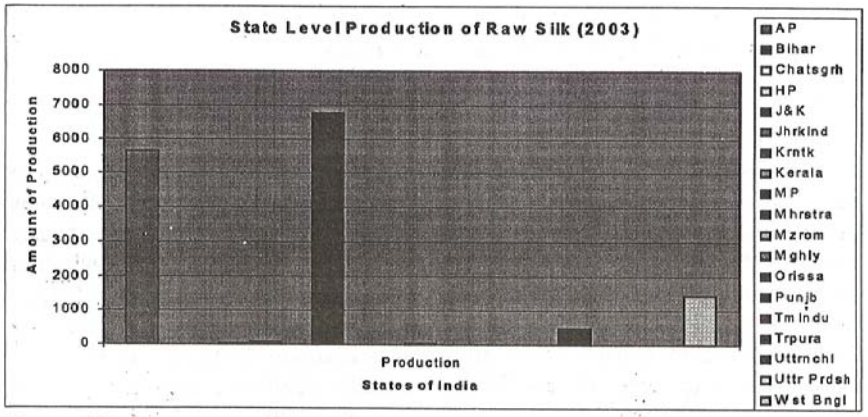


According to previous hypotheses, the factors expected to play significant role in influencing the level of employment in the sericulture sector are briefly summarized with some rational justification:

(i) Raw Silk production: As production of raw silk increases, the level of employment is expected to rise. However, equal level of disparities observed in level of production between traditional and non-traditional states.

(ii) 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, we have to adopt some precautions.

Fig 5: State Level Production of Raw Silk (2003)



(iii) Village: As sericulture is practiced in more and more villages, greater amount of employment generation is expected. Now we have to confirm our hypothesis from the available data set. But again the impact of this variable is supposed to be captured by the production of raw silk.

(iv) Grainage: Grainages are the centers where the silkworm eggs are produced by cross breeding using latest technology. Higher number of grainages implies higher production and higher employment.

(v) Technical Service Centre TSC): These centres provide technical facilities to the artisans. It helps in spreading technological innovations.

(vi) Chawki Rearing Centre (CRC): These centres are the ones where rearing of young age larvae is conducted by trained technicians. This is an institutional facilitiy provided with the requisite equipment for maintaining the optimum temperature and humidity. Mulberry leaf required for the young age 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.

(vii) 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 for bidding. 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.

(viii) 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.

(ix) 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.

(x) 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.

(xi) Cottage Basin, Charka, 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 involved with sericulture activities reveal a skewed distribution

of all the parameters due to a substantial level of regional imbalance. In order to nullify this effect we may run an OLS with the log transformation of the variables. After making necessary adjustments and then running a regression on "sericulture families" (i.e., a proxy parameter of employment), we may test alternative model specifications. After dropping a range of variables due to multi-collinearity, we find only a very few number of significant variables which can explain the variations of the dependent variable. Categorizing the three major sectors under sericulture and silk industry, i.e., rearing sector, reeling sector and weaving sector, the following employment equations may be specified taking the associated explanatory factors of each sector:

$$\ln(\text{emp\_seri}) = c_0 + \ln(\text{area\_ha}) + \ln(\text{seri\_vill}) + \ln(\text{grainage}) + \ln(\text{tsc}) + \ln(\text{cocn\_mkt}) \ldots (1)$$

$$\ln(\text{emp\_seri}) = c_1 + \ln(\text{cotgbasin}) + \ln(\text{charka}) + \ln(\text{multiend}) \ldots\ldots\ldots (2)$$

$$\ln(\text{emp\_seri}) = c_2 + \ln(\text{handloom}) + \ln(\text{powerloom}) + \ln(\text{co-operative society}) \ldots\ldots (3)$$

The results of our regression exercise are reported in Table – 8 below. 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 the above table, we can say, 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%.

Sericulture village, cottage-basin and hand-loom 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

Table – 8: 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 R^2	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)

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.

V.Employment Generating Factors in West Bengal: A State Level Analysis

We now attempt regional level analysis for the state West Bengal so that few location specific variables can be additionally attached and more location specific problems can be diagnosed. We will initiate our investigation with analysis of a cross section field data collected from Malda, a region prominent in West Bengal for raw silk production. We have chosen two villages of that district, i.e., Sujapur and Shershahi for our primary field survey. Sixty respondents (who are silk artisans) were randomly chosen from this sericulture clustered areas and were asked to answer several questions relating to their livelihood; based on their response, tabulation and analysis of the data have been made in this section.

We have primarily identified the following factors as influencing factors of employment generation in this field of sericulture and silk industry. The rationale for choosing those factors is also explained herewith:

(i) Female Workers: As sericulture sector is often known as women labour intensive sector, we intend to investigate whether number of female workers imposes any impact on the total number of employment created in sericulture sector. Female workers are interpreted in numbers and this is continuous variable.

(ii) Household Structure: Household structure may be either joint or single. Since sericulture mainly depends upon family labour, therefore greater amount of employment is expected to be created by the joint family. We would like to verify our hypothesis in real field. We are putting dummy variable "1" against each unitary household and "0" otherwise.

(iii) Education: Education is assumed to be an important determinant of production and the level of employability rises due to increase in level of education. We use binary predictors (0,1) to mark (Illiterate, Literate & School Education Receiving respondents).

(iv) Income: Higher level of income enables a household farm to involve more workers in his sericulture activity. Therefore income earned by an individual firm can be a determinant of its level of employment generation. Income is a continuous variable.

(v) Man-days : It refers to the number of working-days created by a particular work. Higher man-days offered by a job also make it more stable, assuring an average return through out the year. Previous studies shows that sericulture activity offers higher man-days if rearing is practiced through out the year. We hypothesize greater level of employment is associated with higher mandays created by the activity.

(vi) Technological Access: Sericulture industry is practiced in this area over generations. Skill is transferred over generations and in many situations the age-old customs keep the technology diffusion at lower level. However, training is always expected to have a positive impact on the level of employment created in this sector. Therefore, we would like to derive the relationship between training and level of employment generation in sericulture. We are putting "1" against trained families (where at least one member is trained , assuming that he/she can transfer the expertise of modern skill to the other members of the unit) and "0" against others.

(vii) Religion: Since the area is chiefly dominated by minority Muslims, we expect that religion may play a strong bias in favour of choosing this profession. Although the relationship between choosing a job and religious orientation is hardly logical. But since the minorities in our country belong to an oppressed section, therefore inclusion of minorities in employment generation process by sericulture would be looked as a step forward towards inclusive development. We have attempted to run the regression to study the impact of religions upon the employment opportunities. We have put dummy variable "0" against Hindus and "1" against Muslim minorities.

We have collected our primary data from two randomly picked villages of Kaliyachak –I block in Malda district. We have asked questions to sixty respondents randomly picked up from the villages and from the information we have inferred the following result.

We use General Linear Model (GLM) to regress workers employed on the basis of the above explanatory variables. For regressing categorical predictors as well as continuous variables GLM is the ideal model of fit. The results of the ANOVA exercise and regression are comprehensively shown in Tables – 9(a) and 9(b) below. Because 'Type 3 Sum of Squares' has been used, significance test for each variable is identical. ANOVA Table shows us that "F" statistic of the corrected model is significant which explains the goodness of fit of the model. The table also tells us that Adj.$R^2 = 0.571$, which means that 57 percent variations of the dependent variable can be explained by the predictors chosen for the model, which is again at satisfactory level. The table containing parameter estimates indicates 5.597 value of the intercept, i.e., approximately 6 will be the numbers of employed workers in a sericulture household when all independent variables have a value of zero.

Table – 9(a): Tests of Between-Subjects Effects: ANOVA Table

Source	Type III Sum of Squares	d.f	Mean Square	F	Sig.	Observed Power[a]
Corrected Model	356.842	9	39.649	9.714	.000	1.000
Intercept	5.716	1	5.716	1.400	.242	.213
HH_STR	48.476	1	48.476	11.876	.001	.922
INCOME	18.609	1	18.609	4.559	.038	.553
MANDAYS	12.979	1	12.979	3.180	.081	.417
TECH_ACS	10.855	1	10.855	2.659	.109	.359
RELG	32.631	1	32.631	7.994	.007	.792
SCHOL_YR	23.912	1	23.912	5.858	.019	.660
FEMALE	93.012	1	93.012	22.787	.000	.997
RELG * FEMALE	37.222	1	37.222	9.119	.004	.842
SCHOL_YR * FEMALE	8.844	1	8.844	2.167	.147	.303
Error	204.092	50	4.082			
Total	4862.000	60				
Corrected Total	560.933	59				

a. Computed using alpha = .05; b. $R^2 = 0.636$ (Adjusted $R^2 = 0.571$)

Table – 9(b): Parameter Estimates

Dependent Variable: WRKS_EMP

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Observed Power[a]
					Lower Bound	Upper Bound	
Intercept	5.597	1.651	3.389	.001**	2.280	8.914	.914
[HH_STR=0]	-2.222	.645	-3.446	.001**	-3.517	-.927	.922
[HH_STR=1]	0[b]	.	.	.	.	.	.
INCOME	1.001E-04	.000	2.135	.038*	5.936E-06	1.943E-04	.553
MANDAYS	-9.869E-03	.006	-1.783	.081	-2.099E-02	1.247E-03	.417
[TECH_ACS=0]	1.700	1.042	1.631	.109	-.394	3.793	.359
[TECH_ACS=1]	0[b]	.	.	.	.	.	.
[RELG=0]	-6.080	2.150	-2.827	.007**	-10.398	-1.761	.792
[RELG=1]	0[b]	.	.	.	.	.	.
SCHOL_YR	.416	.172	2.420	.019*	7.073E-02	.761	.660
FEMALE	1.075	.265	4.062	.000**	.543	1.606	.978
[RELG=0] * FEMALE	2.953	.978	3.020	.004**	.989	4.917	.842
[RELG=1] * FEMALE	0[b]	.	.	.	.	.	.
SCHOL_YR * FEMALE	-7.642E-02	.052	-1.472	.147	-.181	2.786E-02	.303

a. Computed using alpha = .05; b This parameter is set to zero because it is redundant;

b. ** significant at 0.01 level, * significant at 0.05 level

Zero value for dummy variables is quite meaningful, though zero may be outside for certain numerical variables, like man-days.

The remaining regression coefficients tell us the effect on the estimated value of "Workers Employed in Sericulture'(i.e., workrs_emp) of a one unit increase in each of the independent variable.

The GLM has facilitated in identifying six significant explanatory factors which significantly influence the dependent variable, viz. workers employed in sericulture, either with its 'main-effect' or through its interaction effect.

Since household structure (hh_str) is coded zero for unitary and one for joint household, the coefficient – 2.222 for RELG tells us that, on average, a unit rise in household structure would reduce the level of employment by 2.2 than the unitary household. This in a way explains the lower employment generating capability of the joint household. This effect is significant.

The regression coefficient 1.001E-04 (i.e., 0.0001) tells us that if annual income of sericulture-household rises by Rs.10,000/, employment of workers associated with sericulture will rise by 1. This income effect on employment generation is significant.

Years of schooling and number of female members in a household are two independent quantitative variables which significantly explain variations in employed workers in sericulture. The regression coefficient 0.416 of school-_yr indicates that if average school years can be raised by 10 years, employment of 4 more workers in sericulture can be generated. On the other hand, regression coefficient 1.0175 with respect to number of female members tells us that rise in number of female in household by one unit can raise the employment of workers by 1 (closer to 1.075) unit.

Another significant regression coefficient of a categorical predictor is religion, which is coded zero for Hindu and one for Muslim community. The regression coefficient – 6.08 tells us that a Muslim household employs six persons less than a Hindu household. This in a way explains lower capability of employment generation by Muslim community either due to economic constraint or due to lower social access compared to household belonging to Hindu community.

Another interesting feature is to explain interaction between female and religion, which has significantly explained the dependent variable. The regression coefficient tells us that if number of female in a Muslim household rises by one unit, then increase in one such household gives rise to 2 numbers of workers associated with sericulture.

The insignificant explanatory variables in the constructed model are technological access, man-days and interaction between school years and female. The magnitude of the regression coefficient is positive for the former and negative for the latter two predictors. Positive regression

coefficient between technological access and employment generation in sericulture indicates positive impact of technology on employment in sericulture. This in a way indicates that the technology is not labour saving, although the predictor is not significant.

However, negative magnitude of variable man-days implies that as man-days rise the level of employment declines, which in a way justifies that there is a trade off between number of days of work and number of labourers performing the work; and that is quite logical.

Another interesting result can be interpreted from the interaction coefficient between female and years of schooling. If years of schooling of a female is raised that may substantially reduce the number of workers employed in sericulture. Although the result is not significant but the negative magnitude of the interaction coefficient speaks a trade-off relation between years of schooling of female household and level of employment.

VI. Conclusion

Production rank of West Bengal (in raw silk) comes after Karnataka and Andhra Pradesh, but the land productivity reveals highest efficiency of West Bengal among these three states. 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). Though higher level of labour involvement with lower level of production reveals the possibilities of disguised unemployment, the employment generation within the household through its spillover effect creates different positive externalities in the society, which cannot be undermined. But at the same time, it is also true that over the last decade, the growth in sericulture has declined in respect of involvement of villages and families in West Bengal; the reasons behind this phenomenon are mainly primitive infrastructure and foreign competition. The economic conditions of the poor silk artisans in this inflation-burdened economy needs some special focus for the industry to prosper and sustain in this state.

National level time series analysis on sericulture helps us to derive few significant explanatory variables like production and labour productivity in changing the level of employment in sericulture. Silk production is a significant factor which positively influences the level of employment. Higher level of production always expands the scope of employment generation in this low-skilled over populated rural economy. The cross-section state-wise analysis reveals few factors – like, area of mulberry cultivation, cocoon market and power-loom – as significant factors positively influencing the level of employment in sericulture. On the other hand, primary survey in Malda district reveals that unitary household structures have greater positive contribution in creating employment compared to joint household structures, while income, years of school education, number of females in household also help to increase the level of employment in sericulture. Similarly female from a Muslim community have lesser impact on employment compared to female from Hindu community, which opens up the scope for future level of sociological studies.

Under the Directorate of Sericulture every year certain targets have been adopted by the planners. However, difficulties lie in implementation of the stages. Increase in are of mulberry

cultivation is shrinking in West Bengal, which can be reasoned out as one of the major factors for 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 aggression 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 at 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. Years of school education have also been found to be an important factor in raising the level of employment and that would also deepen the rate of technology diffusion in sericulture in coming days. With all these bright hopes we can expect that a step towards inclusive development is possible with development of sericulture in rural West Bengal.

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