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Socio-Economic Determinants of Technology Adoption in Sericulture – An Analysis

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INTRODUCTION

The world production of raw silk currently stands at 80,774 metric tonnes of which, India's share is about 15,857 metric tonnes. India ranks second among silk producing countries of the world. Our country with varied climatic conditions is blessed with the production of all four types of commercially known silks, namely, mulberry, tasar, eri and muga. The share of India's raw silk production in the total global production is hovering around 19.63 per cent with mulberry area of 1,15,463 hectares (Anonymous, 2003) distributed over 59,000 villages throughout the length and breadth of the country (Sinha, 1990).

In Karnataka, the sericulture enterprise is currently being practiced in 88,903 hectares distributed over 17,000 villages covering almost all districts of the state. Its production of 6,760 metric tonnes of raw silk during 2002-03 (Provisional) accounted for 42.63 per cent of the country's total raw silk production. The sericulture industry characterised by low investment and low gestation period has attracted the attention of policy makers. Sericultural activities have made clear impact on the farmers of southern states especially Karnataka, Andhra Pradesh and Tamil Nadu. Further, efforts are made to develop the industry in non-traditional areas like north-eastern states, namely Uttar Pradesh and Madhya Pradesh to improve the economic status of the farmers. Considering the growth of the industry in Karnataka, the targets have been set at 2,500 metric tonnes of bivoltine raw silk production per annum for the states of Karnataka, Andhra Pradesh and Tamil Nadu. Even though impressive breakthrough has taken place with respect to the production of multi x bivoltine raw silk in the country, the envisaged targets are yet to be met in the bivoltine silk front. The much talked about qualitatively superior bivoltine silk production is yet to make a dent inspite of many efforts made during the World Bank assisted National Sericulture Project (NSP) during 1986-97.

Silk cocoon production is a highly specialised activity, which involves the cultivation of mulberry and rearing of silkworms. Silkworm rearing involves intensive care, careful handling, technical sophistication, close monitoring and supervision by the rearers.

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In spite of the efforts made by Central Silk Board and the state department of sericulture, the practice of bivoltine sericulture is not picking up in India in general and Karnataka in particular. Various studies conducted in this area indicated that the socio-economic characteristics of the farmers play an important role in adopting bivoltine sericulture than any other activities. Hence, the present study was taken up with the objective of understanding the factors influencing adoption and to document the reasons for non-adoption of bivoltine cocoon production by the farmers in Karnataka. Further the study focused on working out the probability of adoption of bivoltine and multivoltine silkworm rearing in the sericulture dominant areas of Karnataka.

METHODOLOGY

The present investigation was carried out in Karnataka state as it contributes 42.63 per cent to the country's raw silk production. Kolar and Mysore districts were selected as the areas of investigation as these two areas represent the unique methods of practicing sericulture in the state. Siddlaghatta taluk in Kolar and Kollegal taluk in Mysore were purposively selected based on the concentration of mulberry area. From each of the selected taluks, six villages and 10 farmers from each village were selected at random. Thus a total of 120 farmers constituted the sample size of the study. The farmers were post-classified into small, medium and large based on the standard acres as detailed below:

Small farmers: Owning less than 2.5 acres of irrigated land or less than 5 acres of dry land,

Medium farmers: Owning 2.5 to 5 acres of irrigated land or 5 to 10 acres of dry land,

Large farmers: Owning more than 5 acres of irrigated land or more than 10 acres of dry land,

where two acres of dry land is equated to one acre of irrigated land based on the number of crops grown on these respective lands and is considered as one standard acre. The primary data for the study were collected from the selected farmers by using personal interview method with the help of a structured schedule prepared for the purpose. The data collected include the personal details of the farmers, namely, age, education, social participation, extension contact, economic motivation, area under mulberry, area under irrigation, income from sericulture, organisational participation, experience in sericulture, mass media participation, etc.

Statistical Tools

The data thus generated from the sericulturists were tabulated and analysed using simple tabular analysis in terms of numbers and frequencies. The data were further subjected to logit analysis to work out the probabilities of adoption of multivoltine and bivoltine sericulture. The Logit analysis was carried out separately for different categories of farmers in each of the selected taluks.

Although the Ordinary Least Squares (OLS) estimates can be computed for binary type dependent variable, the error terms are likely to be heteroscedastic leading to inefficient parameter estimates; thus classical hypothesis tests, such as t-

ratios are inappropriate (Pindyck and Rubinfield, 1981). An alternative proposal is to use Linear Probability Model (LPM). However, if a Linear Probability Model is used, the predicted values may fall outside the 0-1 interval, thereby violating the basic concepts of probability. The use of logit models, which give the maximum likelihood estimators, can overcome most of the problems associated with Linear Probability model and provide parameter estimators which are asymptotically consistent, efficient and gaussion so that the analogue of the regression t-test can be applied.

In order to assess the influence of the socio-economic factors on the adoption of bivoltine silkworm rearing, a logit regression was estimated. The farmers adopting bivoltine silkworm rearing were assigned the score 1 and those adopting multivoltine were given the score 0. The model was estimated using maximum likelihood procedure.

The functional form of the logit model is specified as:

$$\text{Log} \quad \frac{Pi}{1-Pi} = Zi = a + b_iX_i + ui$$

where,
a = Intercept,
Pi = The probability that a farmer will adopt,,
bi = Logit coefficient,
Xi = Independent variables,
ui = The error term,

$\frac{Pi}{1-Pi}$ = The odd's ratio in favour of adoption.

The variables included in the model were:

1. Size of land holding in standard acres.
2. Percentage of mulberry is to the total area.
3. Experience in sericulture in years.
4. Educational level of the respondents in number of years of formal schooling.
5. Age of respondents in years.
6. Family size of the respondents in numbers.
7. Organisational participation index.
8. Mass media participation index.
9. Social participation index.
10. Economic motivation index.

Based on this model, the probability of adoption of the selected sericultural innovations was worked out.

RESULTS AND DISCUSSION

The socio-economic variables such as age, education, size of holding, extension participation and economic motivation influenced the farmers to adopt multivoltine race. Small farmers had a 0.85 probability of adoption of multivoltine silkworm rearing. This shows that the inherent characteristic of multivoltine rearing suits the knowledge and resource endowment of the small farmers.

The results of the logit regression (Table 1) indicated that factors such as area under mulberry, extension participation, extension contact and economic motivation influenced adoption of multivoltine by the medium size farmers. Interestingly, farmers with higher extension contact and extension participation also tended to adopt multivoltine race cocoons. On an average, there was a 0.66 probability that the medium farmers would adopt multivoltine under the existing situation. Among the large farmers in Siddlaghatta taluk, age and education coupled with economic motivation favoured the adoption of multivoltine silkworm rearing.

TABLE 1. FACTORS INFLUENCING ADOPTION OF MULTIVOLTINE SILKWORM REARING BY FARMERS IN SIDDLAGHATTA AREA

Sl. No.	Factors	Small farmers (n = 24)			Medium farmers (n = 20)			Large farmers (n=16)		
		Coeffi-cient	Mean	t-value	Coeffi-cient	Mean	t-value	Coeffi-cient	Mean	t-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Age (Years)	0.23	55.00	2.06*	0.20	48.00	1.96	0.16	44.00	2.89**
2.	Education (Score)	0.62	0.63	2.30**	0.26	5.98	1.99	0.83	1.65	2.40**
3.	Family size (Number)	0.33	2.64	1.92	0.43	1.53	1.53	0.50	2.26	1.83
4.	Irrigated land (acres)	0.43	4.23	1.98	1.53	0.55	0.08	0.05	5.22	1.65
5.	Total land (Standard acres)	0.22	3.50	2.15**	0.53	4.20	1.65	0.46	7.50	1.96
6.	Area under mulberry (Standard acres)	0.25	0.84	1.90	0.21	1.21	2.02*	0.11	2.31	1.97
7.	Social participation (Index)	0.01	0.35	0.95	0.14	1.15	1.26	0.04	0.96	0.36
8.	Income from sericulture (Rs.)	2.33	7,300	2.45**	3.65	18,450	2.33**	4.32	25,800	2.12**
9.	Extension participation (Index)	0.53	3.70	2.35**	0.75	3.40	2.05*	0.40	3.06	1.98
10.	Extension contact (Index)	0.14	2.20	1.33	0.34	5.27	2.54**	-0.93	6.05	-3.69**
11.	Cosmopolitenes s (Index)	0.20	1.65	1.15	0.31	2.65	1.47	0.03	2.90	1.24
12.	Economic motivation (Score)	0.41	0.34	2.33**	0.09	0.40	2.00*	0.31	0.20	2.10**
Probability of adoption			0.85			0.66			0.73	

Note: *, ** and *** Significant at 10, 5 and 1 per cent level, respectively.

Unlike multivoltine rearing, the adoption of bivoltine rearing was partial and patchy among the farmers in the Siddlaghatta area. The results reveal (Table 2) that the bivoltine rearing among small farmers is rare as evident from the low probability of adoption of 0.33. The factors such as age, family size, area under mulberry, income from sericulture and extension participation contributed to higher adoption of bivoltine silkworm rearing in general. The medium farmers showed a slightly higher probability (0.56) of adoption of bivoltine. The factors, which contributed significantly to the adoption of bivoltine in the case of medium farmers were area under mulberry, cosmopoliteness, extension contact and extension participation. Large farmers in Siddlaghatta taluk had the highest probability of adoption (0.73) of bivoltine with irrigated land, area under mulberry, income from sericulture and economic motivation as the factors influencing its adoption.

TABLE.2 FACTORS INFLUENCING ADOPTION OF BIVOLTINE SILKWORM REARING BY FARMERS IN SIDDLAGHATTA AREA

Sl. No.	Factors	Small farmers (n = 24)			Medium farmers (n = 20)			Large farmers (n=16)		
		Coeffi-cient	Mean	t-value	Coeffi-cient	Mean	t-value	Coeffi-cient	Mean	t-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Age (Years)	0.23	55.00	2.06**	-0.13	35.00	1.40	0.24	52.00	1.33
2.	Education (Score)	0.26	0.72	2.45	0.04	2.20	1.63	0.85	1.21	1.01
3.	Family size (Number)	0.37	2.75	2.05**	0.21	2.13	1.93	0.34	2.30	1.32
4.	Irrigated land (acres)	0.52	0.08	1.63	0.84	1.25	1.08	0.37	4.75	2.05**
5.	Total land (Standard acres)	0.12	2.20	1.07	0.73	5.15	1.14	0.23	7.60	1.72
6.	Area under mulberry (Standard acres)	0.63	0.83	2.36**	0.15	1.13	2.95**	0.31	2.40	2.08**
7.	Social participation (Index)	0.25	0.48	1.94	0.42	1.34	1.45	0.08	1.03	1.15
8.	Income from sericulture (Rs.)	0.69	3,500	2.20**	3.13	4,600	1.16	15,750	3.25	2.28**
9.	Extension participation (Index)	0.18	2.63	2.43**	0.33	3.65	2.95**	0.64	4.60	1.90
10.	Extension contact (Index)	0.11	1.80	1.33	0.04	2.85	2.21**	0.08	2.95	1.60
11.	Cosmopolite-ness (Index)	0.01	1.83	1.33	0.04	2.85	2.21**	0.08	2.95	1.60
12.	Economic motivation (Score)	0.68	0.72	1.97	1.09	0.13	1.82	0.29	0.42	2.23**
Probability of adoption			0.33			0.56			0.73	

Note: *, ** and *** Significant at 10, 5 and 1 per cent level, respectively.

From the foregoing analysis, it is amply clear that the farmers have an inherent preference for multivoltine race and the probability of adoption of bivoltine race was rather low among the small farmers (O'mara, 1971; Feder and O'mara, 1982).

However, among the large farmers bivoltine was preferred (with 0.73 probability) mainly due to higher levels of profit. It is also disconcerting to note that extension contact and participation have not contributed much to the adoption of bivoltine. Therefore it is necessary to have more of extension programmes involving farmers of all categories to give a boost to the adoption of bivoltine. It is needless to mention that the infrastructure required to support larger production of bivoltine cocoons needs to be created in the absence of which the entire effort will be a failure. In other words, strengthening the backward and forward linkages for bivoltine rearing is necessary, which will also strengthen the hands of extension machinery for effective implementation of the bivoltine cocoon production programme.

Unlike Siddlaghatta area, where the adoption of multi x bivoltine is predominant among all categories of farmers, in case of Kollegal, it is the C-Nichi race that is reared by all the respondents. In fact, the bivoltine race is unheard of in the area. Practically, C-Nichi race is considered to be more resistant to the diseases and requires very less care during rearing. Therefore, the race is common among all the rearers in the taluk. The farmers in the area, even though are blessed with canal irrigation grow mulberry under rainfed conditions. For the farmers of Kollegal, adoption of multivoltine in place of C-Nichi is considered as the adoption of improved race in the study.

The factors influencing multivoltine adoption (Table 3) in small farmers category in the region were age, education and income from sericulture. Further

TABLE 3. FACTORS INFLUENCING ADOPTION OF MULTIVOLTINE SILKWORM REARING BY FARMERS IN KOLLEGAL AREA

Sl. No.	Factors	Small farmers (n = 31)			Medium farmers (n = 17)			Large farmers (n = 12)		
		Coeffi-cient	Mean	t-value	Coeffi-cient	Mean	t-value	Coeffi-cient	Mean	t-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Age (Years)	-0.13	35.0	2.10**	0.12	48.00	1.32	0.62	54.0	1.85
2.	Education (Score)	0.71	2.21	2.43**	0.09	1.80	1.98	0.05	4.20	1.97
3.	Family size (Number)	0.45	1.05	1.98	0.64	1.71	2.10**	0.33	2.00	1.65
4.	Irrigated land (acres)	0.34	0.91	1.56	0.35	1.10	2.05*	0.03	3.25	2.22**
5.	Total land (Standard acres)	0.84	2.10	1.85	0.05	3.70	1.38	0.17	8.00	1.83
6.	Area under mulberry (Standard acres)	0.28	0.60	1.90	0.16	1.15	1.79	0.11	1.73	1.98
7.	Social participation (Index)	0.44	0.85	1.97	0.03	0.73	1.85	0.02	0.12	2.05*
8.	Income from sericulture (Rs.)	2.68	4200	2.63**	3.45	12200	1.30	3.92	19600	1.52
9.	Extension participation (Index)	0.38	3.40	1.22	0.42	3.21	1.68	0.32	4.25	1.64
10.	Extension contact (Index)	0.74	3.84	1.83	0.24	3.48	2.50**	0.66	5.13	2.53**
11.	Cosmopoliteness (Index)	-0.04	2.45	1.65	0.21	3.50	1.56	0.08	2.13	2.12**
12.	Economic motivation (Score)	0.40	0.16	1.15	0.10	0.32	1.25	0.22	0.65	1.83
Probability of adoption			0.80			0.73			0.68	

Note: *, ** and *** Significant at 10, 5 and 1 per cent level, respectively.

extension contact influenced positively though not significantly. In the case of medium farmers, family size, irrigated land and extension contact influenced the adoption of multivoltine race. The medium farmers had a probability of adoption of 0.73 for multivoltine race. The large farmers in Kollegal showed a probability of adoption of 0.68. The factors that contributed significantly for adoption were irrigated land, social participation, extension contact and cosmopoliteness.

The above analysis indicates that the adoption of multivoltine race in Kollegal area by small farmers is associated with the availability of the family labour on the farm. This is borne out of the fact that sericulture enterprise is labour-intensive. (Sinha, 1990).

The non-adoption of bivoltine race is mainly attributed to its higher failure levels and non availability of facilities like separate rearing house, lack of awareness about proper disinfection methods, improved rearing practices apart from lack of region and season-specific races. On the whole, the results clearly demonstrated that the farmers prefer a management strategy, which provides them regular and stable income as compared to a strategy involving high fluctuations in income (bivoltine race), which means that the rearers preferred to take low risk and expect high returns. This calls for a bivoltine race, which can provide a stable yield and income to the farmers. These results are in line with the results recorded by Blankenburg (1984); Just and Zilberman (1983) and Hiebert (1974). As the bivoltine race is not suitable for all conditions and by all categories of farmers, steps may be thought of to popularise the same among the large category of farmers, who have facilities like separate rearing house, irrigation, improved mulberry variety and are aware of the improved methods of rearing and prevention of diseases. Also the availability of the cocoon throughout the year may be ensured to the buyer by the extension agency and the rearer may be guaranteed of a regular buyer in the market at a better price.

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REFERENCES

Anonymous (2003), *Annual Report*, Central Silk Board, Bangalore.

Blankenburg, P.V (1984), "Why Didn't They Follow Our Recommendations", *Quarterly Journal of International Agriculture*, Vol. 23, No.3, pp. 191-192.

Feder, G. and G.T. O'mara (1982), "On Information and Innovation Diffusion : A Bayesian Approach", *American Journal of Agricultural Economics*, Vol. 64, No. 2, pp. 141-145.

Hiebert, D. (1974), "Risk Bearing and the Adoption of Fertilizer Responsive Seed Varieties", *American Journal of Agricultural Economics*, Vol. 56, No. 11, pp. 764-768.

Just and Zilberman (1983), "Stochastic Structure, Farm Size and Technology Adoption in Developing Agriculture", *Oxford Economic Papers*, Vol 35, No. 8, pp. 307-328.

O'mara, G. (1971), *A Decision – Theoretic View of Technique Diffusion in Developing Country*, Ph.D Dissertation, Stanford University, U.S.A.

Pindyck, R.S. and D.L Rubinfield (1981), *Econometric Models and Economic Forecasts*, Second Edition, McGraw-Hill, London, p. 310.

Sinha, S. (1990), *The Development of Indian Silk*, Oxford & IBH Publishing Co. Pvt. Ltd., Bombay.