Diffusion of Beekeeping Technology in Kerala:
An Economic Analysis

Dissertation submitted in partial fulfilment
of the requirements for
the award of the degree of
Master of Philosophy
in Applied Economics of the
Jawaharlal Nehru University, New Delhi

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2000

June, 30, 2000

I, hereby affirm that the research for this dissertation titled ***"Diffusion of Beekeeping Technology in Kerala: An Economic Analysis"*** being submitted to Jawaharlal Nehru University for the award of the Degree of Master of Philosophy in Applied Economics, was carried out entirely by me at the Centre for Development Studies, Thiruvananthapuram.

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Certified that this dissertation is the bonafide work of Mr. Jameskutty Kuriakose, and has not been considered for the award of any other degree by any other university.

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ACKNOWLEDGEMENTS

I consider it a great privilege that I could do my M.Phil. at CDS under Dr. John Kurien and Dr. Indrani Chakraborty. I am thankful to Dr. John Kurien for giving me the proper direction and constant encouragement. Without him I would not have put my 'scattered bees' into an 'analytical frame'. I am grateful to Dr. Indrani Chakraborty for her critical comments and the insightful interactions especially on the econometric aspects of the study. The freedom of work I enjoyed with both of my supervisors was indeed soothing.

I express my sincere gratitude to Dr. Chandan Mukherjee, the Director, Dr. P. Mohanan Pillai and Dr. Achin Chakraborty, the M.Phil course co-ordinators, for their encouragement and support at all stages of the M.Phil programme.

I thank all the faculty members of CDS for imparting me the know-how of research through classroom lectures, seminars and informal discussions. In particular, I record my thanks to Dr. K.K.Subramanian, Dr. P.S.George, Dr. P.Sivanandan, Dr. K. Pushpangadan, Dr. K.P. Kannan, Dr. Mridul Eapen, and Dr. V. Santhakumar, for their valuable comments and encouragement.

I am grateful to all the staff at the library, the administration and the computer centre especially Ameer, Shoba, Gopakumar, Phil Roy, Sujana and Krishnankutty. My special thanks is due to the Canteen Staff for all sorts of their help.

I have benefited much from the discussions with my seniors, Antonyto Paul, Hari Kurup, Sunny, Dennis, Suresh, Azeez, Venki, Shaji, Jojo, Deepa, Meena, Uma, and Shaheena. - I thank them all. Words are not sufficient to express my sincere thanks to my friend Binoy. Discussions with him helped to finetune my thoughts and methods.

The company of my dear classmates Parameswaran, Rajesh, Hari, Prabhakaran, Subodh, Sridhar, Chitra, and Sharmistha made the campus life an enjoyable one. And my junior friends - Ranjan, Subramanian, Kalitha, Ratikanth, Saji, Subratha Arasu, Ann, Kamna and Soujanya, made it still more lively.

I also extend my special thanks to my friend Veeraputhran for introducing me to the Rubber Board library. The comments and suggestions of Dr. V.T Jose, Dr. Tharian George, Toms, Viswanathan and Binni of Rubber Board were very helpful. My heartfelt thanks are also due to Thomaschettan of MDS for his sincere co-operation and encouragement in the initial stages of the survey. The services of Nixon, George and Unni for the field survey are gratefully acknowledged.

It was my teachers at St. Dominic's College Kanjirapally, who guided me to CDS. At the completion of my M.Phil, may I thankfully remember them.

Computer assistance I received aplenty. Rajesh, Suresh, Ajith, Anil and Sam helped me a lot. I thank them all. Words fail to thank Georgekutty, my friend in need and deed. Not only assisted in solving the computer related problems, but he also spared his computer and burnt midnight's oil with me for days.

A decade long friendship of mine with Regis was always a source of strength and light on my way of life. His encouragement sustained me throughout my M.Phil period. My thanks to him exceed my words.

CDS was a home away from home and at home, the love and affection of my sisters and brothers always instil inspirations and expectations in me. Finally, I search in vain for words to thank my Chachan and Amma whose prayers and blessings have been the source of my energy to go forward.

Jameskutty Kuriakose

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Chapter I

INTRODUCTION

Social scientists in India, especially rural sociologists and specialists in agriculture extension, have devoted their attention, over the past few years or so, to the study of the process by which agricultural innovations are adopted by individual farmers and diffuse within rural social systems. The rapid diffusion of innovations among farmers is considered essential to modernise agriculture and to increase output. Adoption of new farm practices and new agricultural technology also plays an important role in diversifying agriculture to minimise risks associated with crop and market failures.

The prospects of farm diversification as an effective solution to the uncertainties and risks of agriculture has been considered by various research studies across India. Weather and market induced risks are very high to most farmers. Further, the small size of holdings and subsistence nature of farming put constraints on capital formation in agriculture. These considerations make a strong case for farm diversification in Indian conditions. Research studies in India on farm diversification have mainly focused on traditional crops like paddy, sugarcane, wheat, cotton etc as the main crops and horticultural crops as the subsidiary crops and on the impact of new enterprises like dairying and animal husbandry in the farm sector. Dasgupta (1996) made a study on crop diversification and income levels based on a sample survey in the Karimnagar district of Andrapradesh. The study considered sericulture as the activity to diversify farm income. The findings of the study showed that after the introduction of sericulture, the average farm income increased from Rs. 876 to Rs. 2402, for marginal farmers and for small-scale farmers it rose to 3280 from Rs. 2482 at 1984-85 prices. Vyas (1996) considered agricultural diversification as an integral part of the process of structural transformation of the economy. He has given a true account of the complexity in the concept of diversification. According to him diversification involves the following,

- A shift from farm to non-farm activities.
- A shift from less profitable crop to more profitable crop.
- Use of resources in diverse but complimentary activities.

Here the first type of diversification is essentially the diversification of the rural economies

rather than the diversification of agriculture. The second type emphasises the farmer's response to price signals and the efforts to adjust to changes in market conditions. The third type is on the assumption that there exists unemployed or under employed resources that would raise the income frontiers. The rationale for diversification of farm activities are the following.

- The imperative to increase the income on smallholdings.
- The need for fuller employment in the farm households.
- Stabilisation of farm incomes over the seasons.
- The conservation and enhancement of natural resources.

In this context beekeeping (apiculture) holds very good potential as a subsidiary source of income for rubber farmers of Kerala. So far no study on farm diversification have examined the potential of bee keeping as a source of agricultural diversification, which enables the farmers to spread out risks and to ensure a steady flow of income over the years.

In Kerala, natural rubber is one of the major commercial crops, which has made an impressive growth during the past few decades. At present, nearly 20 percent of the total cultivable land in the state is under rubber. In the mid 1990's, there was a sudden and substantial rise in the price of natural rubber and rubber growers made lucrative profit out of it. However, this condition did not last for a long period. Recently, there has been a sudden fall in the price of natural rubber[1]. Now the small scale and marginal farmers cannot earn their livelihood from rubber alone. In this context, it is evident that some amount of diversification is necessary in order to overcome the problems related to the market for rubber. As pointed out earlier, for rubber farmers, bee keeping provides an additional source of income.

The three important byproducts and ancillary sources of income of rubber plantations are rubber wood, rubber seed and rubber honey. Of the three the extent of commercial exploitation of rubber honey is much less compared to the other two (Binni et al: 1998). At present the total area under rubber in Kerala is 469924 hectares, which constituting around 20 percent of the total cultivable land in the state (Indian Rubber Statistics: 1998-99). Results of

[1]Price of natural rubber, which was Rs.466 (per quintal), in 1968-69 rose to Rs.4531 in 1996-97 showing a steady increase over the years. But after 1996-97 there was a sudden fall in the price of natural rubber and by the mid of 2000 it reached s.3150 showing a decline of around 30 percent.

the experimental trials conducted in Rubber Research Institute Kottayam indicated that on an average 15 to 20 hives of *Apis Cerana Indica*[2] can be maintained in a hectare of rubber plantation. With a potential production of 182 kgs per hectare the total potential of honey production in Kerala is 469924 x 182 = 85526.168 tones (Haridasan et. al: 1988). But at present the total production of honey in the state is only 1963.823 tones (Binni Chandy et al :1998). The above data shows that exploitation of rubber honey in the state is only 2.29 percent of potential output of honey. Studies made by Binni et al (1998) also revealed that the Kanyakumari District of Tamilnadu has been dominating in the production and sale of rubber honey and in 1983-84 the region accounted for 69 percent of total collection and in 1990-91, it increased to 88 percent. In this context, it should be remembered that Kerala accounts for 84.97 percent of total area of rubber cultivation in India and the same for Tamilnadu is only 3.37 percent (Indian Rubber Statistics:1998). This phenomenon is mainly due to the migratory practice of beekeepers from Kanyakumari District to rubber plantations in Kerala. From 1965 onwards Tamilnadu Khadi and Village Industries Board (TKVIB) has been providing Rs.3 per bee colony migrated and in 1986 this grant was raised to Rs.10 (Gestus :1998). This phenomenon is mainly because as Kanyakumari region had an early beginning in commercial bee keeping. Also, over time the individual beekeepers from this region institutionalised contractual bee keeping in the rubber plantations of Kerala on a rental basis and the rent is often given in kind.

Although, beekeeping on scientific basis started in Kerala in the late 1950's, the adoption rate among Kerala beekeepers was gradual and very negligible in terms of scale and extent and rate of adoption as far as its potential in the state is considered. In other words, only a few of the potential adopters of Kerala, constituting around 10 lakh rubber farmers have undertaken beekeeping as a subsidiary source of income (Mathew: 1993). On the other hand, the beekeepers of Tamilnadu who migrate with their colonies to the rubber plantations of Kerala during the rubber honey season have undertaken beekeeping as the main source of their income. The rent to the plantation owners is given in the form of honey. Regarding fixation of rent, no bargaining takes place since the plantation owners don't have to bear any additional cost for placing these colonies. Thus without any risk and effort, plantation owners of Kerala get some honey for their home consumption.

In terms of the scale of operation, beekeepers in Kerala are small-scale operators. It is mainly

[2] Apis Cerana Indica is an Indian species of honeybee; details are given in the chapter III

among the middle income categories of people that beekeeping flourished as compared to its popularity among the lower income groups of their counterparts in Tamilnadu (Gestus: 1988). Of the total ten-lakh rubber farmers who constitute the potential adopters in Kerala, only less than one lakh have undertaken beekeeping as a subsidiary source of income.

Another development in the field of beekeeping in Kerala is the use of honeybees for pollination purposes in boosting the productivity of important crops like coffee cardamom etc. Experiments in India show that honeybees can increase the productivity of many crops through pollination (Kozhin: 1976).

Rubber being the major source of honey in South India, it looks interesting to examine why beekeeping flourished in Tamilnadu which contributes around 3.37 percent of the total rubber cultivation in India instead of Kerala which contributes to about 84.97 percent of the total area under rubber cultivation in India (Rubber Board Bulletin 1999). Studies by Binni et. al (1998) proved the dominance of Tamilnadu beekeepers both in the production and marketing of rubber honey. But due to the limitations imposed by time and resources, the present study is limited to the diffusion of beekeeping technology in Kerala only.

Now a question arises, why in spite of its less investment requirements and high profitability[3], which is considered to be an important factor in the diffusion of any innovation, bee-keeping has not received much attention on the part of rubber farmers in Kerala. To answer this question an economic and historical analysis of the factors, which hastened and hindered the growth of bee-keeping industry in Kerala is made within the framework of diffusion theories. Also, an evaluation of the strategies adopted by bee-keeping promotional agencies in the state is attempted.

I.1 Objectives of the Study

A major role of diffusion research in agriculture is to identify the factors, which contribute to the variation in adoption behaviour of farmers. Once these factors are known, they can be manipulated to expedite the diffusion rate among the potential adopters. The specific objectives of the present study are,

[3] Details costs and returns from beekeeping is given in Chapter III.

- ❖ To make an analysis of the process of diffusion of bee-keeping technology in Kerala for identifying the factors which hastened and hindered its growth in the state.
- ❖ To make an evaluation of the strategies adopted by bee-keeping promotional agencies in the diffusion of bee-keeping practice in Kerala
- ❖ To assess the relative role of demand side and supply side factors in the diffusion of beekeeping technology in Kerala.
- ❖ To assess the beekeeping practice in Kerala in terms of scale of operation, cost and returns from beekeeping and the marketing strategies followed.

I.2 Methodology and Sources of Data

In order to get a clear picture of the growth of beekeeping industry over the years and its present status in the state, both primary and secondary data is used. Primary data is collected by a sample survey among the members of Malanadu Development Society (MDS) Beekeepers Association (see Appendix I). For secondary data, publications of various bee-keeping promotional agencies are used.

I.3 Scheme of the Study

The study consists of seven chapters including the present introductory chapter. Chapter two gives a brief overview of the different perspectives of technology diffusion viz., adoption perspective, market and infrastructure perspective, economic history perspective and development perspective. The third chapter deals with a brief account of the technical aspects of beekeeping and the costs and return from a model apiary of fifty colonies of *Apis Cerana*. In chapter four, the diffusion of beekeeping over the years and an analysis of the beekeeping practices among the surveyed adopters are made. The differences in the perception of beekeeping by both adopters and non-adopters also are given. Fifth chapter is devoted to analyse the supply side aspects of diffusion of beekeeping in Kerala. Here a brief description of the various beekeeping extension agencies in the state and their promotional measures are given. Also the relative role of various agencies in the process of diffusion of beekeeping technology in the state is examined. Further a comparison of supply and demand side factors of diffusion is attempted. The sixth chapter deals with the demand side characteristics of

adopters in terms of their socio-economic and educational status. A comparison of the adopters and non-adopters in terms of different characteristics also is made. The last chapter summarises the conclusions drawn up from the preceding chapters.

Chapter II

THEORETICAL FRAMEWORK FOR THE STUDY: THE PERSPECTIVES ON DIFFUSION

Beekeeping is an allied activity in agriculture. Although there is no apparent similarity between the production of rice or wheat and the production of honey, the underlying principles are practically the same in agriculture and beekeeping. Beekeeping is mainly carried out by farmers and other workers who generally take part in agricultural operations. Thus, the determinants, which are established to have an important bearing on the adoption of innovation and new practices in agriculture, are assumed to be the determinants of beekeeping also. In this chapter an attempt is made to review the literature on the different perspectives of diffusion, with special focus on agricultural innovations. Also some of the studies on the diffusion of innovations in the context of Kerala are highlighted. This will serve as the framework for analysing the factors that determine the diffusion of beekeeping technology in Kerala.

2.1 Diffusion: - The Concept

Diffusion research, which is only a century old, has focussed on studying the manner in which innovations, new ideas and artefacts are adopted or rejected temporally and spatially by participants in a social system. A major goal of diffusion research in agriculture is to identify factors, which contribute to the variation in adoption behaviour of farmers. Once these factors are known, they can be manipulated to expedite the diffusion rate among the potential adopters. Generally the process of technological change is understood in terms of the Schumpeterian trilogy of (1) invention, (2) innovation and (3) diffusion. Invention is the process by which new ideas are created or developed (Rogers: 1972). An invention once made must be communicated and incorporated into technology to establish the superiority of the new technology over the existing one and this is termed as innovation by Schumpeter (Solow: 1972). Diffusion is the process by which new ideas are communicated to the members of the social system. (Rogers:1972). It is a time intensive process. But the time needed for the spread of innovation may vary from innovation to innovation among different categories of potential adopters of a social system. There is a general consensus in the literature regarding the 'S' shape of the diffusion curve (Rogers and Shoemaker: 1971;Stoneman: 1983; Griliches: 1957;

Bera and Kelly: 1982). This is because it is always expected that in the initial stages the rate of diffusion will be at a slow rate. With the advent of later adopters diffusion will pick up at a faster rate till it is spread among the whole of the targeted group. This would again slow down the rate of diffusion in the later stages. Most of the studies on the time lag involved in the process of diffusion distinguish the adopters into early adopters, early majority, and the laggards.

A potential adopter before taking a decision whether to adopt or to reject undergoes different stages of decision-making. Rogers and Shoemaker (1971) have classified the different stages in the process of adoption. They are (1) knowledge, (2) persuasion, (3) decision and confirmation. Each stage of this diffusion process is influenced by a number of factors. Based on the different approaches to the determinants of diffusion, Brown (1981) classified the literature on diffusion into four distinctive perspectives of differing vintage. They are (1) the adoption perspective, (2) the market and infrastructure perspective, (3) the economic history perspective, and (4) the development perspective (Brown 1981). A brief description on each of these follows.

2.2 The Adoption Perspective: - Demand Side Factors of Diffusion

The adoption perspective is the dominant and the most completely developed perspective. It focuses on the demand aspect of diffusion. Here adoption of an innovation is viewed as a s function of the individual adopter's propensity to do so, conditioned by social, economic and psychological characteristics (Brown: 1981).

2.2.1 Diffusion as a Function of Socio-economic Characteristics

The relation between socio-economic characteristics and adoption in relation to agricultural innovation is established by various scholars in diffusion theory. The personal and demographic characteristics, which can be deducted from the earlier studies, are age, caste, education and literacy, size of land holding, income and economic status and attitude towards change. The social characteristics are cosmopolitanism, contact to extension agencies, organisational participation etc.

The following are some of the personal characteristics, which are expected to have relationship with the adoption behaviour.

a) Caste: Mulay and Roy (1965), Chaukidar and George (1972) have pointed out a significant relation between caste and adoption. These studies pointed out that the level of adoption was higher among the farmers who belong to the traditionally farming castes.

b) Age: Age of the farmer is found to be an important characteristic by Shetty (1966), Subrahmanian et. al. (1982). Among the different age groups, it was the middle age group, which showed greater tendency to adopt recommenced farming practices. Added to their lack of experience, young people are not in a position to take decision in the presence of the older people who are the head of the families. Older farmers being too traditional and security conscious do not take the risk of adopting the innovation (Dasgupta: 1989).

c) Education and Literacy: Most of the studies like Chaudari and Maharaja (1966), Sharma and Nair (1974) have found a statistically significant relationship between/literacy and adoption behaviour. But the studies by Allen (1965), Shetty (1966) could find no relationship between education and adoption.

d) Attitude towards Innovation: it is argued that the earlier adopters are more willing to assume the risks of innovation because they hold risk- prefer attitudes. There are two types of attitude (1) a specific attitude towards an innovation and (2) general attitude towards change. (Rogers and Shoemaker (1971). But as far as the discontinuance of the practice is concerned, the earlier adopters are risk avoiders (Masen and Halter 1980). The individual attitude has been found to be an influencing factor in the adoption (Rao :1966, Shetty :1968, Chaukidar and George:1972).

e) The discontinuance of a practice can also change the rate of adoption. There are two types of discontinuance: (1) Replacement and (2) disenchantment (Rogers:1972). Replacement discontinuance is a decision to cease using an idea in order to adopt a better idea, which supersedes it. Disenchantment discontinuance is a decision to cease using an idea as a result of dissatisfaction with its performance. Several studies have tried to determine the characteristics of those individuals with a low and high rate of discontinuance. Generally, high discontinuance's have less education, low social status, less change agent contact and the like which are opposite of the characteristics of innovation. The discontinuance of an innovation is an indication that the idea was

not integrated onto the practices and the way of life of the adopters (Rogers and Shoemaker: 1971).

f) Economic Characteristics: - Economic characteristics of adopters measured in terms of the size of land holdings and income from various sources are found to be directly correlated to the ability to take risk of adopting a new idea (Dasgupta: 1989). A positive relation between farm size and adoption rate was established by Chaudary and Maharaja (1966), Shetty (1968), Chaukidar and George (1972). In contrast, the findings of Desai and Sharma (1960), Reddy and Reddy (1972) could not find any relationship between the size of holdings and adoption rate. Rogers and shoemaker suggested that there exist a two-way relationship between economic status and adoption behaviour. The farmers with high economic status adopt agricultural innovations, which result in a higher income for them (Roger and Shoemaker :1971).

g) Social Characteristics: - It is argued that the social characteristics of adopters determines the farmer's contacts with the extension agency and the outside world, the perception of the farmer regarding the innovation his knowledge, and the decision making etc, which in turn will have its bearing on the adoption behaviour of farmers (Singh et. al (1966), Sharma and Nair (1974). Also, the conformity of the practice with the community's norms and culture found to be a significant determinant of adoption. Studies have also shown that in India, inequality of farm capital across a sample of village communities, inequality in the distribution of knowledge about modern agricultural technology and inequality in the size of holdings etc impede the diffusion of innovation (Freeman et. al :1972). People of more similar social status are likely to share information and provide social support necessary to the reduction of risk involved in the adoption of new practices (Freeman et. al: 1972). The degree of village institutional development also found to be positively related to the success of village programme of agricultural change.

2.3 The Market and Infrastructure Perspective

The market and infrastructure perspective is of more recent vintage. The traditional or adoption perspective implicitly assumes equal opportunity for all potential adopters and focuses there fore upon individual characteristics to explain differences in actual times of adoption. By contrast, market and infrastructure perspective takes the stance that opportunity to adopt in many cases is unequal. Accordingly, it views the supply side of adoption and

focuses on the process by which innovation and conditions for innovation are made available to the potential adopters. Brown (1981), who developed this perspective is of the view that individual behaviour does not represent free will so much as choices within a constrained set. He argues that a great deal of variance in diffusion of an innovation can be explained by looking at institutional rather than individual behaviour. Thus the role played by the agency, which propagates the innovation, assumes importance in explaining the diffusion process.

First stage in the diffusion process is the establishment of a diffusion agency through which the innovation is made available to the potential adopters. These agencies, which make the innovation accessible to the potential adopters, determine the constraints within which the innovations are adopted. The diffusion agencies influence the adoption behaviour through (1) their establishment in a geographical area, (2) the strategies, which they adopt, (3) the organisational structure of the diffusing agency and (4) the market structure of the diffusing agency (Brown 1981). The establishment in the geographical area makes the innovation available to the area and determines the spatial diffusion of innovation. Strategies of the diffusion agency may be many and varied. Important among them are the following.

a) Development of Infrastructure and Organisational Capabilities.
b) Pricing: price charged for the innovation will have an important bearing over the rate of adoption.
c) Promotional Communications: Promotional communications are employed to provide the individuals with the information about the innovation and to persuade them to adopt. The impact of information on adoption can vary according to the channel, content, source and motivation of the diffusing agency.

The communication channels that are utilised to diffuse innovation have an important bearing on the rate of adoption. Various channels of communication obtained are mass media, interpersonal local contact, extension contact etc. These variables were found to have a positive impact on the adoption behaviour (Sharma and Nair: 1974). The interpersonal dealing seems to have more favourable impact on the rapid diffusion than mass media, which in many cases will be unfavourable to the farmers. Mass media such as agricultural magazines were found satisfactory for less complex innovations. But as the complexity increased, it needed more interpersonal interaction for the rapid diffusion of an innovation (Roger and Shoemaker :1971, Brown: 1981).

Organisational structure of the diffusing agency is an essential element of diffusion process since it can influence the pace of diffusion. Diffusion agency can be (a) centralised decision-making structure, (b) decentralised decision-making structure with a co-ordinating propagator or (c) a decentralised decision making structure without a co-ordinating propagator.

The structure of diffusing agency has its implications on the spatial pattern of diffusion, since in diffusion under a centralised decision making structure, a single propagator determines the number of diffusion agencies to be established and their location, size and other characteristics. More over, capital availability, sales potential, etc are also important determinants of diffusion.

In the case of decentralised decision making system with a co-ordinating propagator, where vital decisions depends on the information flows and incentives, the diffusion pattern is influenced by the decision of the co-ordinating propagator (Brown: 1981).

The foregoing discussions lead us to the conclusion that both demand and supply factors are equally important in the diffusion of a technology. But the questionable assumption on which these two are based is that they assume innovation to be static. But through the process of learning by doing, it is possible that innovation may undergo changes. This dynamic nature of innovation process is taken into consideration by the economic history perspective.

2.4 The Economic History Perspective

The economic history perspective introduces a temporal dimension to the process of diffusion, and treats innovation as a continuous entity. This approach assumes that innovation is a continuous process where by the forms and functions of the innovation and the environment into which it must be adopted are modified through the life of innovation and these changes affect both the innovation and its market. Improvements brought out by the users are to eliminate the defects embodied in the innovation at the early stages of adoption, and to make it more compatible to the environment to which it is being introduced. This perspective interprets the delayed adoption as the outcome of rational decision-making based on the expectations of future improvements in the innovation. Basically, technological change and innovation are seen as economic phenomena and the pace of diffusion explained largely in terms of profitability. Economic historians consider the following six factors to be important

determinants of diffusion, five of which are endogenous and the last one is exogenous. They are,

1) Continuity of the inventive activity
2) Development of technical skill among the users of innovation
3) Development of Skill in machine making
4) The complementarities, which relax and enable the bypass of constraints that develop in the course of applying the technology.
5) Further improvement of replaced innovation.
6) The exogenous determinant:- the exogenous determinants are those which are outside the innovation production process.

2.5 The Development Perspective

The development perspective examines two aspects: the impact of innovation diffusion on development such as individual welfare and social change. It also examines the way in which diffusion is affected by the aspects of over all level of economic development. With regard to the first question, for many years it was widely believed that innovation diffusion has a positive impact upon individual welfare and collectively economic development and social change. Accordingly, development programmes were forged ahead giving little attention to the benefits of innovation. However, even after the initiation of development programmes, elitist entrenchment still prevails in Third World Nations as well as among regions and social classes in their economic development. Further, some would argue that these characteristics have worsened often as a consequence of innovation diffusion itself. Thus, the development aspect of innovation diffusion has come under increasing scrutiny in recent years.

The second major aspect of development perspective is the impact of the level of development or the development process itself upon the innovation diffusion. This is first discussed in terms of the adoption perspective and then in terms of the market and infrastructure perspective. With respect to the adoption perspective, the ease with which a given innovation will diffuse through a population generally depends upon its congruence with the personal characteristics and social norms of that population, which in turn are related to the level of development. Thus, the appropriateness of an innovation is not an absolute quality so much as an indication of such congruence (Brown :1981) With regard to the market and infrastructure perspective, development also affects innovation diffusion through its inter

relationships with the social institutions, public policy objectives and artefacts of human landscape such as infrastructure. Particular attention is given to the improvement and the proliferation of infrastructure that occurs as a corollary of development. Accordingly, infrastructure additions and improvements may be seen as enabling innovations, which generally increase the rate of diffusion (Brown :1981).

2.6 The Complementarity Between Perspectives

From the above discussion it could be concluded that there is a close similarity between the various perspectives in the diffusion of technology. Each perspective emphasises the different aspect of the diffusion process. The initial slowness of the 'S' shaped diffusion curve according to the economic historians is the reflection of the time needed to improve the innovation to adapt it to a variety of potential markets or users and delays caused by the expectation of further improvement. The adoption perspective attributes the flatness of the 'S' shaped curve to the innovative characteristics of adopters. The market and infrastructure perspective attributes it to the establishment of diffusion agency and their strategies.

Given the various perspectives, researchers who embark on the task of studying the diffusion of an innovation are often confronted with the dilemma of which perspective they should use for the purpose of analysis of a specific case. A review of the literature shows that a vast majority of the pre-1970 uses only the adoption perspective. So Brown (1981) argues that so much attention has been given to the demand or adoption side of diffusion that we may be in a situation of diminishing returns to research effort, where as the supply side is virtually virgin territory for academic and applied research. An emerging number of studies there after, particularly those undertaken by economists, use a combination of the economic history, the development perspective, and also the market and infrastructure perspective. The consensus at the moment is that given the complimentary nature of the four perspectives, all four must be considered in coming to understand the process of diffusion of an innovation.

In India diffusion studies made their first appearance in the early 60's. Most of these studies were conducted either by rural sociologists or specialists in agriculture extension and their studies were dealt primarily with the diffusion and adoption of agricultural innovations. Majority of diffusion studies in our country has dealt either with the problem of differential acceptance of farm practices as a function of status, role, and motivation or with the problem

of the communication of innovations. The area dealing with the problem of differential acceptance of farm practices, as a function of socio-cultural systems has remained relatively untouched (Gupta: 1989).

2.7 Characteristics of Innovation

Attempts also were made to identify the characteristics of innovation, which affect the diffusion of an innovation. The perceived characteristics of innovation which are supposed to influence the rate of adoption are (1) relative advantage, (2) complexity, (3) compatibility, (4) trialability and (5) observability (Rogers and Shoemaker: 1971). Brown (1981) argues that relative profitability and required investment are the two important factors, which determine the diffusion of a new technical innovation or an economic practice. "Ceterus paribus, the more profitable the innovation and smaller the required investment, the greater the rate of imitation (diffusion)" (Brown :1981). Relative advantage or profitability of an innovation has a number of different dimensions like the degree of economic profitability, low initial cost, lower perceived risk, economic incentives associated with it, saving time and effort, the immediacy of the reward etc (Rogers and Shoemaker: 1971).

Now some of the empirical studies on the diffusion of innovations in the context of Kerala can be examined. Kurien (1996), after studying the diffusion process of plywood boats in marine fishing concludes that not all-inventive activity leads to an innovation. He also comments that when diffusion of an innovation takes place, the causal factors are numerous and uniquely interrelated in time and space. As the diffusion proceeds in time, the manners in which these related factors intervene also undergoes a dynamic transformation and create the conditions that steer the diffusion process and give it direction into the future.

Pillai (1992) points out that the failure to diffuse innovation across productive sectors may be a major factor for the long drawn stagnation in the growth of Kerala economy. He also brings out the fact that so far no serious attempt has been made to wards identifying the major constraints to the diffusion of innovations particularly in rural parts of Kerala. He adds that although these suggestions have been raised in some studies, on agricultural development of Kerala, the focus has been confined to the linkage between research laboratories and extension centres. So he concludes that the examination of the constraints in the rural innovations, which can generate significant changes in the economy, are essential.

Shobha Varghese analyses the constraints in the diffusion of HYV paddy seeds in Kerala (Vaghese: 1995). The study brings out the following facts with respect to the diffusion of agricultural technology in Kerala. The sustained agricultural development requires much more than just provisions of physical inputs like seed fertilisers and modern implements. She also brought out the duplication of efforts in respect of extension, education and research. Also, there is a continuous neglect of extension activities, which has a major role in diffusing technology. The analysis also found that the adoption of HYV doesn't depend on yield, but on risk factors since HYV's are highly prone to vagaries of nature. She suggests that there should be continuity in the innovation and diffusion process and emphasis the role of local institutions like panchayaths and Krishi Bhavans in training and extension activities. The importance of the institutional framework in the generation and spatial diffusion of agricultural technology is also highlighted.

Shaheena analysing the constraints to the diffusion of sericulture technology in Kerala, concludes that any single perspective of diffusion may not be adequate to explain the process of diffusion in Kerala (Shaheena :1993). As the major constraint in technology diffusion is the infrastructure, it would follow that the intervention of the extension agency for overcoming the supply side constraints is essential. In the context of rural technology diffusion, it cannot be left to the market forces if rapid diffusion is to be achieved.

From the above literature review we saw that there are so many factors, which influence the diffusion of an innovation. Apart from the above factors, the potential adopter's attitudes, values, structure of the society in which innovation is introduced also will affect its diffusion.

Chapter III

TECHNO-ECONOMIC ASPECTS OF BEEKEEPING

Introduction

In the previous chapter we have seen that innovation characteristics like profitability, investment requirements, complexity etc have an important bearing on the rate of diffusion of an innovation. Several studies have projected the profitability and potential of beekeeping as a subsidiary activity in rubber plantations. The study by Haridasan et al (1988) projected an average productivity of 10 kg per hive per year, and on an average, 15-20 hives can be placed in a hectare of rubber plantation The study by Binni et al (1998) showed an average productivity of 12 kg per hive per year. This chapter provides a brief account of the technical aspects of beekeeping in Kerala. Also, the costs and return from beekeeping from a model apiary is estimated for assessing the economic viability of beekeeping in the context of Kerala.

Section I

I .1 Technical Aspects of Beekeeping

Beekeeping or apiculture is the scientific method of conservation and rearing of bees for the production of important hive products such as honey, beeswax, royal jelly bee venom and for the pollination of crop plants. It is the sum total of the ensuing activities: (1) selection of a good locality with nectar secreting flowering trees, plants, shrubs and bushes; (2) domesticating the bee colonies in hives with proper care on scientific and established lines most suitable to the locality, (3) providing food during dearth of nectar, and (4) the extraction and use of the products to the best advantage of the society at large. An important feature of beekeeping is that it is an exclusive non-land based industry, which doesn't compete with other farming systems for resources. More over, it helps in the conservation of forests and ecosystems because honeybees render essential ecological services such as cross-pollination and propagation of plant species and thereby maintaining biological diversity. Thus, apiculture is different from other developmental activities because it has only positive ecological consequences.

Beekeeping can be taken up both at household and commercial level to generate additional income and employment. It is an important income generating activity to the marginal farmers, land-less labourers, and weaker sections of the society. Hive products such as honey, royal jelly, bee wax pollen etc provide both nutritious food and cash income.

An international Expert Meeting on Bee-keeping Development held in Kathmandu, Nepal, from 21 to 23 June 1989 suggested bee keeping for sustainable agriculture and rural development. The major emphasis of the meeting was on creating awareness among the policy makers and planners in different government organisations and international donor agencies regarding the role of apiculture in solving the different economic, nutritional, ecological and social problems of rural communities. Economic analysis carried out in Himalayan countries revealed that as a small cottage industry, beekeeping required only low cost technology, and even the poorest could engage in this with very little financial support. In Kerala too, researchers and policy makers have pointed out the growth potential of honey. (Thankamma and George: 1968, Haridasan et. al: 1988), Tharian George and Toms: 1992). As a matter of fact, bee pollination researches carried out in western countries revealed that the main significance of honeybees and apiculture is in cross-pollination where as, hive products such as honey; bee wax and royal jelly are of secondary value.

As we have seen in the introductory chapter, beekeeping is possible in areas with adequate bee flora with at least one major honey season. In Kerala the major source of honey is rubber honey and the honey flow season extends from January to April. (Jayarathnam :1970, Suryanarayana :1983). (It is the period in which the rubber trees shed the old leaves and the new leaves appear) One important feature of rubber honey is that it is obtained from the extra floral nectarines such as petiolar nectaries, nectariferous bud scales and nectariferous glands on the lower surface of the leaves (Thankamma and George:1968). But bees collect honey mainly from the petiolar nectaries. Nectaries are active 20-25 days and coincide with flowering, which normally occurs during February to April. The bees are not pollinators of rubber but are best nectar gatherers. The rubber nectar flow season continues for 2-3 months on the whole as the refoliation occurs in an overlapping pattern in the rubber plantations. The nectar flow is adversely affected due to rains in the flow period and consequent leaf shedding as a result of powdery mildew disease (Jose et. al: 1999).

I .2 Species of Honeybees found in Kerala

At present, there are five species of honeybees in Kerala. Among these, *Apis cerana, Apis dorsata, Apis florea* and *Apis trigonna ireedepenes* are native to the region, where as the European species, *Apis Mellifera* which is TSBD resistant to Thai Sac Brood Disease (TSBD) has been introduced to Kerala following the destruction of the *Apis cerana* by (TSBD) in the early 90's. Of the five species, *Apis cerana, Apis Mellifera* colonies[1] are domesticated scientifically in movable frame hives for apiary honey production. Although the little bee *Apis trigona irredepenes* (Dammer Bee) also is domesticated the scientific extraction of honey is not possible in the case of Dammer bees. The following are the different species of honeybees found in Kerala.

1) ***Apis Cerana Indica*: - *This*** species is found in almost all places in Kerala. It can be easily domesticated in movable frame hives and management is easy compared to the other species. It is the most commonly used species in the apiary honey production in Kerala. Although the productivity of *cerana* is much less compared to the *Mellifera*, the investment requirements for this species also is very low[2].

2) ***Apis Mellifera*:-** This species was introduced to Kerala from North India (Punjab and Hariyana) following the destruction of the native honeybee *Apis cerana* in the early 90's. This is domesticated in beehives with movable frames. This is the most important species in honey and bees wax production in the world. Although, it is gradually adapting to our environment, the high productivity reported in major honey producing countries like Germany, China etc has not yet been achieved in Kerala[3].

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[1] A bee colony is a collection of worker bees, drones and a queen. The number of worker bees in a colony extends from 5000-10000 and that of drones from 100-1000.)

[2] The study by Jose et al – RRII Kottayam in different locations of Kerala showed that on an average, the productivity of *cerana* was 9 kg per hive per year and that of *Mellifera* 24 kg in 1998. The income from *Mellifera* beekeeping was four times higher than that of the *cerana* and the investment requirements are 3.4 times higher. However, inconsistency has been observed in honey yield obtained from both type of apiaries and the profitability of beekeeping over the years (Jose et al 1999).

[3] Productivity of *mellifera* is around 50 kg per hive per annum in these countries.

3) *Apis Trigona Irredepenes* (Dammer Bee): - This is the smallest of all bees. It is domesticated in clay pots, wooden boxes etc. The productivity is of this species is very low as compared to the other two domesticated bees. But in terms of quality this honey is superior to the other types and fetches a higher price compared to the other two types[4] (Primary Survey).

4) Apis Dorsata:- This species is usually found in the branches of big trees, or in an open cave under a roof of rock and builds only a single comb. *Dorsata* honey constitutes a major portion of wild honey production (Padmanabhan: 1997). All efforts to domesticate this species have failed.

5) Apis Florea :- Like *Apis dorsata*, this species also build nest in trees and rocks and builds only a single comb. This species also is not domesticated yet.

I .3 Hive Products:- The important hive products are honey, bees wax, bee venom, pollen and royal jelly. In Kerala only honey and bees wax are exploited commercially (Binni et. al: 1998).

Honey:- Honey according to one recent definition is the sweet substance produced by the bees from the nectar of blossoms, or from secretions of living substances and stored in honey combs (Codex Alimentarius Commission:1998). Extracting honey from the comb in apiary beekeeping is done by using a centrifuge, which spins the honey out of the combs against the cylindrical wall of the extractor. As stated earlier, the major source of honey in Kerala is rubber honey. According to the Bureau of Indian Standards (BIS) specifications, rubber honey belongs to medium grade (Grade A) with average moisture content of 22 percent[5]. The major commercial applications of honey are in Ayurveda and Unani systems of medicine, pharmaceutical preparations, confectioneries, bakeries and other food products and manufacturing industries (Binni et.al: 1998).

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[4] The productivity of Dammer bee was only 0.62 kgs and the average open market price of dammer honey was RS 253.43 and that of the other two species were 68.59 (primary survey).

[5] According to BIS specifications, honey is classified into three grades based on the moisture content. It prescribes less than 20 percent moisture for special grade, 20-22 percent for grade A and 22-25 percent for standard grade.

Bees wax:- Bees wax, a by-product of beekeeping industry is used in the manufacturing of artificial comb foundation, drum coating and it is an essential ingredient in industries such as cosmetics perfumes, confectioneries and pharmaceuticals (Binni et. al: 1998).

Pollen:- Pollen is produced during the flowering season of a plant, which usually lasts a few days or weeks. Pollen is the bees source of protein and other substances required for rearing brood and a colony may use up to 50 kg of pollen a year. During pollen flow season, it is possible for the beekeeper to harvest up to 0.5 kg of pollen per day.

Royal Jelly:-It is a very rich food, which enables the honeybee larvae to grow extremely quickly, more especially queen larvae, which are fed exclusively on royal jelly. Royal jelly is used in treating a wide variety of human diseases and malfunctions.

Bee Venom:- It is secreted by the sting glands of the worker bees. Bee venom is used in acupuncture and for treating certain types of rheumatism.

I .4 Beekeeping Equipment:- Main beekeeping equipment needed for scientific beekeeping are bee box with movable frames, Honey extractor, hive stand, bee knife, and bee smoker. It is in bee boxes with movable frames that the bee colony is domesticated. Honey extractor is used for extracting the honey from the comb without destroying it Bee boxes are placed in hive stands in order to protect it from the attack of aunts, termites etc. Bee knife is used for removing the cap of honeycomb before extraction. Bee smoker is used for making the bees less aggressive by smoking them at the time of opening the bee box. Other beekeeping equipment are bee capturing net, bee Vail, queen gate, hive tool, queen excluder sheet, bee escape etc.

Section II

II.1 Costs and Returns from Beekeeping

The costs and returns from beekeeping given here is for a basic unit of 50 colonies of *Apis Cerana Indica,* the Indian species. The figures have been projected from the primary survey data, earlier studies on the topic and the reports of Khadi and Village Industries Commission

(K.V.I.C) Income from bee keeping depends on the yields of various bee products like honeybee wax, royal jelly bee venom etc. In the present analysis only honey and bee wax are considered because only these two are commercially exploited in the state. The most successful bee keeping would be in areas where two seasons: spring and autumn have sufficient bee flora for the bees. But in Kerala the major source of honey is rubber honey (95 percent) and there is only one honey flow season in the state during a year (January-May).

Another factor contributing to the honey yield is colony density (number of beehives per hectare). For optimum yield, colony density is considered to be 15-20 hives per hectare of matured rubber plantation[6] (Haridasan et. al: 1988). But in our case this limit is not considered because of two reasons.

a) A Family of average size five can manage a minimum of 50 colonies with out additional labour[7].

b) The number doesn't pose a limit since at present only less than 3 percent of the honey production potential is exploited in the state.

The reported productivity of honey was 7.32 kg and bees wax 200 gms per hive per year. But the reported yield was found to be less than the projected yield of earlier studies. The reason for the low reported productivity is due to the fact that the honey yield in each year is highly prone to climatic variations and this year's yield was very low in Kerala (Rubber Board Estimates - 2000). Studies made by Binni et. al (1998) shows that average production or productivity of honey per hive per annum is 12. KGs and 200 gms of wax. Estimates made by Haridasan et. al (1988) projected a productivity of 10 kg per hive. For calculating the costs and returns from beekeeping in the present study an average productivity of 12 kg of honey and 200 gms of wax is considered to be the standard yield per hive per year.

II.2 The equipment and Capital Costs

The equipment and capital costs for starting a model apiary of fifty colonies (*apis cerana*) is given in the table below (Table 3.1).

[6] With increase in the hive density in a particular area, the productivity per hive will come down. (Haridasan et al, 1988).

[7] The survey showed that beekeepers who are having more than fifty colonies are employing hired labour.

Table 3.1 The Equipment and Capital Costs

Beekeeping Equipment	Numbers Required	Rate	Total Cost (in Rs.)
Triple chambered Bee boxes	50	200	10000
Hive stand	50	20	1000
Honey extractor	1	750	750
Smoker	1	100	100
Bee colony	50	350-200 =150*	7500
Miscellaneous			400
Total			**19750**

* Horticorp subsidy is Rs. 200 per *cerana* colony
Source: Primary Survey &MDS

II.3 Recurring costs

The recurring expenses include expenses for off-season feeding. For this sugar solution is used. It is estimated that 4 KGs of sugar is needed for one bee colony per year. Thus assuming a cost of Rs. 15 per kg of sugar total cost for feeding amounts to

4 x 50 x 15 = Rs. 3000

Thus, the total cost (both capital and recurring) for a bee unit of 50 colonies amounts to Rs.

19750+ 3000 = Rs. 22750

Table 3.2 Details of income from a unit of 50 colonies.

Hive Products	Yield /hive in kg	Total Yield (In Kg)	Price per Kg	Total Income
Honey	12	50 x12= 600	42	25200
Wax	0.2	50 x 0.2 =10	80	800
Total				**26000**

Source: Binni et.al (1998)

Thus for a model apiary of 50 colonies, total fixed investment for the first year is RS 19750 and recurring expense is Rs. 3000 per year and so the total cost is Rs. 22750. Assuming a productivity of 12 kg of honey per hive per year the total revenue from honey at a price of R 42 per kg (The procurement price of MDS in the year 2000) would be 12 x 50 x 42 =25200. With this we can add the income from wax production also. Assuming 200 gms of wax production per

hive, 10 KGs of wax can be produced from 50 colonies. At the present price of Rs. 80 per kg of wax it will fetch an amount of Rs. 800 to the beekeeper. Thus, the total income to the beekeeper amounts to Rs. 26000 (25200 +800) per year.

Thus in the first year itself the beekeeper can gain around 114.3 percent (26000 /22750 x 100) of his initial investment and can repay the full amount of the loan and interest after six months[8]. From the second year onwards the only expense is for feeding the colonies during the off-season and it amounts to Rs. 3000 per year Thus from the second year onwards the net income from 50 colonies would be Rs. 23000 (26000-3000).

Now the effort and time required for managing 50 colonies can be calculated. It is estimated that to look after one colony it requires 10 minutes every week[9]. Thus for managing 50 colonies 433 hours of labour is needed per year for which the beekeeper gets a return of Rs. 230600 giving him an income of Rs. 53.12 per hour.

Here it should be mentioned that the above calculations are based on the procurement price of Rs. 42 per kg of honey. But in the survey it was observed that, in the open market, on an average the beekeepers are getting Rs. 68.59 for one kg of honey. Also, in the present analysis we have not included the income that the beekeeper can obtain through the sale of bee colonies by multiplying the bee colony from the second year onwards[10]. Another thing, which should be remembered in this context, is that the present analysis considers only the direct benefit of bee keeping. Through the production of honey and bee wax. Pollination researches carried out in western countries proved that the significance of honey bees and apiculture lies in the cross pollination of crops, where as hive products such as honey and bee wax are of secondary value only. When we include the above factors the real gain from bee keeping would much higher than the estimation done above.

No other agricultural activity gives this kind of return with so little effort and time. It also doesn't require hard physical labour and can easily be taken up by women and children. This

[8] It is assumed that the beekeeping unit is started in the month of November and the honey season ends by April.
[9] Weighted average of time required for beekeeping in the honey season and off-season (Primary Survey).
[10] It is estimated that on an average one bee colony can be divided into three before the honey season in each year (Primary survey).

part time activity can give excellent income and leave the beekeeper free to do other work during the rest of the week.

Summing up

In this chapter we have made a description of different species of honeybees and their relative role in honey production in Kerala. We have also estimated the costs and returns from beekeeping for a model apiary of fifty colonies. Our analysis proved that beekeeping is a profitable activity, which requires little effort and investment.

Chapter IV

DEVELOPMENT AND DIFFUSION OF BEEKEEPING

This chapter provides an overview of the development and diffusion of beekeeping in India and Kerala over time and space, which will serve as a background for the study. Further, a detailed analysis of the beekeeping practice in Kerala in terms of the scale of operation, employment implications and marketing strategies etc is made based on the information collected from the survey. Moreover, the problems and prospects of beekeeping as perceived by both adopters and non-adopters are discussed. For a diachronic analysis of the diffusion of beekeeping, adopters are categorized into three groups on the basis of the year of adoption. The early adopters (Category I) are those who adopted beekeeping on or before 1983 (Highest production of honey in the state in the 80's was recorded in 1983 (KVIC Annual Report: 1990). Those who started beekeeping in between 1983 and 1992 (Thai Sac Brood Disease Occurred in 1992) are grouped as subsequent adopters (Category II). Finally late adopters (Category III) are those who started beekeeping after 1992.

Section I

At present the beekeeping in Kerala has come to the national scene ranking first in the production of honey (KVIC: 1991) due to the untiring efforts of individuals, agencies and organisations like Kerala Sarvodhayasangh, Malanadu Development Society, KVIC, KKVIB, Rubber Board and other beekeepers co-operative societies. This analysis is made on the basis of the data available from various sources like Khadi and Village Industries Commission, Kerala Khadi and Village Industries Board, Rubber Board, etc and the information collected from interviews with the officials and beekeepers. The main problem in making such an analysis is the fact that beekeeping industry is relatively less organised and geographically scattered and the financial and economic records maintained by the beekeepers are not scientific and systematic. However, it is expected, that this analysis, based on the available data, will serve as a background for the study.

I.1 Bee Keeping Development in India During The British Period

Although honey and honeybees are known to human beings since time immemorial, bee keeping, unlike several other rural industries is not a traditional enterprise in India. In India, the first movable frame hive was introduced for domesticating bees in Bengal in 1880. Research work on beekeeping began in Tamilnadu from the year 1880, when Rev. J Castets, S. J, a professor of St. Joseph's College, Thiruchirappally, made trials with the rock bees, the little bees and the Indian bees. He came to the conclusion that of all the bees, only the Indian bees could be domesticated and this species alone will yield profitable results. After these initial ventures of very little success, Rev Fr. Newton, a Christian missionary from Italy came into the picture. It was around 1910, that Fr. Newton designed a small hive suitable for the Indian honeybee *Apis cerana indica* in Kanyakumari and successfully maintained it in hives. This hive, which was named as "Newton Hive", is still popular for keeping indica bees. During 1911-17, he also trained large number of beekeepers in southern India and helped them to establish beekeeping as an economically viable proposition. Later, Newton's experiences were published in an article, "The Demonstration of the Indian Honey Bee". Thereafter, the Young Men's Christian Association (YMCA) authorities of the then Travancore and Coimbatore began popularising this industry as one of their means for rural reconstruction. After a brief gap, the Royal Commission on Agriculture (1928) recommended bee keeping as a cottage industry. Thereafter, earnest efforts were made by many states like Madras (1931), Punjab (1933), Coorg (1934), and Utter Pradesh (1938) for the adoption of this industry. Mahatma Gandhi, foreseeing the importance and its utility in rural development included bee keeping in his rural development programmes. An All India Beekeepers Association was established in 1938-39 and subsequently it started publishing "The Indian Bee Journal", which still has the distinction of being the only journal in the country exclusively devoted to bee keeping. Thus even though the British rule put an end to the development of village industries in the country, the bee keeping industry took its roots during this period.

I.2 Beekeeping Development in The Post Independence Period

After independence, taking a cue from the Government of India' s policy to rejuvenate the rural industries, the newly established All India Khadi and Village Industries Board took up the task

of bee keeping development in the country. In 1956 this Board was reconstituted as Khadi and Village Industries Commission (KVIC) under the industry ministry, having Khadi and Village Industries Boards at the state level. Some states like Jammu and Kashmir, Karnataka, Utter Pradesh, and Himachal Pradesh established Departments of Bee keeping Under the State Ministry of Agriculture/industry. Apiculture research in the right earnest started when the Indian Council of Agricultural Research (ICAR; previously called as Imperial Council of Agricultural Research) started funding the bee keeping projects in the states, central institutions and other organisations. Under this programme, a bee keeping research station was established at Nagrota (Punjab) in 1945 and at Coimbatore (Tamilnadu) in 1951. Further, considering the importance of applied and basic research in apiculture, KVIC established a Central Bee Research and Training Institute (CBRTI) at Pune in November 1962, with overall development of bee keeping as its mandate. CBRTI also established some regional centres in various parts of the country. Following the successful introduction and establishment of the exotic honeybee *Apis Mellifera* in Punjab by the Punjab Agriculture University in 1962 at Nagrota (now in H.P) and in 1965 at Ludhiana, ICAR sanctioned Operational Research Project on the establishment of Indian Honeybee in Punjab in 1976.

On the recommendations of the National Commission on Agriculture (1976), An "All India Co-ordinated Project on Honey Bee Research and Training was launched by ICAR in 1981 with CBRTI, Pune as its main centre. At present its headquarters has been shifted to Choudary Charan Singh Haryana Agriculture University Hissar. This ICAR sponsored project has its co-ordinating centres at Solan (H.P), Ludhiana (Punjab), Vijayarai (A.P), Jorhat (Assam), Pusa (Bihar), Vellayani (Kerala) Pant Nagar (U.P), Bhubneshwer (Orissa), Chethalli (Karnataka) and NewDelhi. Some voluntary centres and several State Agricultural Universities (SAUs) are also engaged in bee keeping research and training. During 1993, Ministry of Agriculture, Department of Agriculture and Co-operation laid special emphasis on bee keeping as an important component of the total programme of the ministry and started a "National Scheme on the Development of Bee keeping for Increasing Crop Productivity". Under this scheme, bee keeping research and development projects are sanctioned to various SAUs/Agriculture Departments, Government and non -government organisations. The Government has also took steps to set up a National Bee keeping Development Board in September 1993 with representation of administrators, scientists, development functionaries, NGOs and beekeepers as well.

Until 1960's, the development of bee keeping in India remained confined to the species *A. cerana indica* and that too in the north hill region, southern states and north-eastern region. So far no systematic census has been made in India. However, Phadke and Wakhle (1996) gave an account of the progress of beekeeping in India particularly through KVIC (Table 4.1). Keeping in view the area, topography, and the population of India, this progress seems to be very meagre. The herculean target of achieving six million colonies and a production of 60,000 tones of honey annually envisaged by National Commission for Agriculture (1976) by 2000 A.D, got an unforeseen jolt during 1980s, when a deadly viral disease called Thai sac brood disease appeared in *Apis cerana indica* colonies.

Table 4.1 The Development of beekeeping Industry under KVIC since 1953-54 in India

Year	No. of Beekeepers	No. of Colonies	Honey Production (Tonnes)	Average Production Per Colony (Kg) Per Year
1953-54	232	800	1	1
1963-64	57198	164597	713	4.33
1973-74	150421	522714	2435	4.65
1984-85	200000	868000	550	6.33
1990-91	246000	1061000	9288	8.75
1993-94*	236000	678000	5529	8.15

*Thai sac Brood disease appeared in south India that killed large number of A. *cerana indica* colonies.
Source: Phadke and Wakhle, 1996

The above table shows that there was a steady growth of bee keeping under Khadi and Village Industries Commission over the years except during the period 1993-94 when the viral disease attacked bee colonies in South India.

From the table it is clear that over the years, not only the number of colonies and total production of honey but also the average production per colony (productivity) was showing a steady growth. But, here it should be noted that the above data covers only those farmers who have under taken the activity under the patronage of K.V.I.C. Moreover, it is also estimated that

apiary honey constitutes around 50 percent of the total honey production in India (50 percent is wild honey or hunted honey) (G.S Dogra and J.K Gupta: 1993).

Although the Italian honeybee *A. mellifera* was introduced in India following the attack of Thai sac brood disease in mid 1960s in Punjab, it was extended to the farmers in Punjab only in 1976. This long gap led to the delay in the beekeeping development in Punjab/India. Further, restrictions on its spread in the latter years to other states, proved still more damaging to the growth and development of bee keeping with A. mellifera in India. Nevertheless, Punjab made a tremendous progress in bee keeping with *A. mellifera*. Today, Punjab with only 1.5 percent of India's geographic area has the honour of being the leading state for supplying honeybee colonies of *Mellifera* and beekeeping equipment to other states. The other states where *A. mellifera* was introduced to revive the bee keeping industry is also showing good progress, even though it is not as fast as in Punjab. Today National Horticulture Board and National Bee keeping Development Board has taken up the task of creating awareness through honey festivals, and other beekeeping activities. All India Beekeepers Association is doing great service to the development of this industry through the publication of 'Indian Bee Journal'.

I.3 Development of Beekeeping in Kerala

In Kerala bee keeping is concentrated mainly in rubber areas because the major source of apiary honey is rubber (around 95 percent) (Haridasan et. al: 1988). Rubber trees have a special feature. During the sprouting of leaves, a tiny drop of honey is generated on its bud and bees collect this honey. New leaves appear on rubber trees during the period January to May, and this period constitutes the honey season in the state.

The Kerala Khadi Board took steps in 1949 to promote bee keeping and Kerala Khadi Commission followed suit in 1953 (Mathew: 1993). It was "Sarvodhayasangh" that used to collect honey from the beekeepers. Since the price of honey was not attractive the beekeepers did not show much interest in developing the programme. When the Khadi Board and Khadi Commission started collecting honey in 1972, the farmers began to show greater interest in beekeeping. In 1972 there were only 220 beekeepers and 450 bee colonies in the whole state.

On realising that honey production will increase in rubber plantations, beekeepers of Kanyakumari district of Tamilnadu started migrating with their colonies to central and northern Kerala. Actually it was this "process of migration" that created enthusiasm in Kerala to develop bee keeping.

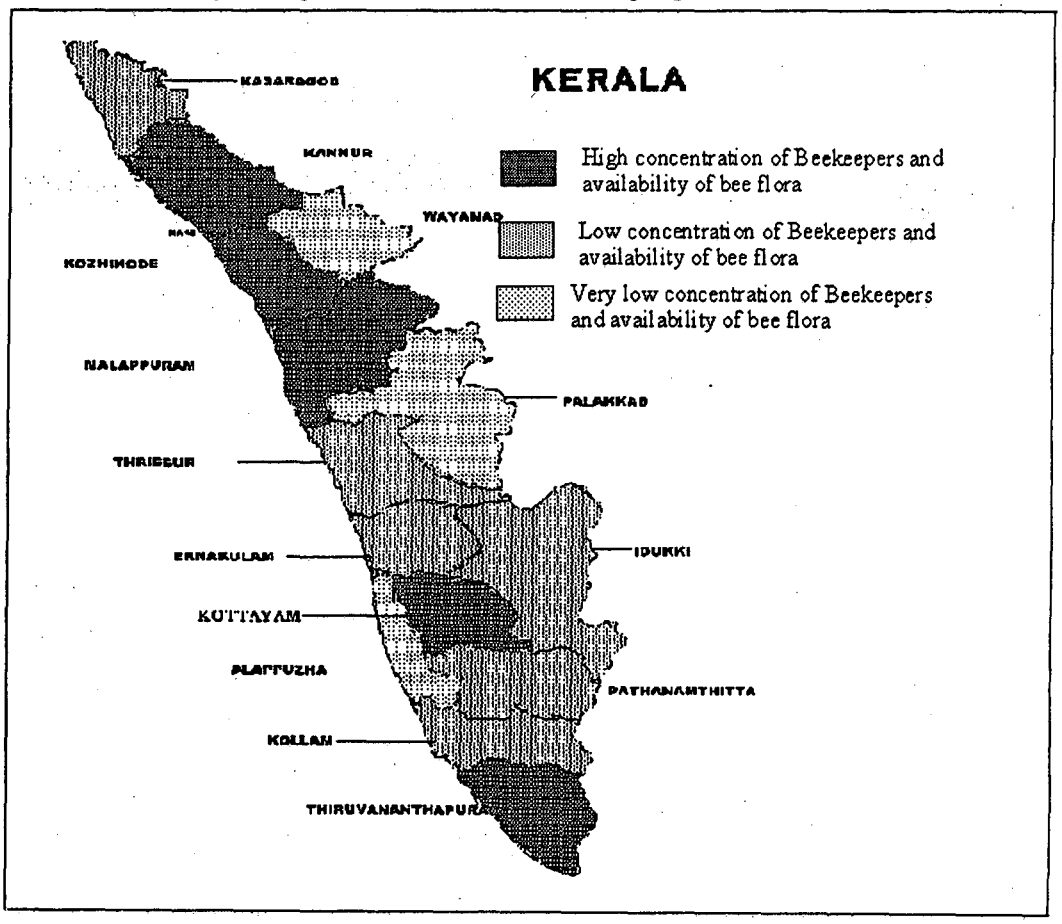
In 1974, only about 205 colonies belonged to the migrant beekeepers. The number rose to approximately to 10 lakhs colonies in 1990 (Mathew: 1993). Meanwhile many voluntary organisations also entered this field such as beekeepers co-operative society, YMCA, Indian Apiary Industries, Indian Institute of Honey, Kanyakumari Sarvodhayasangh etc. It was YMCA Marthandom in Kanyakumari district of Tamilnadu, which started to give training in beekeeping first in India and send these trainees to other parts of the country. Malanadu Development Society from central Kerala and Gandhi Ashramam, Malaparambu in north Kerala also engaged in its promotion in Kerala. Record production of 17,00,000 kilograms of honey in Kerala was noted in the year 1982-83 from 2,36,000 colonies owned by 23,400 beekeepers.

The number of persons interested in beekeeping increased considerably with the introduction of the subsidy schemes prepared by Malanadu Development Society and put into effect by the Rubber Board in 1987. The number of beekeepers, which was 50000 in 1985 rose to 88000 in by 1989-90 (Mathew:1993). Unfortunately, the devastating viral disease, Thai Sac Brood Virus Disease (TSBD) which affected North India in the late seventies, appeared for the first time in Balissery (Northern Kerala) in 1989-90. In the early 1990s this disease resulted in the destruction of majority of bee colonies in the state[1]. There fore serious discussions were made at different levels, for immediate steps to revive the industry. The Kerala Agriculture University with the help of ICAR took the lead in bringing 60 colonies of *Apis mellifera* bees, which is resistant to the brood disease from Haryana. Malanadu Development Society (MDS) Kanjirappally also joined in these efforts and brought ten colonies for development and research. Since the experiences removed the apprehension about the survival of this species in a hitherto unknown climate, MDS brought 300 colonies of *Apis mellifera* in January 1993 and distributed them to beekeepers in different parts of Kerala and their progress is under supervision.

[1] Jacob et. al (1993) reported that about 90 percent of the apis cerana colonies were destroyed by TSBD in Kerala.

The viral disease has more or less disappeared from the state (Suryanarayana: 1996). The studies made by Binni et all (1998) shows that Kerala has achieved a productivity of 12 kgs per hive which is higher than the national average of 8.5 kgs per hive. At present the main agencies, which are engaged in the marketing of honey in Kerala, are KVIC, KKVIB, and Federation of Beekeeper's associations Pappanamcode, Thiruvananthapuram, M.D.S. Kanjirappally and around 200 beekeepers co-operative societies in the state (Binni et.al 1998). Regarding the spatial pattern of adoption, the honey production statistics and availability of bee flora across districts shows that the districts of Kottayam, Kannur Kozhikodu, Malappuram, and Thiruvananthapuram are very good for beekeping. These districts are followed by Idukki, Ernakulam, Thrissur, Kollam, Pathanamthitta and Kasaragode. The geographic conditions of the remaining districts like Alleppy, Wayanadu and Palakkadu are not conducive for beekeeping in Kerala (See Map 4. 1).

Map 4.1 Spatial Diffusion of Beekeeping in Kerala.



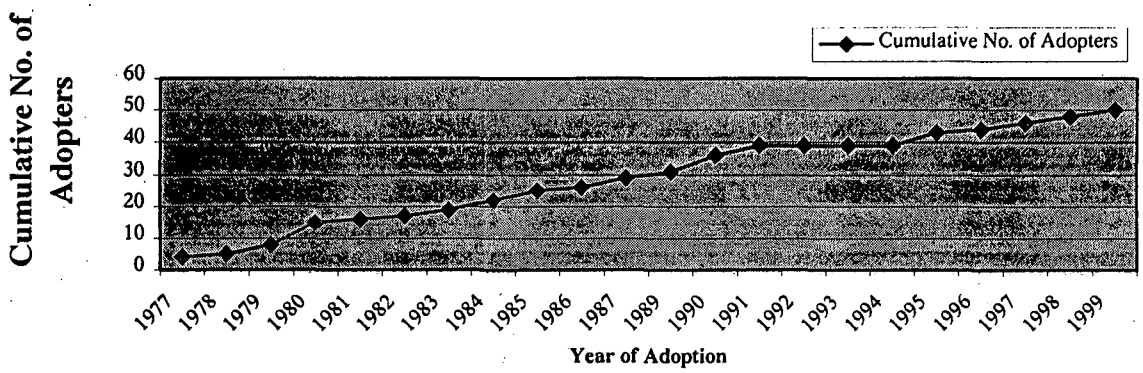
Section II

In this section, a detailed analysis of the beekeeping practice in Kerala is attempted on the basis of the data collected through primary survey.

II.1 Diffusion of Beekeeping Over the Years

Regarding the development of beekeeping over the years, it was observed that 19 beekeepers belong to the earlier class of adopters, 20 in the second category of subsequent adopters and 11 in the third category of late adopters. The diagram (Figure 4.1) depicts the diffusion of beekeeping over the years in the surveyed area. The diffusion curve of beekeeping over the years shows that the development of beekeeping is still in the infancy stage, even though beekeeping on scientific basis started n Kerala in the early seventies. Moreover the diffusion rate (Average No. of adopters per year) shows a declining tendency over the three periods. The average number of adopters per year over the three periods was 3.16, 2.22 and 1.375 respectively.

Figure 4.1 Diffusion of Beekeeping over the Years



II.2 Return from Beekeeping and Scale and Nature of Operation

The average number of colonies at the starting year was 3.06 only. But now the average number of colony is 27.19 and ranges between 4 to 160 colonies (Table 4.2). It shows that Kerala beekeepers are only small-scale operators as compared to their Tamilnadu counterparts, who are having at least a minimum of 100 colonies and the range extends up to 1550 colonies (Gestus: 1988).

Table 4.2 Scale of Operation of Beekeeping.

	Colonies at the time of starting	No of colonies now
Mean	3.06	27.19
Minimum	1	4
Maximum	20	160

But a clear difference in the scale of operation among different categories of adopters was observed. In the case of early adopters (Category I) the average number of colony was 48.87, 18.76 for the second category and 10.64 for the third category (Table 4.3). This shows that the scale of operation is expanded over the years. But the rate of increase of the scale of operation is not high in Kerala as compared to the Tamilnadu migratory beekeepers where the number of colony owned by a single beekeeper ranges from 100 to 1550 (Raja Gestus: 1998). One reason for this difference is that for most the Tamilnadu migratory beekeepers, beekeeping is the main source of their income as compared to the beekeepers in Kerala who do beekeeping only as a subsidiary source of income.

Table 4.3 Scale of Operation among Different Categories of Adopters

Colonies	Early Adopters	Subsequent Adopters	Late Adopters
Average No: of Colonies	48.87	18.76	10.64

The productivity (average production of honey per colony per year) among the surveyed beekeepers was 7.32 kg. Average income from one colony was estimated to be RS 407.32 per year and the establishment cost of one beehive for a model apiary of 50 colonies was RS 410. The reported productivity and income from one colony are less than the projected ones where the productivity was assumed to be 12 kg per hive and the gross income in one year to be RS 552. The establishment cost of one colony also was slightly higher than the projected one. The reported establishment cost of one colony was RS 410 while the projected cost was RS 395. Thus, an average beekeeper having 27 colonies is earning a gross income of RS 11014 per year from beekeeping alone But the correlation between the scale of operation and productivity was negative (-0.12) and insignificant.

On an average the income from beekeeping as a percentage of total family income was 27 percent and as a percentage of income from rubber alone it was as high as 42 percent. The result shows the profitability of beekeeping as a subsidiary activity even at this level of productivity. This result also shows that beekeeping can supplement to some extent the rubber farmers the fall in their incomes due to the fall in the price of natural rubber.

In this context it should be mentioned that 44 percent of the surveyed adopters admitted that beekeeping can fully supplement the fall in their incomes due to the fall in the prices of natural rubber, and 30 percent are of the view that through beekeeping this fall can be supplemented to some extent. The rest 26 percent only responded negatively. (Table 4.4) It was seen that it was mainly the adopters whose number of colonies was more than the average, responded positively to the question.

Table 4.4 Can Beekeeping supplement the fall in income due to the fall in the Price of natural rubber?

Response	Frequency	Percent
Yes	22	44.0
No	13	26.0
To Some Extent	15	30.0
Total	50	100.0

The survey results also proved that once a person has begun the activity there is less probability for him to drop the activity. Although 7 beekeepers i.e. 14 percent have dropped it, it is attributed only to the deadly viral disease TSBD that occurred in 1992 killing all most all the colonies. So we consider this factor as an exogenous one, which occurred in 1992, destroying almost all the colonies, which was virtually a shock to the beekeepers. Also, none among the dropouts complained non-profitability as reason for dropping. But now the disease is not considered be a serious problem by the beekeepers that around 86 percent have restarted beekeeping after the thorough destruction of the bees in 1992.

Individual motives regarding the purpose of adopting beekeeping showed that in the beginning 48 percent started beekeeping only as a hobby, and for 50 percent of the adopters the reason for adopting was to earn additional income (Table 4.5). Comparing the two tables

(Table 4.5 and 4.6) now, 88.4 percent of those who still do the practice, the purpose of the activity is to earn additional income, and only 4.7 consider it as a hobby only. (Home consumption) and 7 percent do it both for home consumption and commercial purposes (Table 4.6). The reason for starting beekeeping among different categories of adopters also supports this view (Table 4.7).

Table 4.5 Reason for Starting Beekeeping

Reasons	Frequency	Percent
Started as a Hobby for own Consumption	24	48.0
To Earn Additional Income	25	50.0
Suitability as Subsidiary to Rubber	1	2.0
Total	50	100.0

Table 4.6 Purpose of doing Beekeeping Now

Purpose	Frequency	Percent
Own Consumption and Hobby	2	4.7
Commercial Purpose	38	88.4
Own Consumption and Commercial Purposes	3	7.0
Total	43	100.0

From the table it is clear that for the first two categories of adopters, the main reason for starting beekeeping was that they considered it as a hobby (47.5 percent and 60 percent respectively). But for the late adopters, the main objective of starting the activity was to earn additional income (63.6 percent) and only 27.3 percent of the late adopters started it as a hobby and 9.1 percent started beekeeping because of its suitability as a subsidiary activity in rubber plantations. Thus the shift of emphasis from a leisure time activity to an income earning exercise itself shows the economic importance of beekeeping.

Table 4.7 Reason for Starting Beekeeping among different Categories of Adopters (In %)

Reasons	Category 1	Category 11	Category 111
Hobby and Own Consumption	47.4	60	27.3
To earn Additional Income	52.6	40	63.6
Suitability as a Subsidiary Activity in Rubber Plantation	-	-	9.1
Total	100	100	100

An analysis of the reason for starting (Table 4.7) and doing beekeeping now (Table 4.8) also proves the popularity of beekeeping as a commercial and income generating activity. For the early adopters 47.4 percent started beekeeping as a hobby and 52.6 percent as an income generating activity. But now all the early adopters who still do the activity consider beekeeping as a commercial enterprise (Table 4.7). In the case of second and third category also the shift of emphasis from a leisure time activity to an income generating commercial enterprise can be observed. In the case of second category, 60 percent started the activity as a hobby and the rest 40 percent as an income earning activity. But now only 11.8 percent consider beekeeping only as a hobby, 82.4 percent do beekeeping as an income generating activity only and the rest 5.9 percent consider it both as a hobby and as a source of income. (Table 4.7) In the case of late adopters, 27.3 percent started beekeeping as a hobby, 63.6 percent the main reason for starting the activity was to earn additional income and 9.1 percent started it due to its suitability as a subsidiary to rubber cultivation. But now no beekeeper from this category considers beekeeping as a hobby only. 81.8 percent of the late adopters consider beekeeping as a commercial enterprise earning additional income and the rest 18.2 percent do it both as a hobby and commercial enterprise (Table 4.8).

Table 4.8 Purpose of Doing Beekeeping Now among Different Category (In %)

Purpose	Category I	Category II	Category III
Commercial Purpose	100	82.4	81.8
Home Consumption and Hobby	-	11.8	-
Commercial Purpose and Home Consumption	-	5.9	18.2
Total	100	100	100

It is clear that in the case of first category, all of them are doing beekeeping on a scientific basis. With respect to the second and third category, 82.4 percent and 81.1 percent respectively are considering beekeeping as a commercial enterprise. Thus even though the problems related to marketing and low procurement price were reported, the main reason for doing beekeeping is on economic considerations.

II.3 Employment Implications of Beekeeping

The table (Table 4.9) shows that majority (58.2 percent) of the beekeepers are helped by family members in doing works related to beekeeping and 39.5 percent do the activity on their own. Thus, the implications of beekeeping on wage employment found to be very negligible as only 7 percent of the beekeepers are employing hired labour that too in honey flow season only. The main reason for less employment of hired labour is mainly because of the fact that most of the beekeepers are small scale operators, and so the works can be done by the beekeeper himself or receiving some help from the other family members.

Table 4.9 Details of labour employment for Beekeeping

Labour Employment	Frequency	Percent
Own Labour only	17	39.5
Helped by family members	23	53.5
Employing hired labour	1	2.3
Helped by Family Members and Employing Hired Labour	2	4.7
Total	43	100

Although direct generation of employment is negligible, backward linkages of employment in the form of increased employment to carpenters making bee boxes and other workers making extractors and other beekeeping equipment are to be considered. Also forward linkages of employment in the field of processing and marketing of honey also deserves significance. More over beekeeping has much implication as it involves the exploitation of the under utilised capacity of the members of the households. In other words the very fact that

beekeepers does not use hired labour points to the existence of disguised unemployment among the house holds of rubber farmers and the utilisation of this under utilised capacity to reduce the phenomenon of disguised unemployment among rubber farmers.

To the question of the type of beehives used, 39 out of 43 persons responded that they are not using the ISI specified beehives i.e. 90.3 percent are not using the ISI specified bee boxes (Table 4.10). Only 9.3 percent i.e. 4 are using the ISI specified beehives. The main reason for not using the ISI specified beehives was reported to be the high cost as compared to the commonly used ones. Thus, of those 39 beekeepers that do not use the ISI beehives, 92.7 percent reported high cost as the reason for not using the ISI type hives (Tables 4.11). The price of ISI specified bee box sold at M.D.S is Rs. 750 and that of the commonly used boxes made by beekeepers themselves or imported from Tamilnadu ranges from Rs. 200 to Rs. 350 (Source: Primary Survey).

Table 4.10 Use of ISI specified beehives.

Response	Frequency	Percent
Yes	4	9.3
No	39	90.7
Total	43	100

Table 4.11 Why not using ISI Specified bee boxes

Reason	Frequency	Percent
High cost	36	92.3
Other Reasons	3	7.7
Total	39	100

Among the other reasons reported for not using ISI type bee box, some of them reported that the commonly used low cost ones are more suitable for high yield and off-season management. Thus, it can be inferred that one reason for the slow diffusion may be the high cost of ISI specified bee boxes, as bee box is one major equipment for beekeeping. This

argument is supported by the fact that the schemes of most of the promotional agencies especially that of Rubber Board insists on the use of ISI specified bee boxes.

II. 4 Marketing of Honey

Regarding the mode of marketing the product, for 41.9 percent of the beekeepers, the only marketing out let is directly selling their product to the final consumers, 18.6 percent rely only on M.D.S for marketing honey and 34.9 percent do both direct selling and selling to M.D.S (Table 4.12). It was also observed that only one person is processing and directly sells the product and one beekeeper uses the product only for home consumption. Thus, in total 79.1 percent are directly selling at least some amount of their product. This phenomenon is mainly due to the difference existed between the procurement price of M.D.S (RS 42/-) and the price at the open market. The average open market price was RS 68.59 and was 63 percent higher than the procurement price (Table 4.13). It was also observed that those who sell their entire produce directly to the consumers are mainly small scale operators and those who sells their product both to M.D.S and directly to the consumers are comparatively large scale operators who cannot sell their entire product in the local market.

Table 4.12 Marketing Outlets for Honey

Marketing Outlets	Frequency	Percent
Direct Selling Without Processing	18	41.9
M.D.S (without Processing)	8	18.6
Home Consumption Only	1	2.3
Direct selling without processing and Home consumption	15	34.9
Direct selling after processing	1	2.3
Total	43	100

Thus it is evident that farmers are ready to sell their product to M.D.S at the prevailing procurement price, if there anything left after meeting the local needs. Thus beekeepers consider marketing at M.D.S only as last resort as they don't have the facility of processing and storing the honey for a long time after the honey season is over. Also the selling price of M.D.S for raw honey was RS 70 and for processed honey was RS 110. Thus M.D.S charges a

high margin on honey marketing. In this context it should be noted that as per KVIC estimates, the processing cost of honey is Rs. 15.98 involving all processing costs plus AGMARK fee, interest on capital depreciation, interest charges etc. (See Appendix 2). The table 4.13 shows the prices of honey.

Table 4.13 Procurement and Selling Price of Honey (in Rs.)

Price	Rupees
Procurement Price of Raw Honey By M.D.S	42.00
Average price received by the Beekeepers in the open Market	68.59
Selling Price of Raw Honey by M.D.S	70.00
Selling Price of Processed Honey by M.D.S	110.00

Thus, a monopsony type of market exists for honey in the surveyed area. This argument is substantiated by the fact that as 92 percent of the beekeepers complained of the inadequacy of the present procurement price (Table 4.14).

Table 4.14 Whether the present procurement price is Fair?

Response	Frequency	Percent
Yes	4	8
No	46	92
Total	50	100

Although four persons are of the view that the present procurement price is fair, one among the four is the one who processes and markets honey. The main reason for this stand by this person is the fact that he processes and markets not only his own product but also procures honey from other beekeepers to meet the entire demand for his bottled honey. The other three persons who share the above view are found to belong to the drop out class of beekeepers. On an average beekeepers suggested Rs. 68.69 as a fair procurement price for honey (Table 4.15). But the reasons for complaining of the inadequacy of present procurement price were different (Table 4.16).

Table 4.15 What do you think as Fair Price for Honey (in Rs.)

Summery Statistics	Rupees
Mean	68.69
Minimum	50
Maximum	90

Table 4.16 Why the present price is not fair

Reason for the Inadequacy of the Price	% of Beekeepers
Do not cover cost of production	36.9
Rise in General prices	27.3
Less than the market price	81.4
Less than the real value of honey	11.6
Middlemen exploitation	37.2

The break even yield of *cerana* bee colony is estimated to be 3.94 kg per hive per year and that of *mellifera* is 16.68 kg at the procurement price of Rs. 42 per kg. (Jose et. al 1999). The procurement price is the same in the year 2000 also. Thus even at a productivity of 7.32 kg per hive, (The Reported Yield) beekeeping is profitable.

From the above tables it becomes clear that the beekeepers main complaint was due to the difference existed between the procurement price and selling price of honey by M.D.S and the open market price. Thus, 81.4 percent pointed out the high margin between the selling price and procurement price. It was seen that for raw honey the selling price was 66 percent higher than the procurement price and for processed honey it was 161 percent higher (selling price of raw honey was Rs. 70 and processed honey was Rs.110). More over 37.2 percent complained of the middlemen exploitation of beekeepers and 27.3 are of the view that the present price is inadequate when we consider the rise in the general price level. Also, 36.9 percent share the view that the present procurement price does not cover the cost of production, and 11.6 think that the price is inadequate as compared t o the real value of honey. In general we can say that although 36.9 percent complained of the inadequacy of present price to meet the cost of production, the main reason for their complaint was their feeling of being exploited as the difference existed between the selling price and procurement price was very high.

II.5 Beekeeping with *Apis Mellifera*

Regarding the prospects of beekeeping with *Apis Mellifera*, it is too early for a full-scale assessment. However the slow adoption rate i.e. only by four beekeepers (9.3 percent) of this species even after seven years of its introduction in Kerala shows that its growth was not much significant as compared to the Indian species in terms of its productivity and other positive traits in its native place and even in North India. But the productivity of *Mellifera* was 15 kg of honey. But his was less than the estimated breakeven yield of 16.68 kg (Jose et. al 1999) but the data on the investment requirement of *mellifera* beekeeping shows that it was 3.4 times higher than that of *cerana* beekeeping which is more than 100 percent higher than that of the indigenous one (*Apis Cerana*). It was also reported that most of the beekeepers that bought one or two colonies of *Mellifera* lost their colonies in the subsequent years i.e, 10 percent lost *Mellifera* colonies, which they bought from M.D.S. The major factor the slow adoption of the newly introduced exotic species may be the fact that the climatic conditions of Kerala are not much suitable for its growth. Also it was first introduced in 1993 in Kerala and distributed to the beekeepers without giving them any training in their management. From the experiences of *Mellifera* beekeepers they reported that the management practices of the new ones are dissimilar to the indigenous bees. Thus the hasty decision of M.D.S to distribute the *Mellifera* colonies without giving them any training caused the destruction of most of the colonies distributed and this created a bad impression among the beekeepers regarding the prospects of the *Mellifera* bees in Kerala. This bad impression created by the destruction of newly introduced bees can be another reason for the slow diffusion of *Mellifera* beekeeping in the state. The data on the prices of *Mellifera* beekeeping equipment shows that it is several times higher than that of the indigenous ones. Thus, another factor responsible for the slow diffusion of *Mellifera* bookkeeping is the high initial investments needed to under take it.

II .6 Dammer Beekeeping *(Apis Trigona Irredepenes)*

The survey showed that 58 percent of the beekeepers are doing dammer beekeeping also. The average number of dammer bees was 8.72 colonies (Table 4.17). The average production of honey per colony per year was 0.62 kg. Although the productivity of dammer bees was very low, the average price received for the dammer honey was several times higher than that of

the ordinary honey. It was found that most of the beekeepers are directly selling this honey to the consumers. The average price received by the beekeepers for the dammer honey was RS 253.45. The reason for this high price is the high medicinal value of dammer honey compared to the other types. In this context it should be mentioned that practically this species does not require any effort on the part of beekeepers for the management compared to the other two. This species does not require feeding in the off-season also. The only cost is for beehives, which are often made of clay pots, and wooden boxes. Thus the cost of dammer beekeeping is practically very low and it holds a high growth potential. But at present no beekeeping extension agency is engaged in its promotion in the state. The table below shows the status of dammer beekeeping among the surveyed households.

Table 4.17 Status of Dammer Beekeeping among the Surveyed Adopters

Summery Statistics	No: of colony	Productivity (in kg)	Price of honey (in Rs.)
Average (mean)	8.72	.6236	253.45
Minimum	1	.25	150
Maximum	100	1	400

II.7 Problems of Beekeeping as perceived by the beekeepers

There was no unanimity of opinion among the beekeepers regarding the problems faced by them. Any way the data on the problems of beekeeping from the beekeeper point of view (Table 4.18) shows that they think TSB disease as the main threat to beekeeping. Second to TSBD, come the problems related to marketing and delayed payment of cash. Also, 24 percent of the beekeepers complained of the inadequacy of present procurement price and off-season management of beehives. 16 percent of them expressed the view that the government is not giving due consideration to the development of beekeeping in the state. Interestingly, only 2 beekeepers i.e. 4 percent of the beekeepers think that Tamilnadu migratory beekeepers are a threat to the local beekeepers. Thus here we see the peaceful coexistence of local beekeepers and migratory beekeepers from Tamilnadu. More over no beekeeper reported management of bees and high cost of production as a problem. But many of the non-adopters consider management of bee colony as the reason for not starting the activity. This result shows the differences in the perception of the technology by the adopters and non-adopters

this can be mainly attributed to the failure of the beekeeping extension agencies in the state to disseminate the technology among the potential adopters.

Table 4.18 Problems of beekeeping as perceived by the beekeepers

Sl. No.	Problems of Beekeeping	% of Beekeepers
1	TSB Disease	32
2	Marketing and Delayed Payment	30
3	Off-season Management	24
4	Not getting Fair Price	24
5	Govt. is not giving due Consideration to Beekeeping	16
6	Adverse Climatic Conditions	8
7	Threat of Migratory Beekeepers	4
8	Management of Bees	0
9	High Cost of Production	0

II.8 Off-Season Management of Bee Colonies

On an average, beekeepers are incurring a cost of Rs. 45 per bee colony per year for off-season feeding of bees. It was also only 63 percent of the adopters reported that they had forage plants for off-season management of bees (Table 4.19). This brings out the fact that still all the beekeepers have not recognised the need for forage plants, which successfully reduces the cost of off-season feeding.

Table 4.19 Beekeepers having Forage Plants

Response	Frequency	Percent
Yes	28	56
No	15	30
Not Applicable	7	14
Total	50	100

II.9 Adopter's Perception of Beekeeping

Nobody surveyed is doubtful of the prospects of this industry as 54 percent of the adopters ranked very high prospects for beekeeping and 34 percent think that its prospects in the state is high. Thus in total 88 percent of the beekeepers find good prospects for beekeeping (Table 4.20). Even though they complained of marketing problems like delayed payment and low procurement price, the view regarding its prospects and the data regarding the cost and revenue shows that beekeeping is profitable even at the present procurement price of Rs. 42. The complaint is mainly due to the exploitation of market surplus, which occurs due to the difference between the supply price and demand price of the honey by marketing agencies like M.D.S. Thus, a sort of middlemen exploitation of farmers can be seen in the case of honey marketing. The table below shows the adopters perception of the prospects of beekeeping in Kerala.

Table 4.20 Prospects of beekeeping in Kerala as perceived by the Beekeepers

Response	Frequency	Percent
Very High	27	54
High	17	34
Not so Bright	6	12
Total	50	100

Summing up

In this chapter we have analysed various aspects of beekeeping technology like investment requirements, income and profitability. The analysis of beekeeping practice in Kerala shows that then Kerala beekeepers are small-scale operators as compared to their counterparts in Tamilnadu. But there was a clear difference in the scale of operation among different categories of adopters as the average number of colonies of earlier adopters are about five times higher than that of the late adopters. Although most of the beekeepers started beekeeping only as a leisure time activity, the main reason for doing beekeeping now is the economic considerations. In terms of the employment implication of beekeeping, majority of the beekeepers are helped by beekeepers in doing the works associated with beekeeping and

only a few beekeepers are employing hired labour. Bu the high involvement of family labour shows that with the adoption of beekeeping house holds are able to utilise the unutilised labour potential in the households. We noticed that there was considerable difference existed between the procurement price, and the open market price of honey. Although majority of non-adopters reported that the main reason for not adopting beekeeping was their perceived complexity associated with the management of bees, none of the adopters consider management of bees as a problem. Moreover most of the adopters assigned high prospects for beekeeping in the state. Although the reported productivity of *cerana* colonies was less than the projected one, it was proved that *cerana* beekeeping was profitable even at the reported level of productivity and at the present procurement price. But in the case of *mellifera* beekeeping it was found that the reported productivity was less than the break-even yield. The diffusion rate of this species also was very low even after seven years of its introduction in the state. With respect to Dammer beekeeping it was observed that 58 percent of the beekeepers have some colonies of Dammer bees along with *cerana* beekeeping.

Chapter V

SUPPLY SIDE CHARACTERISTICS OF BEEKEEPING TECHNOLOGY IN KERALA

Introduction

In chapter two we have seen that the first stage in the diffusion of any innovation is the establishment of a diffusion agency through which the innovation is made available to the potential adopters. The diffusion agencies influence the adoption behaviour through (1) their establishment in a geographical area, (2) the strategies which they adopt, (3) organisational structure of the diffusing agency, and (4) the market structure of the diffusing agency. (Brown 1981). Thus the services of diffusion agencies range from disseminating the information to make the venture successful by the constant involvement wherever and whenever necessary. In this chapter an attempt is made to evaluate the role of the extension agencies in the diffusion of beekeeping technology in Kerala. At present there are about eight official beekeeping promotional agencies in the state. Section I of this chapter gives an account of the various beekeeping promotional agencies and their promotional measures. In section two, an evaluation of the extension services provided by the promotional agencies is made. Details of the financial and technical assistance received by the beekeepers also are scrutinised. Moreover, the difference in the perception of beekeeping technology both by adopters and non-adopters are analysed. The data presented in the chapters are collected through the primary survey.

Section I

The major bee-keeping extension agencies and the details of their promotional measures are discussed.

1.1 Khadi and Village Industries Commission (KVIC)

The KVIC, an autonomous statutory body was established by an act of parliament in 1956 to plan organise and implement the programmes for the development of Khadi and Village Industries. Since bee-keeping industry was included in the schedule of KVIC, the commission

established bee-keeping directorate with its head quarters in Bombay and a network of technical staff in all states reaching through districts to potential villages. At present the KVIC have technical staff of about 200 workers throughout the country (Phadke: 1998). The beekeeping directorate have evolved about ten different patterns of assistance for providing financial and technical help to Beekeepers' co-operatives, institutions and individuals. Some of the patterns of assistance are (1) establishment of beekeeping substations, (2) model apiary cum nursery, (3) migration of bee colonies, (4) purchase of beekeeping equipment and (5) training in beekeeping. Every year development plan for each state is finalised and the financial and the technical assistance is provided by the KVIC to the state Boards, institutions or co-operatives for implementing the approved programmes. In Kerala the beekeeping promotional measures of KVIC are carried our through Kerala Khadi and Village Industries Commission (KKVIB).

1.2 Kerala Khadi and Village Industries Board (KKVIB)

The state Khadi Board receives financial and technical assistance from KVIC for implementing development programmes. The Board conducts training programmes and gives financial assistance. The KKVIB implement programmes directly or through co-operatives and registered institutions. The KKVIB scheme of financial assistance to beekeepers included 50 percent subsidy for loans to start beekeeping units at 4 percent interest. But from 1995-96 onwards due to the subsidy cut from the central Government this scheme was abandoned and now their loan for all Village industries including beekeeping carries 16 percent interest and 25 percent subsidy under the newly started margin money scheme. At present they are also not in a position to conduct training programmes due to financial stringency. The field men who were in charge of beekeeping training are now absorbed in the KKVIB offices[1].

1.3 Federation of Beekeeper's Associations

It is a subsidiary organisation of KKVIB and is the federation of beekeeper's societies in the state. At present there are 28 registered societies under bee federation. It was started in 1992 and is financed by the state govt. KVIC and KKVIB. Its main activity is to collect honey from

[1]There were 20 field men in the state to give training in beekeeping.

member societies and to process and market it. The federation is also supposed to conduct training in beekeeping. But due to financial constraints, at present their operation is limited to the collection and marketing of honey. Though Central Bee Research Institute (CBRI-Pune) has developed a new equipment to process honey, the bee federation still follows the traditional method of processing due to lack of finance.

1.4 Rubber Board

From 1987 onwards, Rubber Board is engaged in the promotion of beekeeping among rubber farmers through imparting training in beekeeping and subsidising the establishment of new beekeeping units. In 1992, the Rubber Board discontinued the scheme due to the destruction of the bee colonies by the Thai Sac Brood Disease (TSBD). But from the financial year 1996 97 onwards, the Board restarted the scheme. Rubber Board conducts training programme in beekeeping at Rubber Research Institute headquarters at Kottayam (RRII Kottayam) and other regional centres of Rubber Board. The financial assistance to beekeepers includes a subsidy of rs. 1000 for a bee-keeping unit of 4 colonies and equipment for Indian bees (*Apis cerana indica*) and Rs. 4500 for a unit of Italian bees *(Apis Mellifera)*. The subsidy scheme can be availed by new beekeepers for starting beekeeping units. Both rubber farmers and tapping workers can avail this scheme. The Rubber Board scheme is implemented through approved beekeeping agencies. In the year 1999-2000, there are 24 such Rubber Board approved agencies, which are spread all over Kerala and Kanyakumari district of Tamilnadu. Out of the 24 approved agencies, 9 of them are in the district of Kottayam (See Appendix 3). The Table 5.1 shows the details of Rubber Board Scheme from 1996-97 onwards. The allotted amount for beekeeping development, which was 14 lakhs in 1996-97, was reduced to 6 lakhs in 1999-2000. Although the number of the beneficiaries of the rubber Board scheme is increasing over the years, the utilisation rate of the allotted fund for beekeeping development is very low except in 1997-98. This slow response from the farmers can be the reason cutting down the allotted amount for beekeeping development over the years.

Table 5.1 Details of Rubber Board Scheme for Beekeeping Development

Year	Allotted amount (in lakhs)	No: of beneficiaries	Distributed amount (in lakhs)	Utilisation of the allotted amount (in %)
1996-97	14	101	2.17563	15.54
1997-98	10	133	5.49950	55.00
1998-99	5	162	0.50500	10.10
1999-2000	6	-	-	-

Source: Rubber Board

1.5 Horticulture Board

The Horticulture programme for beekeeping development includes free training to beekeepers and subsidy for purchasing bee colonies. The subsidy includes Rs. 200 per bee colony, the cost of which is estimated to be Rs.350. The beekeeping extension measures of Horticulture Board are carried out through recognised agencies and co-operatives.

1.6 Central Bee Research and Training Institute (CBRTI)

Considering the importance of applied and basic research in apiculture, KVIC established a central bee research and training institute at Pune in 1962 with the over all development of bee-keeping as its mandate. The broad objectives of the institute are, (1) To improve the performance of the Indian honey bees with special emphasis on *Apis cerana*, (2) To assess the utility of the Indian honey bees in planned pollination to increase crop- yields and to improve their quality, (3) to study the physio-chemical composition of bee products like honey, beeswax, royal jelly and bee venom and to evolve suitable methods for their production and marketing and (4) to undertake higher training in beekeeping directly and to supervise lower courses at regional and field levels. In Kerala the CBRTI helps the development of beekeeping through its publications and technical assistance to approved agencies and beekeeping co-operatives.

1.7 Indian Council of Agricultural Research (ICAR)

Although KVIC established a Central Bee Research and Training Institute with over all development of beekeeping as its mandate, the apiculture research in the right earnest started when Indian Council of Agricultural Research started funding the bee-keeping projects in the states, central institutions and other organisations. On the recommendations of the National Commission on Agriculture, (1976) an all India co-ordinated project of honeybee research and training was launched by ICAR, Pune as its main centre. At present this ICAR sponsored project has its co-ordinating centres in all most all states. In Kerala the ICAR sponsored programme for beekeeping development is undertaken by Kerala Agriculture University Vellayani.

1.8 National Bee Board

National Bee Board was established in 1993 to co-ordinate the works being done under KVIC, state Khadi and Village Industries Boards, ICAR and beekeeper's co-operatives.

Besides these agencies, there are some non-governmental agencies like Malanadu Development Society (MDS) Kanjirappally, which are engaged in the promotion of beekeeping in the state.

1.9 Malanadu Development Society (MDS)

Malanadu Development Society (M.D.S), which is the social service organisation of the Kanjirappally diocese of the Catholic Church has its headquarters at Parathodu in Kottayam district. It is registered under the Charitable Societies Act and has got more than fifty projects under its sway. One of the leading projects is the honey unit started in 1977. M.D.S is also a licensed agency to grade honey for AGMARK labelling. M.D.S is one of the major agencies in the state in the field of both imparting training in beekeeping and collecting processing and marketing honey. It is also a designated agency for carrying out the schemes of most of the promotional agencies in the state. Thus M.D.S collects honey directly from the beekeepers and grades, processes, and markets honey. It has also a Beekeepers Association of more than 500 active members of which majority are rubber farmers who have taken beekeeping as a subsidiary source of income.

Section II

This section is devoted to analyse the role of beekeeping promotional agencies in the state in diffusing beekeeping technology among the potential adopters. This section is devoted to analyse the effectiveness of the promotional measures and to scrutinise how far the promotional measures of beekeeping extension agencies have reached the beneficiaries. This part is based on adopters and non-adopters responses in the survey.

2.1 Sources of Information for Starting Beekeeping

To the question how did they first come to know about beekeeping, 66 percent responded that it was through friends and relatives and the rest 34 percent through promotional agencies (Table 5.2). This result leads us to the conclusion that it was mainly through the interaction among the beekeepers and potential adopters, rather than through the efforts of extension agencies the diffusion of the technology in the state occurred.

Table 5.2 How Adopters Came to Know About Beekeeping

Source of Information	Frequency	Percent
Friends and Relatives	33	66
Through Promotional Agencies	17	34
Total	50	100

This result at a desegregate level shows that in the case of early adopters, supply side factors were prominent as 52.6 percent came to know about beekeeping from the extension agencies (Table 5.3). But in later stages, the promotional agencies played less role in diffusing the technology among the potential adopters. In the case of subsequent adopters (second category) only 15 percent started beekeeping guided by the efforts of promotional agencies, and in the case of late adopters 36.4 percent started the activity as through the efforts of promotional agencies. The reason for the slight increase in the weightage of supply side factors in the diffusion of beekeeping in the case of late adopters can be the restarting of the Rubber Board scheme in the later half of 90's. This result leads us to the conclusion that in the initial stages diffusion agencies played more role, but in later stages the role promotional agencies are declining and the activity diffuses mainly through the interaction among the adopters and potential adopters.

Table 5.3 How Different Categories of Adopters Came to Know About Beekeeping (In %)

Source of Information	Category I	Category II	Category III
Through Friends and Relatives	47.4	85	63.6
Through promotional Agencies	52.6	15	36.4
Total	100	100	100

2.2 Presence of Migratory Beekeepers and their Effect on Local Beekeepers

In 62 percent of the adopters' neighbouring places Tamilnadu beekeepers are placing colonies, and in 38 percent of the adopters' locality they have not come yet (Table No 5.4). Any way the result shows that Tamilnadu migratory beekeepers are present in most of the rubber areas. Only in one beekeeper's holdings, they were placing colonies earlier but stopped now as he himself started beekeeping.

The role of migratory beekeepers of Tamilnadu in popularising beekeeping in Kerala is found to be insignificant as nobody reported that they have started beekeeping inspired by Tamilnadu beekeepers. The main reason for this is the fact that in most cases migrants are placing colonies in the holdings of upper income groups of the society for considerations of safety and since the probability of these higher income groups taking to beekeeping being lower. Thus, the absence of interaction between the potential adopters of Kerala and migrants is one reason for the low diffusion effect of the migratory beekeeping in Kerala. Moreover, the migrants may not be ready to reveal the technology to the local people as the adoption of beekeeping among the local may threat on their activity in Kerala.

Table 5.4 Presence of Migratory Beekeepers

Location	Frequency	Percent
In your Locality only	30	60
In your Holding only	0	0
Both in the locality and holding	1	2
Neither of the two	19	38
Total	50	100

2.3 Role of Various Extension Agencies in Disseminating Information About Beekeeping

The table (Table 5.5) shows the effect of promotional agencies on the beekeepers through providing information about beekeeping. It is seen that 86 percent of the beekeepers has got information about beekeeping at least from one promotional agency. Of this, the majority have got information from M.D.S (68 percent) and 32 percent from Rubber Board, 12 percent from KKVIB and 2 percent from Horticulture Board. But the above data covers all the beekeepers that have received at least some information about beekeeping from the promotional agencies. All the above reported persons need not have undergone any of the official training programmes of the promotional agencies. This result shows that the promotional measures of extension agencies are not reaching the potential beneficiaries as even now, there are 14 percent of the beekeepers, who have not come in touch with any of the extension scheme of the beekeeping promotional agencies in the form of technical assistance for starting Beekeeping.

Table 5.5 Information About Beekeeping from Extension Agencies (In %)

Promotional Agencies	% of Adopters who got information
M.D.S	68
Rubber Board	32
KKVIB	12
Horticulture Board	2
No Information About beekeeping from Extension Agencies	14

2.4 Financial and Technical Assistance

To the question whether they have received any financial or technical assistance from any of the promotional agencies, 62 percent responded yes, and the rest 38 percent has not received any assistance yet. (Table 5.6) This result leads us to the conclusion that the activities of the promotional agencies are not the only factor in diffusing beekeeping in Kerala, as still a considerable percentage of beekeepers are not covered under any of the schemes of the promotional agencies.

Table 5.6 Technical or Financial Assistance Received

Response	Frequency	Percent
Yes	31	62
No	19	38
Total	50	100

Of those who received financial assistance from the promotional agencies 32.3 percent received help from the rubber Board scheme, 29 percent from the KKVIB scheme and 19.4 percent availed Horticulture Board scheme, and only one person i.e. 3.2 percent received help both from KKVIB and rubber board scheme. It was seen that only 9.7 percent have received technical assistance from the extension agencies (Table 5.7).

Table 5.7 Details of Financial and Technical Assistance Received by the Beekeepers

Extension Agencies	Frequency	Percent
A. Financial Assistance		
Rubber Board	10	32.3
KKVIB	9	29.0
Horticulture	6	19.4
Any Other	2	6.5
Rubber Board & KKVIB	1	3.2
B. Technical Assistance		
KKVIB and Rubber Board	3	9.7
Total	31	100

2.5 Non-adopters Perception of Beekeeping

The non-adopters perception regarding beekeeping, beekeeping extension agencies, reasons for their non-adopting beekeeping etc were also enquired. Information regarding all these aspects is expected to be helpful in coming to understand the factors hindering the diffusion of beekeeping practice in Kerala.

To the question whether they are aware of the possibility of beekeeping in rubber plantations, all of the non-adopters responded yes (Table 5.8). But this result is insignificant and cannot be generalised because the non-adopters selected were the neighbouring households of adopters and naturally the non-adopters will be aware of the possibility of beekeeping in rubber plantations. But out of 25 non-adopters, only 52 percent know that rubber honey is secreted from the leaves of rubber, and the rest thinks that it is from the flowers of rubber that bees collect honey.

Table 5.8 Non-adopters awareness of Rubber as a source of Honey

Response	Frequency	Percent
Knows that honey is collected from rubber leaves	13	52
Knows but don't know the source of rubber honey	12	48
Total	25	100

To the question why they are not adopting beekeeping, only 20 percent responded that non-adoption is due to the lack of interest, and the rest 80 percent are ready to under take it but cannot do it now due to several reasons (Table 5.9). For 40 percent, the reason for not adopting was the lack of time, and for 28 percent it was due to the fear of managing bees, and for 20 percent, the reason was the lack of technical support. Only two persons i.e. 8 percent complained of the lack of finance for starting beekeeping as the reason for non-adopting (Tables 5.10)

Table 5.9 Reasons for Non-adoption.

Reason for Non-adoption	Frequency	Percent
Fear of Managing Bees	4	16
Lack of Technical Support	3	12
Lack of Finance	1	4
Lack of Time	9	36
Lack of Interest	5	20
Fear of Managing Bees and Lack of Technical Support	1	4
Fear of Managing Bees and Lack of Time	1	4
Fear of Managing Bees Lack of Technical Support and Lack of Finance	1	4
Total	25	100

Table 5.10 Reasons for Non-adoption (In %)

Reasons for non-adoption	Percentage
Fear of Managing Bees	28
Lack of Technical Support	20
Lack of Finance	8
Lack of Time	40
Lack of Interest	20

2.6 Non-adopters Awareness About Beekeeping Extension Agencies

It was observed that 52 percent of the non-adopters are aware of at lest one official beekeeping agency in the state, and the rest 48 percent have no information about the beekeeping promotional agencies in the state[2] (Table 5.11). At the desegregate level, 48 percent knows about rubber board scheme and 8 percent knows both Rubber Board and KKVIB and only one person i.e. 4 percent recognises Horticulture Board as a beekeeping promotional agency.

Table 5.11 Extension Agencies known to Non-Adopters

Extension Agencies	Frequency	Percent
Rubber Board	10	40
Horticulture Board	1	4
Rubber Board and KKVIB	2	8
No Information	12	48
Total	25	100

It was also seen that Tamilnadu migratory beekeepers are placing colonies in the locality of 92 percent of the non-adopters and of this in four persons holdings itself they are placing colonies (Table 5.12). Here also, we can see that the very presence of migratory is not facilitating the adoption of beekeeping by the potential adopters.

[2] Although MDS is engaged in beekeeping in the promotion of beekeeping, it is not considered in the present analysis as it a non-governmental agency.

Table 5.12 Presence of Migratory Beekeepers in the Places of Non-adopters

Location	Frequency	Percent
In your Holdings	1	4
In Your Locality	15	60
Both	3	12
Neither of the Two	6	24
Total	25	100

It was found that the consumption habit of honey among the non-adopters was rare as most of them use honey only occasionally or use it only for medicinal purposes (Table 5.13). Thus, 92 percent of the non-adopters reported that they use honey only occasionally and 8 percent uses it only for medicinal purposes. The above facts shows even at present, honey is not considered as a food item and does not appear in the daily diet of the people.

Table 5.13 Habit of Consuming Honey by Non-adopters

Consumption	Frequency	Percent
As Medicine	2	8
Occasionally	23	92
Total	25	100

Also, 40 percent of the non-adopters reported that they never purchased honey, but consumes it occasionally when they get it from the natural beehives and 32 percent occasionally purchases honey directly from the beekeepers and 28 percent from M.D.S (Table 5.14).

Table 5.14 Source of Purchasing Honey

Source	Frequency	Percent
M.D.S	7	28
Directly From the beekeepers	8	32
From Natural Bee Hives	10	40
Total	25	100

Non-adopters general perception of beekeeping was that it was a profitable enterprise as most of them cited the examples of Tamilnadu migratory beekeepers as to prove its profitability. But due to one reason or other, they are not in a position to under take it now. However their response regarding the reasons for non-adopting proves that majority are ready to undertake it. The reasons for non-adopting can be addressed by the active participation of promotional agencies. Thus, there is ample scope for spreading this activity among the non-adopters. The above result shows that the extension agencies have not succeeded fully in making the people aware of the usefulness of honey consumption.

Summing up

In this chapter we have analysed the extension services of major beekeeping promotional agencies. We found that most of the beekeeping extension agencies like KKVIB, KVIC, and Kerala Federation of Beekeepers Associations etc are not so active in their promotional efforts due to financial constraints. At present only Rubber Board is engaged actively in promoting beekeeping among potential adopters. The study shows that in the initial stages, the diffusion of beekeeping was facilitated by the efforts of promotional agencies. But in later stages, potential adopters started doing beekeeping observing the profitability of beekeeping by the earlier adopters Thus, in the case of late adopters, the adoption was mainly through the demonstration effect.

The diffusion process of beekeeping technology in Kerala was facilitated by the active intervention of M.D.S, KKVIB and Rubber Board at a later stage. M.D.S played an important role in creating a sufficient condition favouring the diffusion by providing beekeeping equipment, imparting training in beekeeping and in the field of marketing the product also. All these efforts helped in conscientising people. More over, the approved agencies of Rubber Board through out Kerala do a good job in diffusing the activity among rubber farmers. Also the efforts of KKVIB in the earlier stages of its diffusion in Kerala deserves special mention. But in later stages, the promotional measures of both KVIC and KKVIB and KSBIF are reduced due to the financial constraints. Thus on the supply side, the provision of beekeeping equipment and imparting training in beekeeping is a problem. At present, only Rubber Board and some NGO's like MDS are imparting training and provide beekeeping equipment. It was also observed that

even though most of the non-adopters are ready to undertake beekeeping, what prevents them from adopting the activity is their misconception or the perceived complexity of beekeeping. This result proves that the promotional agencies have not succeeded in making the technology available to the beekeepers and to conscientise them about it. However, we saw that in the case of Rubber Board scheme, the funds allotted are not utilising fully over the years. The reasons for this low response from potential adopters of beekeeping can be different. The response of non-adopters showed that only 40 percent of them know about the Rubber Board scheme for beekeeping development. Thus, the failure of the Rubber Board to popularise its scheme among potential adopters can be one reason for the slow diffusion of beekeeping in Kerala. If this is the case with the scheme of Rubber Board, which have direct contact with rubber farmers who are the potential adopters of beekeeping, the schemes of other promotional agencies will definitely less effective compared to the rubber Board scheme. The failure of the extension agencies to convince the potential non-adopters about the viability and economic profitability of beekeeping can be the slow reason for slow response from the potential adopters to the extension schemes and in turn the slow diffusion of beekeeping practice in Kerala. Thus, in terms of quality and quantity, extension network for the promotion of beekeeping in Kerala is not enough as compared to the potential of beekeeping in the state.

Chapter VI

DEMAND SIDE ASPECTS OF THE DIFFUSION OF BEEKEEPING TECHNOLOGY IN KERALA

Introduction

Diffusion has been defined as the process of acceptance of some specific idea or practice by individuals, groups, or adopting units linked to specific channels of communication to a social structure and to a given system of values or culture (Dasgupta: 1989). Thus, adoption units are an important component of the whole process of diffusion. In the present study, a household has been taken as the unit of adoption since it has been assumed that the decision of the individual might be the result of joint decision making within the family. Moreover, the socio-economic characteristics of the family also will have its influence on the beekeeping adoption decision of farmers. The socio-economic characteristics, which are expected to have an important bearing on the adoption of innovation in agriculture, have been taken to the relevant ones in the case of beekeeping also for reasons of similarity between beekeeping and agriculture. The objective of this chapter to identify the farmers characteristics affecting the adoption of beekeeping and is divided into two sections. In the first section, we will make descriptive analysis of the characteristics of adopters and non-adopters and their effect on beekeeping adoption decision. The hypotheses drawn from this analysis is tested in the second section using a logit regression model. The data presented in the tables are collected through the primary survey.

Section I

1 Adopter Characteristics of Beekeeping in Kerala

The implications of farmer's characteristics like economic status, educational qualifications, religion; social participation etc on the adoption behavior of beekeeping is analysed in this section.

Social Characteristics of Adopters

(a) Religion:- Caste and religion constitutes one of the most fundamental structural features of Indian rural economy. Many of the earlier studies on diffusion have shown a significant association between caste and adoption behavior, as there has always been an overlap between caste occupation and tenure status. From the survey it was observed that 86 percent of the sample covered belongs to the Christian community and the remaining 14 percent to the Hindu community (Table 6.1). The main reason for the Christian dominance may be the fact that it was a Christina organisation (MDS Kanjirapally), which is the main beekeeping promotional agency in central Kerala. Normally, the members of Christian community have more interactions with M.D.S and thus the probability of adoption was higher among the Christians. It was also observed that the proportion of Christians who adopted beekeeping was more than proportional to their share in total population of the surveyed Panchayats. The sample survey doesn't find any SC/ST candidates. The reason for this non-adoption among this category of people can be attributed to less social participation of SC's and ST's so that they will have less probability of coming to contact with new ideas and innovations introduced in the society. Another reason for this can be attributed to the innovation characteristic itself, the peculiarity of beekeeping i.e. its possibility is more for those who have rubber cultivation and mainly work at their farm places. But SC/ST's are mainly land-poor wage employees who usually work out of their residence. No representation from the Muslim Community also can be attributed to specific religious characteristics. They are mainly traders and merchants. Also, they have relatively less interaction with the M.D.S, which in turn might be another reason for the low adoption by this community.

Table 6.1 Religionwise Distribution of Adopters

	Frequency	Percent
Christian	43	86
Hindu	7	14
Total	50	100

Thus, the social characteristics of the adopters are explained in terms of the religious identity in our case i.e. the accessibility of the class to the technology-providing agency. The social characteristics are also explainable in terms of the more possibility of interaction among the

adopters, which further contributed to the diffusion among the same caste or through interaction among them i.e. the 'neighborhood effects'.

(b) Social Participation:- Regarding the social interaction of adopters, it was reported that 48 percent of adopters are participating in at least one of the social organisations like political parties, community service societies or social service organisations (Table 6.2). But no difference was observed between the adopters and non-adopters regarding the social participation. So we cannot make any conclusion regarding the effect of social participation of farmers on the adoption of beekeeping.

Table 6.2 Social Participation of Adopters and Non-adopters

	Adopters		Non -Adopters	
	Frequency	Percent	Frequency	Percent
Political Parties	8	16.0	3	12
Social Service Societies	7	14	4	16
Community Organisations	9	18	4	16
No Social Participation	26	52	14	56
Total	50	100	25	100

(c) Educational Qualifications:- Concerning educational qualifications, it was observed that 74 percent of the adopters are having educational qualifications of SSLC or above. Of these, 20 percent were degree holders and 36 percent were having PDC or ITI (Table 6.3). The data concerning the educational qualifications of adopters show that beekeeping is popular with relatively educated class of the society. The absence of illiterate people in the beekeeping field shows that those who are educated are better informed about the possibilities of starting additional income generating activities as they may be having more social contacts and are more likely to come into contact with the new technology providing agencies. This shows that adoption rate was more among categories of people with more educated and social exposure rather than among illiterate people. But no significant difference was noticed among three categories of adopters regarding their educational qualifications.

Table 6.3 Educational Qualifications

Educational qualification	Frequency	Percent
Below SSLC	13	26
SSLC	18	36
PDC/ ITI	9	18
Degree	10	20
Total	50	100

(d) Physical Characteristics of Adopters:- Regarding the age of adoption, it was observed that mainly the younger class of the society was interested in beekeeping, as the average age of beekeepers at the time of starting beekeeping was 24.9 years. In most cases it was observed that the adopters were not the heads of the households, but the sons having no assigned job in the household and farm activities, but helping their parents in the household activities. So this category found beekeeping as a good source of making their own income. But once it is started, the beekeeper continues to do it even after the adopter has shifted from the original family and he himself became the head of the new household after his marriage. The average size of the family (excluding children below 5 years of age) at the time of adoption was 5.78. Thus it was found that beekeeping was adopted by comparatively large size families

1.1 Economic Characteristics of Adopters

(a) Economic Activities of Households:- It was observed that the agriculture was the main source of income for 96 percent of the adopters. Only for 4 percent of the adopters, beekeeping was found to be the main source of income. 56 percent of the beekeepers are also doing cattle rearing with beekeeping. For 10 percent of the adopters, beekeeping was the only subsidiary activity and for another 10 percent there are three subsidiary activities including beekeeping. For those seven who dropped beekeeping, two were having both dairy and salaried job and one engaged in agriculture and wage employment and four doing daring with agriculture. Also 80 percent of the surveyed households are having more than two sources of income (Table 6.4).

From the above analysis it can be inferred that all works related to beekeeping can be synchronized with other farm activities of rubber farmers and it satisfies the multiple economic activity family concept. The result also shows that in Kerala beekeeping is considered only as a subsidiary activity where as in Tamilnadu, most of the beekeepers have undertaken it as the main source of income (Gestus: 1998).

Table 6.4 Economic Activities of Household

Economic Activities	Frequency	Percent
12	4	8
13	5	10
14	1	2
123	28	56
125	2	4
134	2	4
135	1	2
136	2	4
1234	2	4
1235	1	2
1236	2	4
Total	50	100

Where,
1-Agriculture, 2-Dairying, 3-Beekeeping, 4 - Wage Employment, 5-Salaried Job, and 6-Other Business.

b) Annual Family Income and Size of Land Holdings:- Data on the economic status of adopters showed that average annual family income was RS 41600. There was a slight difference between the average income of those who have dropped beekeeping (Seven out of fifty surveyed beekeepers dropped beekeeping following destruction of bee colonies due to Thai Sac Brood Disease in 1992) and those still continue in the field. For dropouts the average annual family income was RS 42900 and for those who still doing the business it was RS 41400. But the difference between the average size of land holdings by adopters and dropouts was more pronounced. For adopters the average size of land holding was 349 cents and for dropouts it was 464 cents. Thus, even though the size of land holdings of drop outs was 32.9

percent higher than that of those who still do beekeeping, the average income of dropouts was only 3.5 percent higher than that of those who still do beekeeping. This difference shows the effect of beekeeping on the incomes of households. The same trend can be observed when we compare these variables with that of non-adopters also. For non-adopters the average annual family income was RS 46000 and average land holdings was 841 cents. (Table 6.5) thus, there was clear difference between adopters and non-adopters in their economic position in terms of the annual family income and size of land holdings . This result is also in conformity with the difference existed between the average income of adopters and dropouts. This difference leads us to the conclusion that the farmer's incentive for undertaking subsidiary activity decreases as income increases.

Table 6.5 Average Annual Family Income and Land Holdings

Category	Annual Family Income (In Rs)	Land Holding (In Cents)
Adopters	41600	365
Non-Adopters	46000	841
Those Still do Beekeeping	41400	349
Households dropped Beekeeping	42900	464

The economic characteristics of adopters in terms of total family income showed that it was mainly the marginal and small-scale farmers[1] who adopted beekeeping. Thus the adopters constitute the middle-income group of the society. The result shows that there is low representation from both lower income and upper income strata of the society.

A comparison of the economic status among the three categories of adopters showed that there was a slight difference between the average incomes of these categories the first two category of adopters are comparatively better off in their economic status in terms of annual family income compared to the late adopters (Table 6.6). One interesting result which we can see from the table below is that even though the early adopters (Category I) average size of

[1] Rubber Board classifies holding (growers) as small holdings and estates. Small holding consists of holdings up to four hectares an the holdings above four hectares are grouped as estates

land holding was low compared to the other two categories, the average size of their family income was higher compared to that of the other two category. The reason for this difference is the fact that earlier adopters are large scale beekeepers compared to the other two category and naturally the income of the first category will be higher as the addition to their annual family income from beekeeping will be higher compared to the other two category.

Table (6.6) Category wise Distribution of Annual Family Income and Size of Land Holdings

	Category I	Category II	Category III
Average Annual Family Income	44736	40000	39090
Average Total Land Area	359.315	384	342.27
Average Area Under Rubber	295.26	300.45	202.36

However in terms of the size of land holdings, the late adopters are belonging to the lower economic strata as compared to the first two categories (Table 6.6). The reason for this can be the fall in the price of natural rubber in the mid 90's which caused a substantial reduction in the incomes of marginal and small scale farmers which in turn compelled them to undertake some subsidiary income generating activities to compensate the fall in their incomes.

(c) Type of House:- The type of houses also explains the economic status of adopters. Regarding the type of houses of adopters, it was observed that majority (62 percent) of the adopters are having tiled roofed houses, and 32 percent of the houses were concrete roofed, and for the rest 6 percent, roof was made of sheet (Table 6.7). Absence of low quality houses like thatched houses indicates that the poorest of the poor in the society are not doing the activity. But it should also be kept in mind that the absence of low quality houses in the surveyed area might also indicate the general economic condition of the locality. But the personal contact to the area proves that thatched houses are not uncommon in the surveyed area and so the above conclusion holds good.

Table 6.7 Type of House of Adopters

Type	Frequency	Percent
Concrete	16	32
Tiled	31	62
Sheet	3	6
Total	50	100

(d) Material Possessions of Households:- The details regarding the material possessions of the households also were enquired so as to get more information regarding the economic status of households. The data proved that most of them belongs to comparatively economically well off sections of the society in terms of the possessions of the household appliances (Table 6.8).

Table 6.8 Material Possessions of Adopter Households

Material Possessions of adopters	Percent of Adopters Having Each item
Four Wheelers	6
Two Wheelers	24
Fridge	32
T.V	82
Radio/Tape recorder	98
Gas Stove	60
Telephone	68

Thus, it is observed that 6 percent of the adopters are having four wheelers, 24 percent two wheelers, 32 percent fridge, 82 percent T.V, 98 percent Tape/Radio 60 percent gas stove and 68 percent have telephone connection. Thus, the table above shows that the adopters are relatively better off sections of the society.

The reason for low adoption from the economically backward and landless people can be attributed to several factors. First of all, technology is made available to the classes having more social interaction. Secondly demand side factors like the inability of this group to make necessary investments to start the activity also can be another contributory factor. Thirdly innovation characteristics itself is not in conformity with the occupational structure of these category of people, i.e. as most of them are wage employees and casual workers they may not be able to do beekeeping as they are working out of their households. The low adoption of upper income is explained by the very fact that as they are rich doesn't motivate them to undertake subsidiary activities to generate additional income. On the other hand, the adoption of beekeeping mainly among the middle income group can be attributed to several reasons. First of all, this income category are very much in the need of additional source of income

secondly they have more interaction with the technology providing agencies compared to the lower income class. Thirdly they are also in a position to undertake the necessary investments to start beekeeping.

Thus, the above analysis leads us to the conclusion that the theory of backward supply curve of effort and risk still holds good in peasant economies as the tendency to undertake subsidiary income generating activities decreases as income increases. Also' the neo-classical notion of a farmer as an individual decision maker who aims at maximising his profit doesn't hold good here since the adoption ratio is very low among the potential adopters[2]. Also the scale of operation of the adopters is also very small.

Section II

Logit Analysis for Testing the Relative Influence of Various Farmer Characteristics on the Beekeeping Adoption Decision

In this section a logit regression analysis is made to test the influence of various adopter characteristics on the adoption decision of beekeeping. The farmer characteristics, which are supposed to have an influence on the beekeeping adoption behaviour of farmers, are selected for the analysis. The characteristics selected are size of land holdings, area of land under rubber, annual family income, years of education, presence of Tamilnadu migratory beekeepers, religion, and social participation of adopters.

From the analysis done in the first section, the theoretical relationship between the probability of adopting beekeeping and the adopter characteristics can be stated as follows. Since beekeeping is a subsidiary activity for rubber farmers, which involves less investment and family labour intensiveness, it is expected that the probability of adoption of beekeeping is likely to be more among small scale and marginal farmers as compared to the families having large size of land holdings because of two reasons. Firstly marginal and small-scale farmers need to increase their incomes through subsidiary activities, as their incomes will be lower. On the other hand large land holding families naturally will have higher incomes and so the

[2] Even now less than 10 percent (88000) of the potential adopters who constitute around nine lakh rubber farmers in Kerala have adopted beekeeping.

urge for increasing the incomes through subsidiary activities will be less compared to the small scale and marginal farmers. Secondly, beekeeping being a family labour activity, members in small land holding families will have more spare time to spend for beekeeping as compared to large land holding families because the small land sized farmers will have less farm work compared to the large land sized families.

The relationship between the area under rubber land and the decision to adopt also is likely to follow the above said relationship due to the same reasons cited above. The relationship between the annual family income and the probability to adopt is likely to be an inverse one due to the reason that as the income increases the urge for earning additional income is likely to diminish especially in rural areas. So it is postulated that the possibility of adoption of beekeeping falls as income increases. Regarding the effect of the year of education on the adoption behaviour, it is theorised that education will have a positive influence on the adoption of beekeeping as the educated people will have more social interaction. This will help them to know about the possibility of beekeepig and also about the extension services of various beekeeping promotional agencies as compared to the illiterate and less educated people. But after a stage the positive influence of education on adoption will decrease, as highly educated people are not ready to do farm activities and they usually prefer employment either in the secondary or tertiary sector.

Religion (Being Christian or not) is considered as an explanatory variable in our analysis because 86 percent of the sampled adopters were Christians. The main centre for imparting training in bee keeping and the designated agency for providing the subsidy schemes of various bee keeping extension agencies in the surveyed area is M.D.S, which is the social service wing of the Catholic Church of Kanjirappally diocese. In this context, it is postulated that Christians will have more chances of coming to contact with M.D.S and the probability of adoption among Christians are more compared to the non-Christians.

In chapter four it was seen that there was no effect for the presence of Tamilnadu beekeepers on the adoption behaviour of farmers as none of the adopters reported that they started beekeeping inspired by the Tamilnadu migratory beekeepers. The effect of the presence of Tamilnadu migratory beekeepers on the adoption behaviour of local farmers can be two sided.

In one way it can prevent the adoption of beekeeping by the local farmers as the presence of migratory beekeepers either in own holdings or in the locality ensures the availability of honey to the locals at their door. Another possibility is that the Tamilnadu migratory beekeepers will help the local people to know about the technology and the profitability of beekeeping and this will positively affect the adoption of beekeeping by the local farmers. The effect of social participation of farmers on adoption of beekeeping also was not significant. With these postulated relationship between these explanatory variables and the adoption of beekeeping by the rubber cultivators an attempt is made to analyse the relationship estimating a logit regression model.

In the binary logit regression model, the dependent variable takes either of the values '1' or '0'. If the rubber cultivator adopts the beekeeping practice, it takes the value '1' and otherwise '0'. The model predicts the probability 'Pi' that the rubber cultivator adopts the beekeeping practice given the values of the explanatory variables. So we can write,

$$\log\left[\frac{P_i}{1-P_i}\right] = a + bX_i$$

Where, 'a' is a constant, b is a vector of coefficients and 'Xi' is a vector of variables. Equation one can also be written as,

$$P_i = F(a + bX_i) = \frac{1}{1+e^{-(a+bx_i)}}$$

As noted by Mukherjee et al (1998), estimation of the above model using individual case (or ungrouped data) is carried out by the maximum likelihood method. The vector Xi includes the following variables.

1. Farm characteristics like total land holding (TLA)
2. Total Land Area under Rubber (RLA)
3. Year of Education (YE)
4. Economic status as reflected by the annual Family income of households (AFI)
5. Religion (RL) (Being Christian is denoted as 1 and otherwise '0')
6. Presence of Tamilnadu migratory beekeepers in the locality (PM). In this case if the migratory beekeepers are present either in own holdings or in the particular ward, it is denoted as one and otherwise '0'.

7. Social participation of farmers (SPA) If the farmers are members of at least one of the social organisations. It is denoted as '1' and '0' other wise.

The last three variables are dummy variables. It is to be noted that, given the limited number of observations, equation one could not be estimated using all the variables together. So we have estimated the logit model considering different combinations of explanatory variables at a time. Table 6.9 summarises these results.

Table.6.9 Logit Regression Results

Variable	Equ-1	Equ-2	Equ-3	Equ-4	Equ-5	Equ-6	Equ- 7
Constant	0.3022	0.4168	-2.1289	0.9495	0.3392	0.3922	-2.5851*
	(0.189)	(0.286)	(-1.804)	(0.667)	(0.217)	(0.248)	(-2.11)
YE	0.3748*	0.4142*	0.3812*	0.2422**	0.3794*	0.3852*	0.4090*
	(2.813)	(3.096)	(3.056)	(1.726)	(2.98)	(3.001)	(3.18)
RLA	-0.0027		-0.0023**	-0.0049*	-0.0026**		-.0026**
	(-1.531)		(-1.867)	(-2.732)	(-1.8.01)		(-2.06)
AFI	0.0000025	.000027**-					
	(0.116)	2.18)					
PM	-2.7529**	-3.0069*			-2.7774**	-2.838**	
	(-2.396)	(-2.672)			(-2.452)	(-2.489)	
RL			0.4674				
			((0.088)				
TLA						-0.0022**	
						(-1.828)	
SPA							0.8351
							(1.38)
Chi^2	29.74	25.48	19.29	17.96	29.73	29.6	21.25*
	(0.00)	(0.00)	(0.0002)	(0.0001)	(0.000)	(0.00)	(0.0001)
Pseudo R2	0.3115	0.2669	0.2018	0.28	0.3114	0..31	0.223
LLF	-32.8684	-34.9976	-38.1061	-23.091	-32.8752	-32.94	-37.11

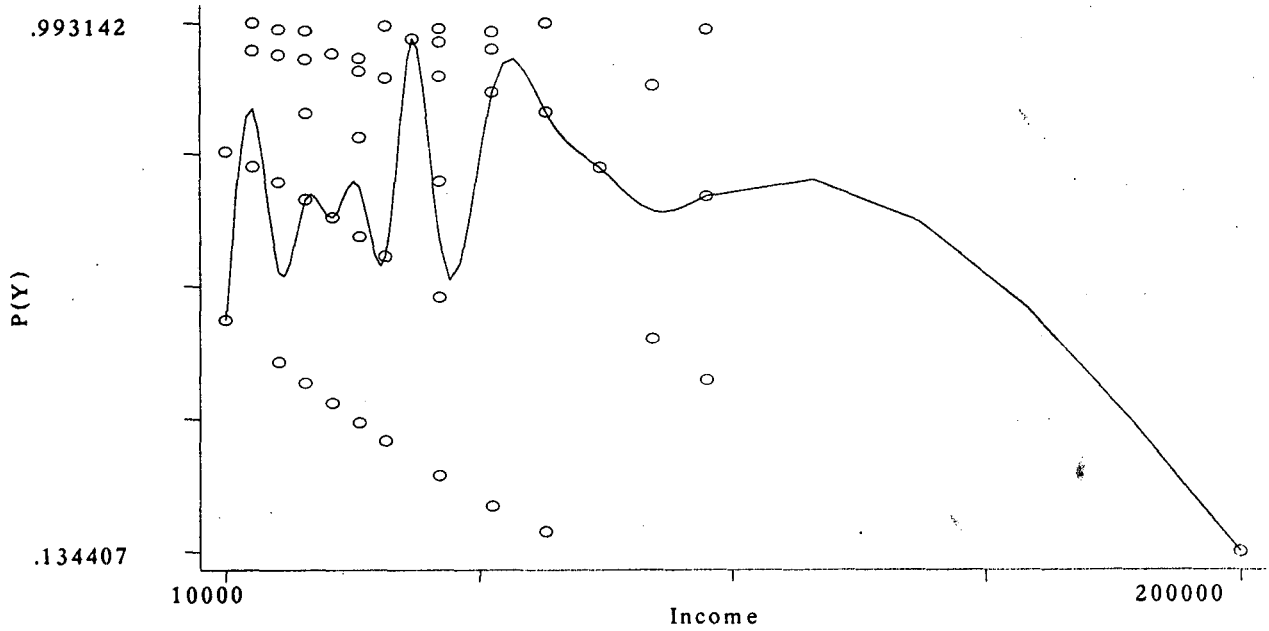
Note (i)*significant at 1 percent
(ii)** significant at 5 percent
(iii)Figures under brackets under each estimated coefficients represent t- values.

Let us start with the interpretation of these equations. The first estimated equation shows that with an increase in the number of years of education one year, the predicted logit in favour of adopting beekeeping practice will change by 0.3748. Similar interpretation holds for other estimated coefficients too. It appears that positive responses for changes in predicted logit in favour of adoption of beekeeping practice are derived mainly from the two variables; year of education (YE) and religion (RL) For each estimated coefficients, t- statistics are reported within the brackets. It follows from Table 6.9 that the year of education is to be significant either at 1 percent or 5 percent level in all the seven alternative specifications. However religion (RL) and social participation (SPA) are not significant even at 5 percent level. The other variables appeared to be significant either at 1 percent or 5 percent level are total land area (TLA), area under rubber (RLA), annual family income (AFI) and presence of migratory beekeepers (PM).

The chi-square values reported under each equation test the null hypothesis that, all coefficients in the model, except the constant term are zero. Given the degrees of freedom, we found that the null hypothesis is rejected in all the seven estimated equations. So it is interesting that each of these different combinations of explanatory variables in our logit model jointly have significant effect. Detailed analyses of the results with respect to each explanatory variable across the different specifications are reported below.

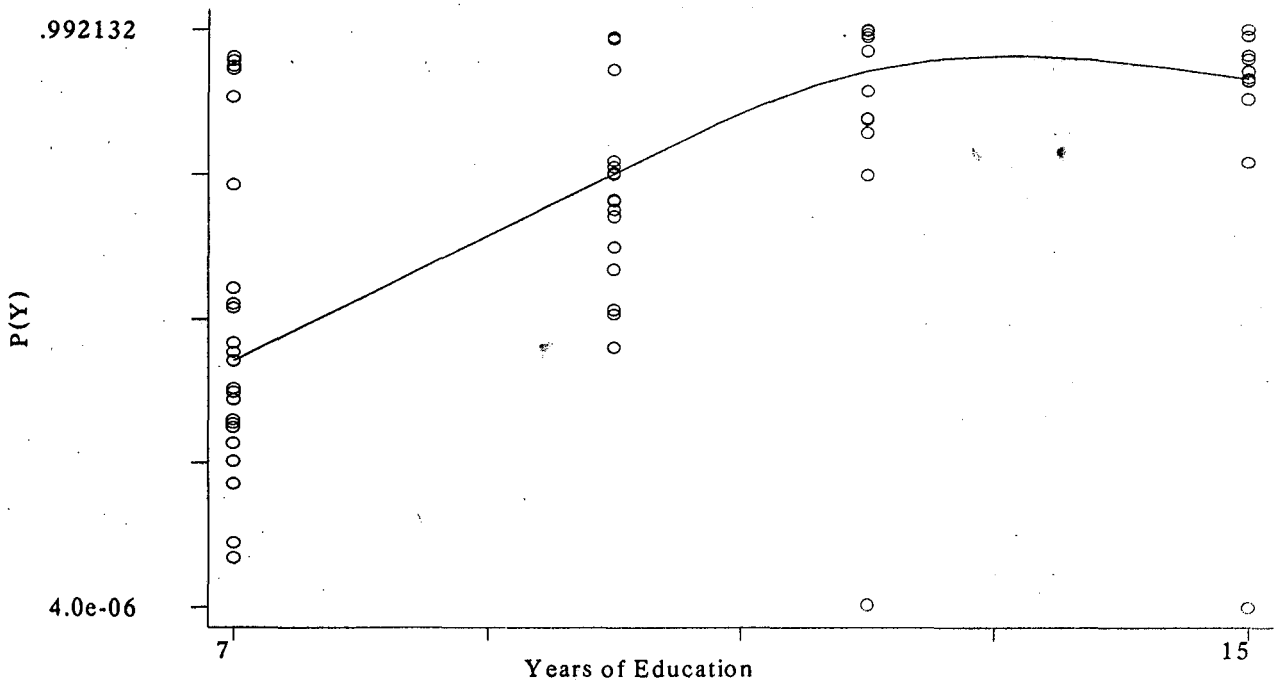
1. Income:-The relationship between the annual family income and the possibility of adoption was negative and significant. (Equation (2) Figure (6.1) depicts the effect of income on predicted adoption probability of farmers in the four surveyed panchayaths. From the figure we can see that, at a higher level of income, the probability of adoption is low. The result confirms our theoretical postulate that as the income increases the probability of adopting beekeeping will decline.

Figure 6.1 Relationship between Annual Family Income and Probability of Adopting Beekeeping



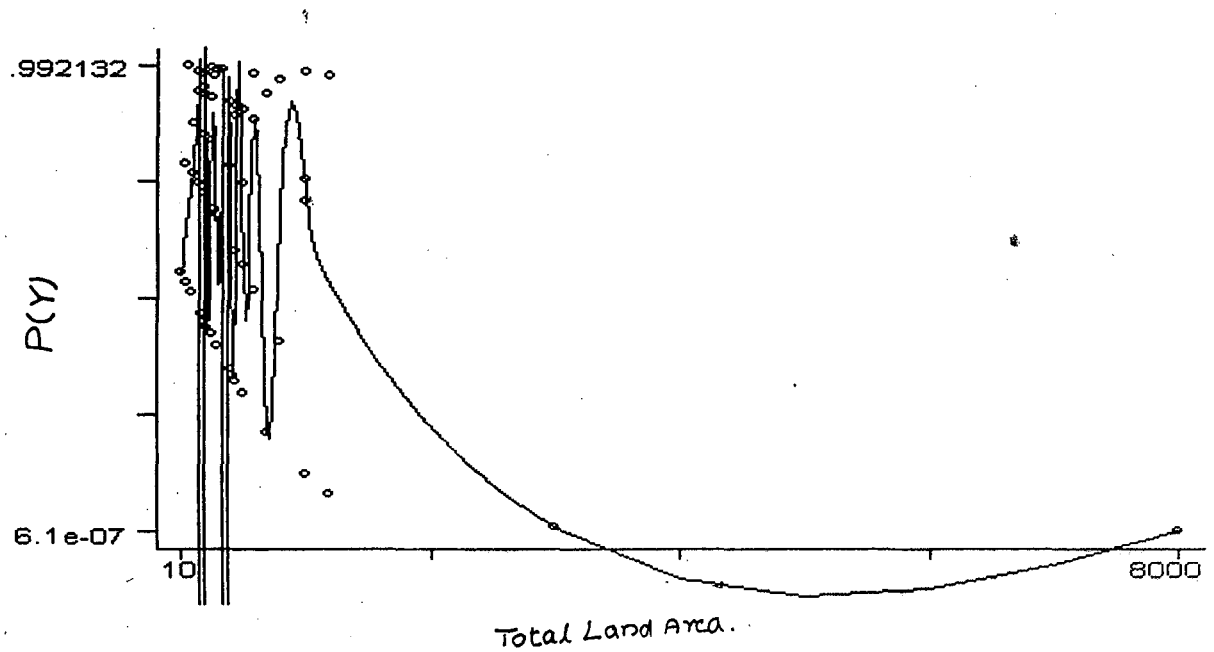
2. Years of Education:- The relationship between the year of education and the probability of adoption proved to be positive and significant.(Equations 1,2,3, 4 and 5) Figure (6.2) gives the relationship between the year of education and the probability of adoption of beekeeping. The figure shows that although the probability increases as the education increases, at higher levels of education, the curve becomes much flatter indicating that the probability of adoption increases at lower rate as the local of education increases. This result also justifies our hypothesis that a higher level of education increases the probability of adoption, but we cannot expect an increase in probability of adoption at par with the increase in the level of education.

Figure 6.2 Relationship Between Years of Education and Probability of Adopting Beekeeping



3. Total Land Area of Households:- The relationship between the possibility of adoption and the size of total land holdings also showed a negative and significant sigh (Figure 6.3). The reason for this negative sign is the same as explained in the case of the relation between the size of rubber holding and the possibility of adoption.

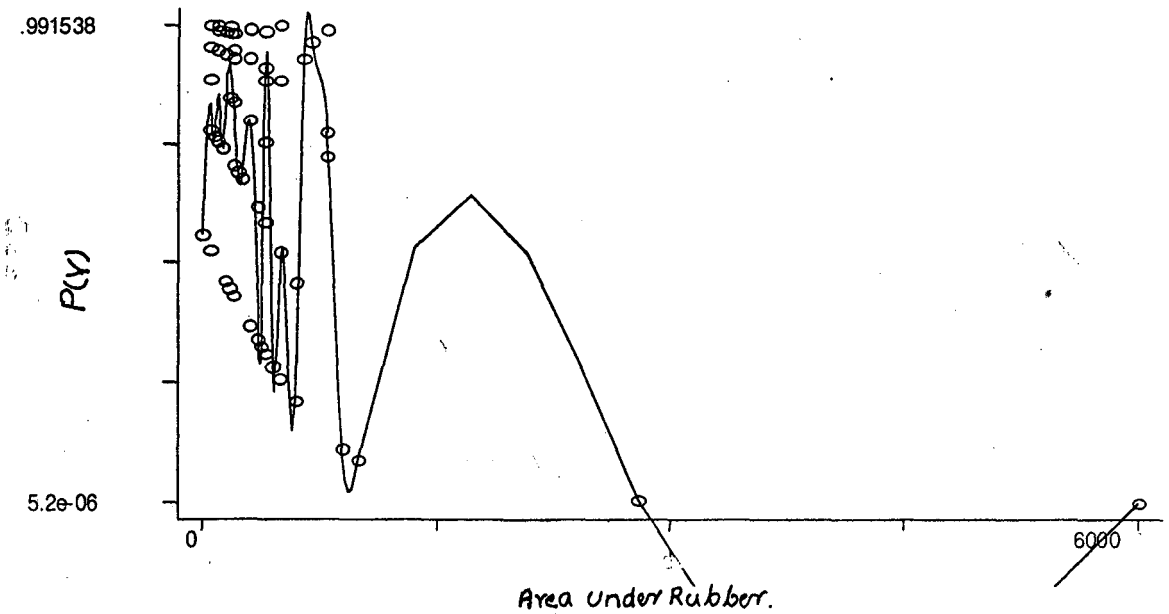
Figure 6.3 Relationship between Total Land Area and Probability of Adopting Beekeeping



4. Presence of Migratory Beekeepers:- Although we assumed no effect for the presence of Tamilnadu beekeepers on the adoption behaviour of farmers, the estimated result shows a negative significant sign for this variable (in Equation (1) and (2) and (5)). It indicates that the presence of Tamilnadu migratory beekeepers reduces the probability of adoption of beekeeping by the local people. This result justifies our first hypothesis about the influence of migration on the adoption behaviour of farmers. In one way it can prevent the adoption of beekeeping by the local farmers as the presence of Tamilnadu migratory beekeepers either in own holdings or in the locality ensure the locals the supply of honey. If they are present in the own holdings of farmers, they will get some bottles of honey as rent, which they can use for their home consumption. If they are placing colonies in the locality of the farmers, they can very well purchase honey from the migratory beekeepers for their use. In both cases, the presence of Tamilnadu migratory beekeepers is likely to prevent the adoption of beekeeping by the local farmers. This result is interesting because the adoption of some of a farm practice by a particular category of people prevents the adoption of the same practice by other people because the non-adopters also benefit from the adoption of the former category of people.

(5) **Area of Land Under Rubber:-** The relationship between the total area of rubber land and the probability of adoption showed a negative and significant sign (Equations 3,4, and 5). This result also confirms our earlier postulation that the probability of adopting beekeeping will decrease as the size of the rubber land holdings of farmers increase. This relationship is depicted in figure (6.4).

Figure 6.4 Relationship Between Total Area Under Rubber and Probability of Adopting Beekeeping.



(6) **Social Participation:-** Regarding the effect of social participation of farmers, we hypothesised no significant effect of this variable on adoption decision of farmers. Although the logit analysis produced a positive relationship between these two variables, the result was not statistically significant.

(7) **Religion:-** Although we established a positive relation between religion (being Christian or Not) and adoption behaviour of farmers and the analysis also showed the same sign, the result was not statistically significant.

Summing up

In this chapter we have analysed the demand side characteristics of adopters. The analysis proved that beekeeping was popular among small scale and marginal rubber farmers and the majority of the adopters belong to the middle income strata of the society. The logit regression analysis also suggest that the probability of adoption of beekeeping is more with small scale and marginal farmers rather than with farmers having high economic status with larger land holdings and family income. It was also observed that it was mainly the younger farmers who adopted beekeeping. This result is against our theoretical postulation that the possibility of

adoption of new farm practices and innovations are less among the younger farmers. The reason for this can be the fact that beekeeping can be started on a small scale with a small amount of investment. Regarding the effect of education on adoption behaviour, it was proved that the possibility of adoption is more among farmers with a critical minimum level of education rather than with illiterate people on the one side and highly educated people on the other. The results of the logit analysis showing the effect of the presence of migratory beekeepers from Tamilnadu on the adoption of local farmers was as expected showing a negative and significant sign. With respect to the effect of social participation on the adoption possibility, the results of the descriptive analysis and the logit regression analysis produced similar results showing no significant effect. But the postulated positive relationship between religion (being Christian or not) and adoption of beekeeping was proved insignificant in the logit analysis.

Chapter VII

SUMMARY AND CONCLUSIONS

Beekeeping, being an allied activity in agriculture, we analysed the factors which hastened and hindered its growth in Kerala within the framework of diffusion theories, especially the diffusion of agricultural technologies and new farm practices. As evident from the literature, the process of diffusion of a technology can be analysed in different perspectives of diffusion viz., the adoption perspective, the market and infrastructure perspective, the development perspective and the economic history perspective. Considering the complementary nature of these perspectives, in the present study, all four perspectives are used to analyse the process of diffusion of beekeeping in Kerala.

The study may be concluded by summarising the main findings of the study and by drawing upon their implications on the different perspectives of diffusion in the context of Kerala. In doing so we may highlight,

1. The socio-economic characteristics of adopters and non-adopters.
2. The role of different beekeeping extension agencies in diffusing the technology in the state.
3. Returns from beekeeping and the nature and scale of operation.

A religion based classification of the adopters shows that 86 percent of the adopters belong to the Christian community and the rest 14 percent to the Hindu community. The Christians were found to be more than proportionate to their population share in all the surveyed panchayaths. No representation from the Muslim community was noticed. Although majority of the adopters were Christians, the results of the logit analysis showed no effect of religion on the adoption behaviour of beekeeping among farmers.

Regarding the educational qualifications of adopters it was found that most of the beekeepers are having a critical minimum level of education as 86 percent of the adopters were having an educational qualifications of SSLC or above. In the logit analysis a positive relationship between the years of education and the farmers probability of adopting beekeeping was observed. But at higher levels of education, the probability of adoption was decreasing.

The socio-economic characteristics of adopters proved that this technology has tended to favour the middle income group i.e. those with critical minimum of socio-economic status as demand and supply side factors are more favourable to them. From the demand side this group is in a position to undertake necessary initial investment. As regarding the supply side factors, several schemes adopted by the promotional agencies were welcomed by the middle income group in true spirit and this group happened to be the main source of publicity. This result is in conformity with the results of Mohanan Pillai's study on the diffusion of smokeless choolas in Kerala. In his study the adoption rate of smokeless choolas was very high among the middle income group of the society. Among the different categories of adopters, the average annual family income of early adopters was higher than that of the other two categories. It may be because of the fact that the scale of operation of early adopters were comparatively higher compared to the other two category and this might have contributed a larger share of income from beekeeping to their total family income. Except for a few beekeepers, rubber was found to be the main crop and on an average it constituted 78.8 percent of their land holdings. The predominance of rubber cultivation is true in the case of non-adopters also. Also rubber was the main source of income for 96 percent of the beekeepers and for only 4 percent beekeeping was the main source of income.

14 percent of the beekeepers surveyed had dropped beekeeping by the time of the survey. The economic status of the dropouts in terms of annual family income and the size of land holdings found to be a little higher than that of those who still do the activity. The only reason for dropping the activity was the TSB disease, which occurred in 1992.

The comparison of the economic profile of both adopters and non-adopters indicates the dissimilarity exists in terms of income, size of land holdings etc. In terms of the annual family income and average size of land holdings, the non-adopters were in a higher economic status compared to the adopters. Although all the non-adopters expressed their awareness of the technology, adopters and non-adopters differ in their perception of beekeeping technology. Nobody from the adopter category complained about management of bees as a problem. But for 28 percent of the non-adopters, fear of managing bees was the reason for non-adoption. This fact leads us to the conclusion that the promotional agencies have not succeeded in disseminating the technology successfully among the potential adopters.

The role of promotional agencies in diffusing the technology was found to be less effective and the results of the classification of the information sources proved that it was the personal channel which were the main source of information for beekeepers to start beekeeping rather than through promotional agencies' efforts through mass media or printed media for promoting the activity in the state. In our case, the adoption process was mainly facilitated by the neighbourhood effects (64 per cent) rather than by the efforts of the promotional agencies especially in the case of late entrants. But the role of promotional agencies cannot be underestimated because in the case of earlier adopters, it was mainly through the efforts of promotional agencies, especially that of KKVIB and M.D.S that the diffusion of beekeeping was started in the state, but in the later stages diffusion was facilitated through the demonstration effect.

The reduced effect of promotional agencies in the later stages can also be attributed mainly to the reduced role of KKVIB in the later stages caused by the cut in subsidies for all village industries including beekeeping by central government necessitated by the New Economic Policy initiated in the early 90's. There was no significant effect of the migratory beekeepers of Tamilnadu on the local beekeepers as nobody reported that they started beekeeping as inspired by the migratory beekeepers of Tamilnadu. Thus beekeeping technology was transferred most effectively from a local beekeeper to a potential adopter as they were moved by the success stories of earlier adopters. Coupled with the neighbourhood effects, the arrangements made by M.D.S KKVIB and Rubber Board in later stages to supply beekeeping equipment played an important role in the diffusion in all states of the process as M.D.S started a beekeeping unit in 1976. Also, the Rubber Board scheme for popularising beekeeping, which started in 1987, deserves special mention. Any way most of the beekeepers think that, still the government has got much greater role to play in the development of beekeeping in the state. Ironically, the utilisation of the funds allotted for the beekeeping development by the Rubber Board is very low. So at present much cannot be expected from the promotional agencies at the government level. In the present context the responsibility of the diffusion of this technology should be under taken by NGOs like MDS and co operatives of beekeepers.

The scale of operation of beekeeping was found to be very small as compared to the migratory beekeepers of Tamilnadu. But the scale of operation of earlier adopters was high as compared to the late adopters.

Most of the beekeepers reported that they started beekeeping only as a hobby. But now majority considers the activity as an income earning commercial activity. Majority of the beekeepers admitted that beekeeping could supplement the fall in their incomes due to the fall in the prices of natural rubber.

Although proved to be profitable, the complexity or the perceived complexity of the activity may be the reason for the low adoption rate of this subsidiary activity among potential adopters as for some potential adopters; the main reason for non-adoption was their perceived complexity of the activity. Also, the study proved that cost of entry was not a problem for non-adopters since it can be started in a very small scale also.

Beekeepers also complained of the problems relating to the marketing of honey. Regarding the price of honey, 92 per cent of the beekeepers think that the present procurement price is not fair. The main reason for this complaint was the difference existing between the procurement price of M.D.S and their selling price of honey. Also the average price received by the beekeepers in the open market was 63 per cent higher than the procurement price. But our analysis of the costs and returns from beekeeping proved that beekeeping is profitable even at the current procurement price of Rs. 42 per kg.

Here it is worth mentioning that the interaction between M.D.S and beekeepers is not limited to the marketing of the product only. M.D.S provides the inputs or beekeeping equipment and colony, and also a designated agency for arranging various subsidy schemes and imparts training in beekeeping. In the Kottayam district, M.D.S is the only agency, which have the infrastructure to make bulk purchases of honey from the beekeepers and to process and to market it. The beekeepers are forced to sell their products to MDS at the present procurement price, as they don't have the facilities for storing, processing and marketing honey. In other words the output market for beekeeping is interlinked and to some extent interlocked with input markets. Interlocked in the sense that M.D.S is the only agency for both providing inputs and also for marketing output in the area. This interlocking has resulted in a monopoly element to M.D.S and this could be the reason for the existence of considerable difference between the procurement price and selling price of honey.

The return from beekeeping is found to be much less than the projections of earlier studies. The average productivity of *cerana* was 7.32 Kg and that of *mellifera* was 15 kg. Fluctuations in honey yield due to seasonal variations over the years can be the reason for this difference.

Although beekeeping is a labour intensive activity, the proportion of beekeepers employing hired labour was only 7 percent. The main reason for this low absorption of hired labour is the fact that the scale of operation is very small among the beekeepers of Kerala. The average number of colony was only 27.36

Another thing to be noticed is that although the promotional agencies spent some effort and money for the promotion of this industry in the state, and to some extent they succeeded in their endeavour, they did not do anything to increase the demand for honey among common man. Honey is still not considered to be a food item in our country. The per capita consumption of honey shows this. It is only 2-3 gms in India. In Kerala more than 70 percent of the honey produced is purchased by Ayurvedic pharmaceuticals. One possible reason for low per capita consumption of honey may be the high price due to the double pricing made by the processing agencies dealing in honey.

At present the rubber honey is exploited mainly by the migratory beekeepers of Tamilnadu, especially from the Kanyakumari district. During the rubber honey flow season (January-May), they place bee colonies in rubber plantations of Kerala. After the honey flow season is over they take back these colonies to the coconut plantation of their own places, as the coconut trees are rich in pollen during the dearth or rainy season

It was seen that the Kanyakumari district of Tamilnadu is dominating the collection and sale of rubber honey accounting for 88 percent in 1990-91. Thus even if rubber honey constitutes 95 percent of the total production in both Tamilnadu and Kerala, and Kerala accounts for 84 percent of the total area under rubber in India, Tamilnadu with less than 4 percent of the total rubber cultivation dominates the collection and marketing of rubber honey.

Compared to its potentialities, the extent of adoption of beekeeping practice among potential adopters who constitute more than nine lakh small scale and marginal rubber farmers in Kerala is very low as the total number of beekeepers in Kerala is around 88000 as per recent

estimates. The adoption rate is only less than 10 percent. Also the extent of utilisation of production potential of rubber honey is less than 3 per cent.

One possible reason for the slow rate of adoption may be the fact that till mid 90's the rubber farmers received a fairly reasonable price for natural and thus a steady income, which kept them satisfied. But after the sudden fall in the price of natural rubber in the mid 90's, the incomes of rubber farmers have almost halved. Now more and more farmers are coming forward interested in beekeeping to supplement the fall in their incomes. The number of persons coming for beekeeping training at M.D.S Parathode proves this. Thus, the incentive for undertaking subsidiary activities are influenced by the level of income of farmers and their desire to increase the incomes to a higher level.

Diffusion Perspectives in the Diffusion of Beekeeping Technology in Kerala

In the light of the observed patterns and characteristics of adopters of beekeeping technology in Kerala, the relevance of the different perspectives of diffusion in our case can be analysed. The characteristics of adopters, which are expected to have its bearing on the adoption of beekeeping were the size of the land holdings, income, educational status etc. The results of the study showed that the possibility of adoption of beekeeping is high among the middle income category of farmers as compared to the upper income and lower income group. The relationship between adoption behaviour and level of education of farmers also showed the expected positive sign as predicted by the theories of diffusion. But it was seen that the probability of adoption was less at a higher level of education. The process of diffusion of beekeeping over the years (Among Different Categories of Adopters) showed that in the initial stages, the diffusion of the technology was facilitated mainly by the promotional agencies. But in later stages, the diffusion is more demand led as majority of the beekeepers started beekeeping as they got information about beekeeping from other beekeepers. On an average, the demand side factors played more role in the process of diffusion of beekeeping in Kerala as 64 percent of the adopters first came to know about it through friends and relatives. Thus, our analysis shows that any single perspective of innovation diffusion in itself is not adequate to explain the process of diffusion of beekeeping technology in Kerala.

Innovation characteristics like profitability, complexity etc are said to have great influence on the rate of adoption of any technology. In our case the characteristics of innovation, which

had greater influence on the adoption was profitability and the perceived complexity of beekeeping. Most of the beekeepers started beekeeping only as a hobby. But now, for majority of the beekeepers, the reason for doing beekeeping is to earn additional income. Thus the shift from a leisure time activity to a commercial enterprise proves the profitability of beekeeping and it can be the main reason for the adopters to continue the activity. Most of the non-adopters also admitted the profitability of beekeeping citing the examples of Tamilnadu migratory beekeepers. But adopters and non-adopters differ significantly in their perception of the complexity of the beekeeping technology. While no adopter complained beekeeping activity itself or the management of bees as a problem, for 28 percent of the non-adopters the reason for their non-adoption was their perceived complexity in doing the works related to beekeeping. This leads us to the conclusion that the beekeeping extension agencies have not succeeded fully in disseminating the technology among the potential adopters.

To conclude, the analysis of the process of diffusion of beekeeping in Tamilnadu and Kerala brings out some interesting results. In Tamilnadu both demand and supply side factors played an equivalent role in the process of diffusion in the very beginning of the introduction of beekeeping technology. But in Kerala, the demand side factors, on economic considerations were much weak and supply side factors played more roles till the mid 90's. But after the mid 90's the demand side factors have become more active, while the supply side factors are loosing their importance. So the diffusion of beekeeping practice among potential adopters in Kerala would more demand led in the subsequent years. The analysis also proved that economic profitability of an innovation is a necessary but not sufficient condition for its adoption among potential adopters. Also, the diffusion of any innovation especially agricultural innovations aimed at diversifying agriculture depends to a large extent on the farmers desire to increase their income to higher limits and to achieve higher standard of living. Thus, as the beekeeping technology was introduced, the potential adopters of Tamilnadu found a living on beekeeping. But for the potential adopters of Kerala, the adoption was gradual as they were ensured a moderate level of income from the rubber cultivation itself. Thus, while the land-poor potential adopters in Tamilnadu made use of the opportunity, for the Kerala farmers it was a matter of choice to adopt or not to adopt. The low rate of diffusion of beekeeping in Kerala leads to the conclusion that in developing economies the diffusion of a new technology should not to be left to the market forces alone because the targets of the rural economies are less motivated to undertake risks of new practices unless the promotional agencies take an active role in the process.

The analysis also proved that the bio-physical conditions of the activity defined in terms of the suitability of the activity to the bio-physical conditions of the area (i.e. the complimentary nature of rubber cultivation and beekeeping) are necessary but not sufficient in explaining the diffusion process as compared to the social and physical conditions of the adopters and infrastructure factors in terms of the provision of beekeeping equipment and technology and also providing marketing facilities for the product.

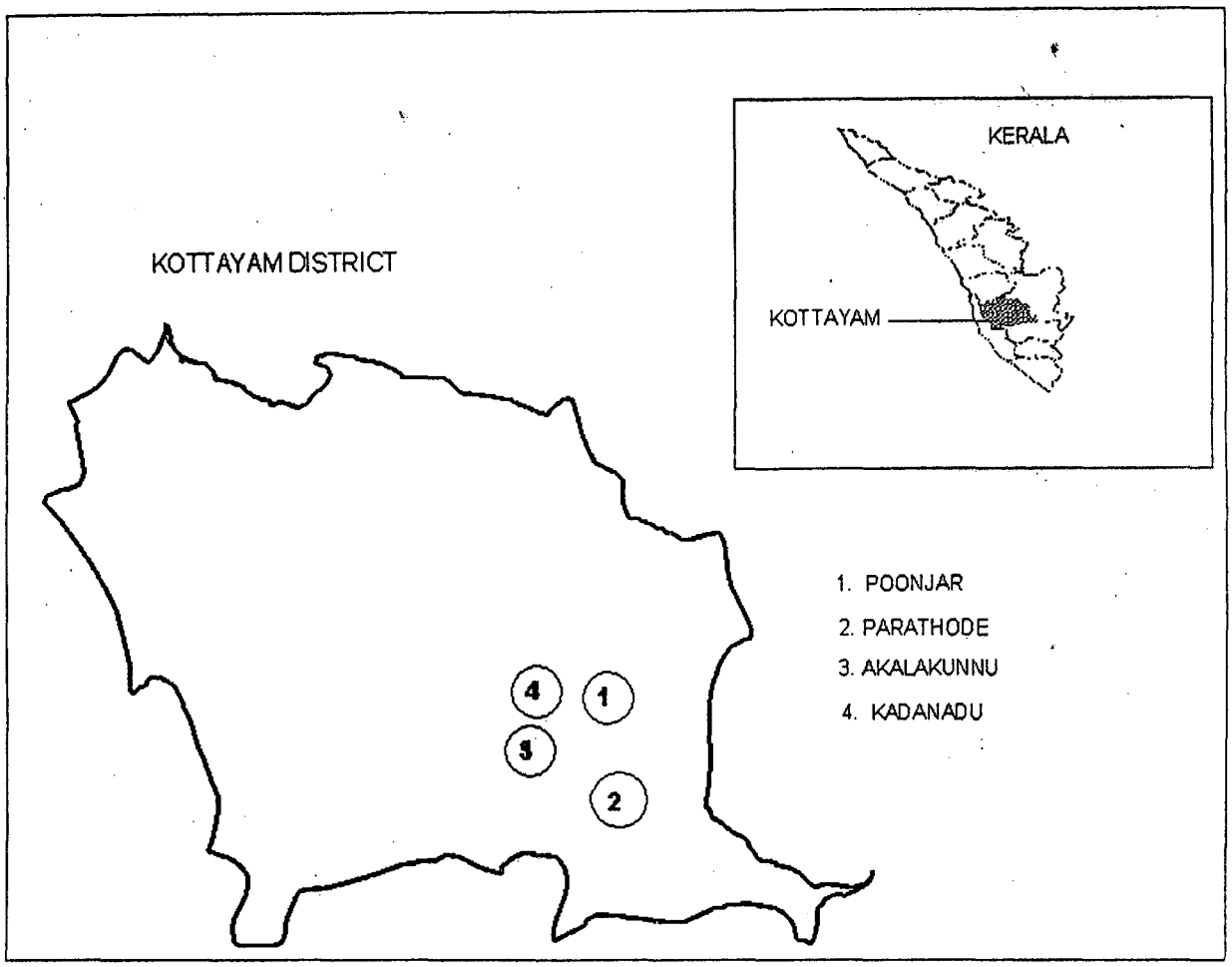
Appendix 1

The Sample Survey

The sample survey was conducted among the members of Malanadu Development Society (MDS) beekeepers Association. Scrutinising the list of M.D.S beekeepers Association, four panchayaths in Kottayam district, where beekeeping is concentrated were selected for the sample survey (See Figure A.1). From these four panchayaths 50 beekeepers were randomly selected from the list of M.D.S Beekeepers for the survey. The survey also intended to differentiate between adopters and non-adopters of Kerala to identify the factors for adoption and non-adoption. To differentiate the adopter characteristics from that of non-adopters, 25 non-adopter households also were surveyed. The non-adopters selected were the neighbouring households of the surveyed adopters.

Although the sampling units were the M.D.S Beekeepers Association members, in the present study, households are regarded as the basic unit of analysis as the decision of adopting or not adopting beekeeping as a subsidiary source of income is structured through economic, social and cultural conditions of the households. The interactions among adopters and non-adopters and interaction with the promotional agencies are taken into account in analysing the process. As pointed out earlier, the analysis of the process of diffusion of beekeeping is made within the framework of different perspectives of diffusion. Thus, the survey scrutinised the demand side characteristics of adopters and non-adopters in terms of their socio-economic conditions. The supply side factors also were analysed to assess the extent to which the adopters and non-adopters are aware of the various beekeeping promotional agencies and their schemes, and also the extent to which the schemes are made available to the beneficiaries. Finally the innovation practices of the adopters itself is an area of interest for our analysis due to the reason that innovation characteristics like profitability, complexity, scope for trials etc are very important factors which influences the diffusion of any technology. The adopter's and non-adopter's perceptions of the technology also were analysed. Of the fifty surveyed adopters, all of them reported that they have lost their entire colony in 1992 due to the deadly viral disease (Thai Sac Brood Disease), which occurred in 1992 destroying almost all the colonies. But out of fifty, forty-three beekeepers restarted beekeeping and seven did not.

Figure A.1. The Panchayats Covered Under the Sample Survey



Appendix 1I

Costing Price Rs. 42 /- Blunded Honey Cost Chart with effect from 1.1.1994

Sl No.	Particulars	Processed Per kg.	1000gm.	500gm.	200gm.	100gm.
1	Cost of raw honey	46.00	46.00	23.00	9.20	4.60
2	Sample drawing & filtering etc.	0.08	0.08	0.04	0.08	0.01
3	Wages on pre-processing and processing	0.35	0.35	0.18	0.07	0.04
4	Processing shrinkage, drainage and waste pre-processed 1%	-	-	-	-	-
5	Raw processed 3%	1.38	1.38	0.69	0.28	0.14
6	Cost of fuel	0.18	0.18	0.09	0.04	0.02
7	Cost of containers	2.60	6.25	3.85	2.65	1.60
8	Cost of pp caps, wax etc.	0.17	1.10	1.10	0.83	0.66
9	Wages on bottling, corking, labelling, warpping	0.30	0.32	0.28	0.22	0.20
10	Cost of cellophane, labels, strap etc.	0.10	0.51	0.35	0.25	0.22
11	Cost of mats, cartons, ropes etc.	0.65	1.43	0.88	0.50	0.33
12	Wages on lifting, loading etc.	0.10	0.10	0.06	0.03	0.03
13	Agmark fee	0.05	0.05	0.03	0.01	0.01
14	Interest on capital @ 4%	2.22	2.32	1.21	0.56	0.32
15	Establishment charges, rent, contingencies depreciation, insurance etc. @15%	7.80	8.70	4.65	2.10	1.20
16	Discount on sale @ 10 %	61.98 -	68.77 6.77	36.41 3.50	16.75 1.41	9.38 0.74
	Total	61.98	75.54	39.91	18.17	10.17
	Rounded to (invoice pride) Rs.	62.00	75.55	40.00	18.25	10.35
	Maximum selling price not to exceed Rs.	-	81.50	43.25	20.00	11.50

Appendix 1II

List of Rubber Board Approved Sponsoring Beekeeping Agencies/ Societies Under Apiculture Scheme for 1999-2000

1. Y.M.C.A Rural Centre and Institute of Rural Development, Marthandom P.O, Kanyakumary District, Tamilnadu.
2. Marthandom Honey Traders, Kuzhithurai, Kanyakumari District, Tamilnadu.
3. Khadi and Village Industries Commission, Trivandrum.
4. Kerala State Bee-Keeping Industries Federation, Gramodaya, Trivandrum.
5. Chandram Honey Producers Society, Pappanamcode, Trivandrum.
6. K.M.R Bee-Keeping Centre, Vettikavala P.O, Kottarakara, Kollam District.
7. R.S.G. Beekeeping Centre, Chanappara P.O, Kadackal, Anappadu, Kollam District.
8. Priyadarsini Charitable Society, Pezhumpara P.O, Vayalathala, Pathanamthitta.
9. Changanacherry Social Service Society, Changanacherry.
10. Malanadu Development Society, Parathode P.O, Kanjirapalli.
11. Kanjiramattom Gandhigram RPS, Kanjiramattom, Kottayam
12. Devakripa Charitable Society, Idyanal P.O, Ramapuram,,Pala.
13. Ullanad Beekeeping Co-operative Society Ltd Pala.
14. All Kerala Beekeeper's Association, Neeloor P.O, Pala.
15. Idanad Rubber Producers Society Ltd. Pala.
16. Janatha RPS, Aimcompu, Kadanad P.O, Pala.
17. The Poonjar Panchayath Khadi and Village Bee-Keeping Sahskarana Sangam Ltd. Poonjar.
18. Elavampadom RPS, Elavampadom P.O, Palakkad.
19. Farmer's Society, Karuvanchal P.O, Kannur.
20. Golden Bee Box Industries and Bee Farm, Chittarickal, Kasargod.
21. Happy Bee-farm Industries, Chittarikal, Kasargod.
22. Mellifera Bee-Keeping Society, Chittarikal, Kasargod.
23. Valayam Chirangara Balagramam Valayam Chiranagara Perumbavoor.
24. Kannur Rural Development Society, Nellikutty P.O, Chungam Kannur.

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