TECHNOLOGY NEEDS AND RISKS ASSESSMENT OF SPECIALISED HOMEGARDENS

by

SREELAKSHMI C

(2016-11-071)

THESIS

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DECLARATION

I, hereby declare that this thesis entitled **"TECHNOLOGY NEEDS AND RISKS ASSESSMENT OF SPECIALISED HOMEGARDENS"** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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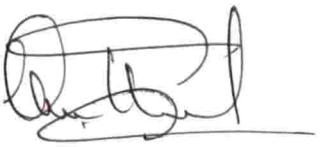

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LIST OF ABBREVIATIONS AND SYMBOLS USED

%	Per cent
&	And
CD	Critical difference
et al.	and co-workers/co-authors
Fig	Figure
KAU	Kerala Agricultural University
AEU	Agro-ecological units
ICAR	Indian Council of Agricultural Research
NSSO	National Sample Survey Office
No	Number
NTFPs	Non-timber Forest Products
INDC	Intended National Determined Contributions
FCEI	First Commodities Exchange of India
E 1	Initial cost
E 2	Income generation potential
E 3	Employment generation potential
E 4	Commercialisation
E 5	Regularity of returns
E 6	Rapidity of returns
T 7	Physical compatability
T 8	Efficiency
T 9	Trailability
T 10	Complexity
T 11	Predictability
T 12	Flexibility
T 13	Viability
T 14	Desirability
T 15	Availability of supplies
Ev 16	Energy saving potential
Ev 17	Local Resource utilisation
Ev 18	Sustainability
SC 19	Social acceptability
SC 20	Social approval
P 21	Attitude
P 22	Perceptions of technology
P 23	Perceived social status
HR 24	Family labour
HR 25	Hired labour
HR 26	Physical labour requirement
HR 27	Skilled labour requirement

Introduction

CHAPTER 1

INTRODUCTION

Traditionally, homegardens constitute the prominent agricultural land-use activity in Kerala, which is sumptuous in agro-biodiversity. The adjoining Western Ghats further facilitates vast agro-biodiversity and picturesque the agricultural lands of Kerala. As compared to other mono-specific production system, homegardens are multi storeyed agroforestry systems that are ecologically complex and are structurally and functionally diverse. An infinite number of multiple services are offered by homegardens. Millions of marginal farmers rely on homegardens for their livelihood and nutritional security apart from offering diverse economic and other ecological benefits. The trees in this farmlands ensures multiple functions such as food, fodder, timber, fuel, medicinal plants, pulpwood and other 'Non Timber Forest Products' (NTFPs) (Kumar, 2006). In addition to the direct benefits, homegardens provide enumerable indirect services such as nutrient cycling, climate moderation and soil fertility improvement (Beer *et al.*, 1998). Probably, homegardens serve as the potential sources in meeting the Intended Nationally Determined Contributions (INDC) of the country based on the Paris Climate agreement.

Generally, homegarden is defined as the special type of sustainable agricultural production system practiced around the home with or without extended garden, where a multi-species of annual and perennial crops along with /without animal husbandry components and other specialized components like aquaculture, sericulture, apiculture, etc. for the purpose of meeting the fundamental requirements of home and besides generate additional income through the sale of surplus to fulfill the requirements of household (Thomas, 2004). Homegardens are the primitive forms of agriculture and with the current issues of rising population, lack of resources and food crisis, they can ensure people with better livelihoods. Planners, environmentalists, researchers, and extension personnel often is deprived of the information to identify situation where homegardens can accomplish sustainability in terms of technology, socio-psychologically and economically. To

make homegardens more remunerative and as a strategy to mitigate risks, diversification is the best choice. Diversification can meet the price fluctuations and ensure economic stability. The high diversity of crop combined with tree and livestock species with different uses and production cycles in these systems, facilitates year-round production of food, wood and a wide range of other products. Similarly, it also helps to curb risk of production failure, pests and diseases, increases productivity cum output flexibility and also it enhance the microclimate and soil conditions. Altogether, the presence of different functional groups of crops, trees and livestock in homegarden systems satisfies the dietary and cash requirements of the households, thereby enhancing food and livelihood security (Tesfaye, 2005).

As a result of commercialization and decreasing land due to fragmentation, cultivation systems are becoming more specialised. Although emphasis on the dialectical relationship between diversification and specialization is not novel, concern about diversification is more underlined because of major developments in the agricultural sector in many developing countries. Agricultural diversification can possibly benefit farmers and consumers by providing a wider range of products, superior production stability, curb risks, and finally more proficient land use systems. The factors leading to specialization are environmental constraints to production, high margins of economic return, narrow technological adaptation, and regulation of prices, inputs or crop size. Keeping in view the potential benefits and technological potential of agricultural diversification, an enhanced understanding of the factors controlling the diversification needs to be defined (Zandstra, 1982). Horizontal diversification reflects the measure of both the cropping intensity and the structure of homegardens. The functional dynamics and the economic entities in the homegarden as a result of value addition or product diversification is shown by means of vertical diversification (Aravind *et al.*, 2004). Studies reveal that the diversity of crops that results in specialisations with primary homegarden components along with vegetation, livestock, fisheries and other specialised components enables continuous produces/products and reduces the production risks (Thomas, 2016).

Therefore specialised homegarden is a system that can overtire current limitations of time, space and capital that should be triangulated with effective extension interventions at ground level for the overall remunerativeness and sustainability of homegardens. Hence the present study was undertaken with the following objectives:

I) To delineate the technology needs, categorize the different dimensions and the risks of specialisations in homegardens.

II) To delineate the extent of horizontal cum vertical integrations, constraints and solutions as perceived by the homegarden farmers incorporating specialisations.

1.1 SCOPE AND IMPORTANCE OF STUDY

Any agricultural production becomes sustainable only when it fetches farmer due economic benefits. Traditional homegarden systems have been transformed to the sustainable production systems that make it unique and specialised. The extent of specialization thus assumed significance and it becomes important to study the horizontal and vertical diversification of specialised homegardens. This further reflects into the structural and functional dynamics of specialised homegardens which would enable the research and extension system to formulate research agenda and proper and specific delivery mechanisms.

Sharma *et al.* (1991) have revealed that production of crop and land productivity had tremendously improved by an effective integrated homegarden farming systems. Further it discourages the conversion of land into non-agricultural practices. Complex farming systems are the operational farming unit in each agro-ecological zone for small scale farmers in developing nation.. Thus they need to access a wide variety of locally legitimate technologies if they are to surge their productivity (Swanason *et al.*, 1997). Specialised homegardens facilitate better income generation and offers additional employment opportunities. Farmer characteristics are also assumed to be different for specialised homegardens. Hence

it becomes imperative to study the socio-cultural, technological, economic and psychological dimensions of farmers of specialised homegardens.

1.2 LIMITATIONS OF THE STUDY

The study undertaken is confined to a limited number of specialised homegardens in each agro ecological units of Thiruvanathapuram district. Hence findings of the study have limited scope for generalisations. The data collected from the respondents may or may not be free from individual biases and prejudices.

In spite of these limitations, much care had been taken to make the study objective as possible.

1.3 PRESENTATION OF THE THESIS

The entire Master's thesis is presented as five chapters:

The first chapter 'introduction' explains the importance of the topic, objectives, scope and limitation of the study. Second chapter, 'theoretical orientation' deals with review of relevant literature in line with the objectives of the study. Third chapter 'research methodology' describes the sampling design, the study area, measurement of independent and other variables, method of data collection and statistical tools used. Fourth chapter 'results and discussion' discusses the results of the study to draw specific inferences and the final chapter 'summary' briefly summarizes the work done, salient findings, explains the implications based on the results of the study and also suggests future areas of research.

Review of Literature

CHAPTER 2

REVIEW OF LITERATURE

A proper framework for the research study is based on the ideas generated through different information sources. Review of literature is a comprehensive way of collecting information pertinent to research studies. Hence various studies which were directly or indirectly related to the topic of research were thoroughly reviewed and collected. Different reviews satisfying the objectives of the study is described under the following heads.

2.1 Personal and social characteristics of homegarden farmers

Understanding the proper behavioural dynamics of the data will enable the proper maneouring of research data so as to generate useful information for the study. The review of literature related to the different personal and social characteristics of homegarden farmers are presented under the following heads.

a) Age

Age was operationalized as the number of years completed by the respondent at the time of investigation.

Singha (1996) in his study on homegardens revealed that majority (66.67 per cent) of the coconut farmers in Assam were middle aged (between 30-50 years).

Manjusha (1999) studied about the age and extent of adoption of recommended practices by farmers in bitterguard cultivation and revealed that relationship between age and extent of adoption is non-significant.

Thomas (2004) in his study on "Technology assessment of homegarden systems" revealed that age is positively related with the knowledge of the farmers.

Voeks (2007) reported that homegarden species knowledge holds a positive relationship with the landowner age irrespective of the gender differences.

Jayawardhana (2007) in his study revealed that 80 per cent of coconut based homestead farmers belong to old age category.

Krishnan (2013) reported that more than half of homegarden farmers fit to the middle age category which was trailed by old age category (43.33%) and finally the young farmers comprising 3.33%.

Williams *et al.* (2018) revealed that the age of the agricultural decision-maker and the size of homegardens were positively correlated with the overall species richness of homegarden farming systems.

b) Education

Education was operationalised as the extent of formal or non formal learning possessed by the specialised homegarden respondent at the time of investigation. A few review pertaining to the variable is mentioned below.

Rathinasabapthi (1978) in his study entitled "Knowledge and extent of adoption of integrated pest management for cotton" revealed that education had positive and non -significant relationship with adoption of improved cultivation practices.

Waller *et al.* (1998) and Caswell *et al.* (2001) reported that for acceptance of new practices particularly information-intensive and management-intensive practices, education creates a positive mental attitude.

Sasankan (2004) stated that 49 per cent of cassava farmers possessed secondary level of education and less than 2 per cent were illiterate farmers.

Muchara (2009) stated that the ability to interpret information is better for those people who have higher educational level.

According to Esakkimuthu (2012), 30 per cent of banana farmers had high school level education on his study entitled 'innovations in technical backstopping for Thiruvanathapuram district panchayat –a critical appraisal of samagra project on banana cultivation.

Pillai *et al.* (2016) found that education on nutritional security could definitely improve the same and gives added benefits to homegardens.

c) Family size

Family size refers to the members of either sex living in a household/family dependent on the head of the family.

According to Verma and Rao (1969), family requirement plays a significant role in determining size of the garden in his study entitled " Impact of farmers' training programme on adoption of recommended practices."

Rocheleau (1987) stated that women were responsible for providing homegarden products to the household. They control the resources and processes and also work in the garden as reported in the analysis of land use in Pananao in Dominican Republic.

Moreno Black (1996) stated that homegardens provide a place for all family members to be involved in some form or other. It facilitates greater participation of family members thus enhances their feeling of self -worth.

Isreal (2003) found in his study entitled "Impact of National Watershed Development Project for Rainfed Areas (NWDPRA) in Anantapur district of Andhra Pradesh" that most of the respondents had moderate (81.67%) family size followed by small (17.08%) and very large (1.25%) household category.

Satyagopal (2009) revealed that in his study on "Development of extension strategy to reach the unreached farmers" majority (74.44%) of the unreached farmers had medium family size followed by low (23.89%) family size and high (1.67%) family size categories.

d) Occupation

Occupation is the main vocation and other vocations undertaken by the respondent at the time of investigation.

According to Kamalakkannan (2001), sixty per cent of the respondents were having farming as their main occupation in the study entitled 'Content analysis of selected mass media in dissemination of farm technology."

According to Raju (2002), farming was the main occupation for more than half (57.5%) of the respondents under watershed environment followed by farming plus enterprise (21.5%), farming and wages (14.0%) and farming / service (7.0%) in Medak district of Andhra Pradesh.

According to a study conducted by Awotide (2012), those farmers who had agriculture as the main vocation had a negative effect on the on the adoption of improved rice varieties.

Sobha (2013) stated that in a study on "farm telecast in Kerala ''that 56.67 per cent were having additional occupation along with the farming.

Beevi (2014) found that percentage of youngsters accepting agriculture as primary occupation is less due to higher education and lack of available land for economic cultivation.

Wekumbura *et al.* (2017) found that 25 per cent of the respondents perceived homegardening as an occupation in a study on "Prospects and Issues Related to Tea

Cultivation in Mid Country homegarden based tea smallholdings in a selected village in Sri Lanka."

e) Annual homegarden income

Annual homegarden income refers to the total annual earnings of the farmer from farm activities in the homegarden.

Salam and Sreekumar (1990) revealed that an inclusion of livestock component (Jersey cross bred cow and poultry) and irrigation technology in the homegarden of 68 cents of land with cropping component (having multitier crop canopy configuration) could meet the home demands as well as educational requirement of seven member family with 5 children.

According to a study by Lok and Mendez (1998), homegardens plays a pivotal role in enhancing the economic and subsistence income by supplying products cultivated in their own land.

Howard (2006) revealed that homegardens ensures year round income as a result of diversity of crops which can be harvested at different times.

Krishnan (2013) concluded that 33 percent of respondents had an income higher than total average income and 67 per cent of sampled homegarden respondents had an annual homegarden income less than total average income (Rs 2,84,000).

It was revealed that significant majority of homegardens in Sri Lanka are maintained to produce food (vegetables) for home use and secondly, the sale of the excess to derive an income (Sangakkara and Frossard, 2016).

f) Effective homegarden area

Effective homegarden area refers to the homegarden area measured in cents.

Lok (1998) reported that smaller size of urban homegarden enhanced the management intensity and species density, as a result of available space reduction when compared to the rural homegardens.

Das and Das (2005) found that larger the size of homegardens, more is the micro zones or management zones and larger area allocated to the arecanut cultivation. Well defined dense zones were an added feature in such homegardens, whereas demarcation is not that prominent in small homegardens and is composed of several species mixed together.

Basheer (2016) in the study entitled "Technology utilization of bitter gourd in Thiruvanathapuram district" found that that majority of the respondents cultivated bitter gourd in area less than or equal to 0.50 acres (75.56 %). Only 5.55 per cent of farmers cultivated bitter gourd in more than 1 acre land and 18.89 per cent farmers' utilised area between 0.51 and 1 acre for bitter gourd farming.

Esakkimuthu (2012) revealed that majority of the banana farmers (70 per cent) were having an area below 60 cents.

g) Attitude

Attitude could be defined as the positive and negative feeling of the homegarden farmer towards specialised and non –specialised component.

Alam *et al.* (2010) stated that among the available species mango was given the highest preference ranking. It could be assessed that various perceptions, preferences and attitude of the farmers would provide a strategy for the future policy formulation, preparation of homegarden management plans and development of homegardens in Bangladesh.

Goswami (2012) found that exists a positive and high significant association between economic motivation and attitude of fish farmers in West Bengal towards scientific fish culture.

Kumari (2014) in the study entitled on found that 65.78 per cent of the respondents had favourable attitude towards Homestead technologies of RAU. It was followed by 18.67 per cent respondents with neutral and 15.55 per cent respondents with unfavourable attitude towards Homestead technologies of RAU respectively.

h) Extension participation

Extension participation was operationalised as the extent of farmer participation in various programmes organised by governmental and non governmental initiatives.

John (1991) stated that extension participation had positive and significant influence on adoption of pepper cultivation practices. He concluded that mere membership in group itself enhanced the extension participation of the members in a study on 'feasibility analysis of group approach in the transfer of pepper production technology'.

Sindhu (2002) stated that old farmers are most likely to lose interest in active participation within and outside social system among vegetable farmers in a study on 'social cost-benefit analysis in vegetable production programmes in Kerala through participatory approach'.

According to Singh *et al.* (2003), most of the respondents had low to medium level of extension participation in their study on 'media use profile of farmers'.

Wankhede and Khare (2005) found that extension participation had significant relationship with effectiveness of farm telecast in their study on 'perception of farmers viewing Krishidarshan programme'.

Anupama (2014) in a study on 'content development for agricultural expert system on organic vegetable cultivation' concluded that 67 per cent had medium extension orientation whereas 11 per cent farmers each had low and high extension orientation respectively.

i) Extension contact

Extension contact was operationalised as the frequency of farmer contact with various extension personnels or professionals operating in that area.

Sulaiman (1989) found out that there exists no significant relationship between extent of adoption and personal guidance for better farming in his study on "Evaluative perception of appropriateness of the recommended fertilizer management practices."

Engles (2001) reported that potential benefit arises from the production system or from outcome of research only if there exist link between homegardens, national research and extension services. Similarly, public or private sector funded research do not address the problems encountered within homegardens. Also, production of food in homegardens are not reflected in national statistics was revealed in his study entitled "Rudolf mansfield and plant genetic resources."

Uaiene *et al.* (2009) revealed that contact with new technologies depends mostly on the existence of non-governmental organisations (NGOs), donor supported projects or outgrower schemes for crops like cotton and tobacco.

Floyd *et al.* (2013) found in his study on "The adoption and associated impact of technologies in Western hills of Nepal" that the level of extension inputs was a driving factor to the adoption of technologies in the Western hills of Nepal.

j) Market orientation

Samantha (1977) defined market orientation as one of the three sub scales of the scale measuring management orientation. It was operationalized as the degree to

which a farmer is concerned with towards scientific farm management consisting of planning, production and marketing functions of farm enterprises.

Sajeevachandran (1989) opined that a positive and significant relationship existed between market orientation and adoption of scientific practices in pepper.

Fayas (2003) reported that 89 per cent of vegetable farmers had presumably high level of market orientation.

Purnima (2004) from her study on "Women Self Help Group dynamics in the North Coastal Zone of Andhra Pradesh" reported that majority (48.75%) of the respondents had medium market orientation followed by high (27.92%) and low (23.33%) market orientation.

Rowe (2009) found that nearly half of the food consumed at home comes from homegardens. Also, one-third of the food sold in the market is contributed by homegardens.

Sakia and Khan (2012) found that homegardens are maintained for meeting the household requirement of fruit, timber, vegetable, ornamentals and fuelwood. Market oriented production was always given secondary importance for homegarden production systems.

2.2 Horizontal and vertical crop diversification in specialised homegardens

a) Agricultural diversification

Agricultural diversification plays an important mechanism for economic growth. It depends on the available opportunities for diversification and on farmers' approachability to those opportunities. It can be facilitated by technological disruptions - through, by changes in consumer demand or in government policy or in trade arrangements, or by development of irrigation, roads, and other infrastructures. In opposition, it can be hampered by risks in markets and prices and in crop-management

practices, Degradation of natural resources, by conflicting socio-economic requirements, possibly for employment generation, or for self-sufficiency or foreign-exchange-earning capacity in particular crops or livestock or fishery or forest products can affect the diversification.

Grimes (1929) had discussed the advantages and limitations of the diversification of the agriculture. He concluded that diversification of agriculture lowers the production costs of the agriculture products resulting to the stable and large annual farm income. He also said that main purpose of the diversification of the agriculture products is to increase the income and improve the agriculture condition.

Diversification happens because homegarden members are 'strapped' by the level of farm income and 'heaved' by off-farm opportunities (Efstratoglou-Todoulou, 1990).

Delgado (1995) recognized that there are three mandates for policy level encouragement of diversification. Greater food security should be designed and implemented in order to attain staple food production and to meet the marketing issues policies. This is the primary target of diversification. Increase in high-value production may not happen unless food security risks are considerably dropped, particularly in areas devoting a high share of resources to subsistence food production. Secondly, there should be reduction in the transaction costs associated with the flow of resources and products between regions and between countries. It ensures that gains from the production of tradables can flow to areas producing non-tradables, which helps to support the production of tradables. Third, to contribute to the source of foreign exchange to overseas markets there is a need to promote nontraditional exports. This could be accomplished by capitalizing in research, extension, and information systems of high-value crops, livestock and fishery products, and by emergent quality infrastructure.

Diversification in agriculture commonly means growing different crops instead of concentrating under a single crop. However, Pingali and Rosengrant (1995) had demarcated diversification as "alteration in product prime and input use decisions grounded on market forces and the ideologies of profit maximization".

The course of diversification rising out of traditional commodities is generally hastened by factors such as rapid technological change in agricultural production. As a result of the change in a wide variety of freights such as cereals, pulses and high-value crops, enhanced rural infrastructure, strategy changes, and diversification in food mandate patterns. Decline in the profitability of certain commodities (cotton) is one of the factors contributed to diversification in Peru (Escobal *et al.*, 2000).

Conversely, Joshi *et al.* (2004) have defined "agricultural diversification as movement of production-portfolio from a low-value commodity mix (crop and livestock) to high-value commodity-mix (crops and livestock)." This makes a shift from traditional definition. However, to encompass all the agricultural and allied sector, diversification should be considered as a strategy of changing crop or enterprise-mix with more equivalent distributive share for each sector. But the rationale to select agricultural diversification as strategy connects different logic *viz.* risk minimization, sustainability or high production depending on the intention of the farmer.

It was found that for those farmers without animal husbandry (>40% of rural population) by diversifying on-farm crop production, better-quality management and growing medium duration crop varieties can reduce economic losses due to climate change from 25% to 19%. Also, the integrated approach can appraise impacts on both agricultural production and also human well-being, which is domineering in developing context-specific national adaptation approaches (Masikati *et al.*, 2017).

b) Horizontal and vertical diversification

Hussain (1987), in his study entitled "Consequences of Green Revolution in India" has observed that where green revolution has ushered in the state of Punjab and Haryana , the cropping pattern was largely pretentious and as a result cropping pattern has transmuted from diversified to specialized.

Tropical homegardens comprises of vegetation layers (stories), resembling the tropical forest structure. The top level consists of canopy of tall trees. It lowers radiation and mechanical impact of rainfall. Thereby, creates a constant micro-climate in the lower layers and in addition to it, leaf fall contributes to the maintenance of soil fertility. The lower layer constitutes staple food and fruit production (*eg.* banana, mango, papaya, *etc.*) followed by bush level growth (*eg.* cassava, maize, peppers, etc.) in the third layer. In-ground and ground-covering species (roots and tubers and others) form the last layer, while climbing species slanting the lower stories (Fernandes and Nair, 1986; Ninez, 1987).

There exists boundless multiplicity in the types of trees, shrubs, vegetables and crop species, animals, as well as in the organization of these components (Mergen, 1987).

Agricultural diversification refers to growing/engaging new to an existing farm or non-farm activities utilizing farm resources (Kasryno, 1992; Ali, 2004).

Haque (1996) stated that horizontal diversification as that form of diversification wherein farmers diversify their agricultural activities in order to either stabilize or increase their income or both. This can either take the form of shift from subsistence farming to commercial farming or the shift from low value food crops to high value crops whereas vertical diversification refers to the farmer access to non-farm income that is income from non-agricultural sources well as in the three-dimensional planning of these components.

In a study on 400 home gardens in Thiruvananthapuram district, Kerala, Jacob (1997) revealed that the number of crop and tree species in homegardens varied from less than 5 to more than 40. Most home gardens (57.75 %) entailed 10–20 species. An average of 14–15 species and 397 plants per homegarden were observed in the region as a whole, designating a very high degree of crop arrangement.

Pingali and Rosegrant (1995), in his study entitled "Agricultural commercialization and diversification" argue that economic growth, urbanization and withdrawal of labour from agriculture leads to the commercialization and diversification and involves the gradual decline of integrated farming system by specialized enterprises for crops, livestock, poultry and agriculture products. The study also show that commercialization is a universal phenomena triggered by economic growth.

Hamid and Alauddin (1998) revealed that the introduction of shrimp aquaculture on a larger/commercial scale has developed shrimp-based farming system. Shrimp production has permitted rural women to make more cash income and to become more active income-earning members in rural homegardens.

Home gardens also safeguard the use of idle labour. A study on the diversification adopted by farmers in their home gardens exposed cattle-rearing was a complementary enterprise in 17.5 per cent of homegardens, and 30.25 per cent raised poultry along with annuals. Among all farm families, 30.5 per cent possessed cows, bullocks, goats, sheep, buffaloes, and poultry (chicken, duck, quail and turkey) (Jacob and Nair, 1999).

Joshi *et al.* (2003) revealed that alteration of resources from one crop to a large mix of crop and livestock, considering the nature of varying risks and expected returns from each crop or livestock activity, and adjusting in such a way that it leads to optimum portfolio of income.

Kurosoki (2003), investigated the role of crop specialization and diversification in the process of agricultural diversification empirically in the West Punjab. He found that the cropping pattern of traditional and subsistence farming changed over the period with the change in crop concentration and productivity, therefore, a dynamic shift had been observed towards the high value-added crops.

Yao (2004) in his study concluded that so as to enhance vertical diversification, it may be appropriate for the government to provide enticement in the form of risk distribution and excise release so that the private sector could invest in treating and post harvest activities.

Bhalsing (2009) reported on the impact of physical and socio-economic conditions on the agriculture through analyzing the contemporary competition existing among crops for area, for rotation and effect on double cropping highlighting the importance of horizontal integrations

Hansson *et al.* (2010) revealed that farm diversification is increasing and they also pointed out that the degree of specialization and diversification are influenced by firm characteristics, business structure, financial and demographic condition.

Sati (2012) has pointed out that the diversification of agriculture is the outcome of the natural demands as initially the farmers were cultivating their land for the subsistence of their livelihood but as the population increases and per capita land decreases the diversification of agriculture began. He also asserted that farmer's decisions are influence by environmental, socioeconomic, and cultural factors as well as political climate. Diversity in crops varies spatially – both horizontal and vertical and temporally- rabi and kharif seasons.

Thomas and Ravikishore (2017) reported that it can be deduced unequivocally that 80 per cent of the specialized homegardens had more than four tiers of horizontal diversification. Hence it can be inferred that the majority of the specialized

homegardens had a four tier or more levels of horizontal diversification which is typical and unique for Kerala homegardens. Also, it can be inferred that inclusion of specialized components in the homegardens can bring in more returns and hence improve the profitability of the specialized homegarden farmer.

2.3 Type, extent and characteristics of specialisations in homegarden :

Homegardeners are perpetual experimentors' and constantly trying and testing new species (Ninez, 1987).

Meerabhai *et al.* (1991) reported that coconut based farming system is commonly practiced in homestead agriculture especially in coast land and mid-land Kerala.

Krishnan (2013) revealed that majority of the homegardens shows that there were six tiers or more horizontal diversification (40% of the specialized homegardens), followed by five tier and four tier diversification (20%) each. Therefore, it can be deduced unequivocally that 80 per cent of the specialized homegardens had more than four tiers of horizontal diversification. Similarly, the vertical diversification is more for the specialized components. Thus it can be inferred that inclusion of specialized components in the homegardens can bring in more returns and hence improve the profitability of the specialized home garden farmer. Specialization such as Hi-tech Greenhouse units also implied that value addition units attached to the same was needed in order to realize more profit and enhancing the level of vertical diversification.

Sebastian (2013) reported that extent of horizontal diversification of 62 per cent homegardens are 4 tiers or above and 38 per cent are less than 4 tiers whereas maximum vertical diversification level was three which was noticed for coconut, pepper, tapioca and arecanut, followed by 2 levels of diversification for banana and

tuber (yams and colocassia) and least vertical diversification present in vegetables in a study conducted on Thiruvanathapuram district.

Ajeesh *et al.* (2015) has shown evidence that subsistence farmers have house-trained locally popular indigenous fruits (*Anacardium occidentale, Cocos nucifera and Garcinia gummi*) and trees (*Ailanthus triphysa, Hevea braziliensis, Swietenia macrophylla and Tectona grandis*) in Kerala.

2.4 Technology needs of the specialised components of homegarden

Hoda (1979) opined that technology enables man to live more comfortably and securely by application of science and knowledge to practical use.

Gladwin (1980) has reported a case in which prior etno-scientific-research would have enabled agricultural research to be more responsive to local conditions.

Mc Graw (1982) defined technology as systematic knowledge and action, usually of industrial processes, but applicable to any recurrent activity.

Raju (1982) concluded that new technology in agriculture means all forms of new farm inputs, practices and services such as fertilizers, insecticides, herbicides, tube –well water, improved farm machineries and equipments and agricultural extension service.

Altieri and Anderson (1986) revealed that for accelerating moderate to high level food production, indigenous technology should be integrated with technology development for resource poor families

Talwar and Gowda (1989) found that difference in adoption of technology by one-fourth of the farmers is need of the hour by extension agencies to study the characteristics and reasons in order to bridge the gap of adoption.

In a homegarden of 68 cents of land within crop component (multi-tier canopy configuration) inclusion of livestock component (Jersey cross bred cow and poultry) and irrigation technology could meet the home demands as well as educated requirement of seven members family consisting of five children (Salam and Sreekumar , 1990).

According to Rajendran (1992), 14 dimensions were identified that were related with technology and its feasibility using the mean relevancy score. They were initial cost, income generation potential, regularity of returns, availability of raw materials, availability of supplies and services, time utilization pattern, rapidity of returns, physical compatability, efficiency, profitability availability, simplicity, viability, suitability and social acceptability.

Rao (1998) has stated that prompt technology advancement and the amplified rate of obsolescence of technologies impose technology forecasting for any planning process. Technology forecast can be defined as a probabilistic prediction of technological changes in terms of future characteristics of useful machines, system or trials and needs of the clients.

According to Truong and Yamada (2002), farmers prefer the technology with low input but with high benefit and ensure high productivity. Farmers perceive technology as fairly good but application of technology seemingly is a problem. Farmers lack capital for construction of dikes for raising fish, buy fingerlings and other materials.

Oldele (2004) concluded that regardless of all the technological innovation transfer, there exists eclectic break between levels of production which research contends is attainable and that which farmers accomplishes.

Uaine *et al.* (2009) has reported that further away a village or a household is from input and output markets , the smaller is the likelihood that they will adopt new technology.

Zaman *et al.* (2010) has recognized that farmers dependent on the naturally growing trees on the homegarden .The modern technologies and extension supports to develop the traditional production systems were almost not available.

According to Sujitha (2015), the level of adoption of plant protection practices in coconut producers of homesteads belonged to medium level (75 %) of adoption in Kerala.

Thomas *et al.* (2013) found that technology assessment of homegardens in a whole can serve as a useful feedback to the research system for designing technologies useful to small and marginal farmers for large scale recommendation so as to show benefits of development. It will aid in technology change and improvement in any sphere, increases economic returns and enhance development processes of the state.

2.5 Risks associated with specialised homegarden

Risks in agricultural production pose a major threat to the economic well-being and development of households in rural areas of developing countries.

Dillon and Scandizzo (1978) conducted mind experiments involving choice between risky and sure farm alternatives to assess risk attitudes of samples of small farm owners and share croppers of Brazil. The results revealed most of the subsistence farmers were risk averters and risk aversion was more common and even greater among owners than share –croppers.

Production Risk: Production risk comprises all series of activities that affect the quantity and quality of production, the fluctuated weather, pest, diseases, and other

factors. The adverse effects of weather, pests, and diseases on production have been debated for years (Schickele, 1949; Collier, *et al.* 2008; Hansson *et al.* 2010)

Risk management deals with selecting the appropriate mix of alternative strategies to reduce risks within the farm's operation, transfer risks from the operation to others more capable of handling risk exposure, or build the operation's capacity to bear risks (Harwood *et al.* 1999).

Harwood *et al.* (1999) deliberated the various sources of risk in agriculture and stated that, "Accepting risk is a turning point to assist producers make good management choices in a situation where adversity and loss are only options."According to him, there are mainly five sources of risk in farming

1 Production or yield risk as erratic weather, rainfall, pests and diseases.

2 Price or market risk implies the changes in the price of output or inputs and the level of sales.

3 Institutional risk includes alterations in policies and regulations.

4 Human or personal risk as a result of some disruptive changes, e.g. death, divorce, industry or the health condition of a principal in the farm, and

5 Financial risk rising from changes in interest rates on rented capital.

Meuwissen *et al.* (2001) studied farmers perceptions of risk and risk management and showed that price and production factors were perceived as important sources of risks

Risk or the "disclosure to a plan in which one is ambiguous" (Holton, 2004) is routine in agriculture as a result of continual political, economic, and social change, as well as consociate to weather and market variation.

Hardarkar *et al.* (2004) stated that market risks stems out from unpredictable currency exchange rates. Risk is present always in agriculture and despite widespread use of risk management policies there is need for continued outreach and research to further curb its effects.

Human risk: Labor makes up the largest cost associated with producing and harvesting most agricultural crops and accounts for about 50 per cent of the food marketing bill (Fields, 2008).

Knowles and Bradshaw (2009) revealed that a farmer's income or resource base and ability to obtain credit can also influence his/her choice of crops, farming systems and willingness to invest in new crops, systems or technologies.

Similarly while choosing financial investments, as well as in decision-making regarding crop choice and land use in agriculture, the comparison of asset risk and return properties is common (Bishop *et al.* 2010, Williams *et al.* 2010).

Donnell *et al.* (2011) found that by growing five crops typically found at farmers' markets, revealed that production and marketing risk are significant factors for direct marketers in small scale farms.

Gunter *et al.* (2012) stated that the probability of small-scale production in Northern Colorado using three situations based on fluctuating levels of investment in production, storage, and distribution. Exclusively utilizing wholesale markets was untenable based on the first three years of production. They also resolved that risk for each option varied due to differing levels of assurance to capital and labor.

It was found that shortage of family labor, high price of fodder, and limited farm income were perceived as the most important risks by Kinfe *et al.* (2016).

2.6 Cost –benefit analysis of specialised components in homegardens

Talib and Singh (1960) indicated that yield and income per acre were high in mixed farming as compared to monocrop farming. It was significantly high in the case of small farmers dwelling unit.

Das (1988) reported that in the case of multi-storied cropping under irrigation in coconut garden the benefit: cost ratio was 1.76 and the internal rate of return was higher than 20 per cent and the net present value worth Rs. 32,700/-. He also opined that different varieties of cereals, pulses, oil seeds, tubers and rhizomatous crops were relatively more compatible and remunerative intercrops than the other annuals in coconut garden of Kerala.

Kandasamy and Chinnaswamy (1988) found that dairy-based system was more profitable than others among different mixed farming practices. The mean annual net income was Rs. 6090/- with per day income of Rs.16.68/-. The next best system was diary-cum-poultry based farming system, with a mean annual net income of Rs.5899/- with per day income of Rs.16.16/-. Poultry based mixed farming gave only a marginal mean annual net income of Rs.2287/- with a per day income of Rs.6.27/-.

Galhena *et al.* (2013) opined that home gardens are mainly intended to grow and produce food items for family consumption, but they can be diversified to produce outputs that have multiple uses including indigenous medicines and home remedies for certain illnesses, alternative fuel source, manure, building material, and animal feed.

Krishnan (2013) reported that high B:C ratio was observed for fruit trees in the homegardens. This can be attributed to the fact that being perennial in nature and the nature of its survivability the expenditure for inputs is low when compared to the modest returns through sale of its produce. In addition to this it has a nursery for sale of saplings. Followed by fruit tree nursery maximum weighted B:C ratio was observed for aquaculture followed by terrace farming.

2.7 Constraints experienced by specialized homegarden respondents

Constraints constitute the basic point in the development of new technology.

Nikhade and Bhople (1989) has stated constraints as the state or quality of sense of being restricted to a given course of action.

According to Abara and Singh (1993), if the technology requires a substantial amount of initial set up cost ,then large fixed costs can become a constraint to technology adoption.

Anonymous (2003) has classified the constraints pertaining to crop diversifications as Technical, Economic and institutional.

Technical constraints includes water availability in dry spells. There are many alternative crops grown during dry season where water is unavailable and land is left fallow. Lack of seeds/ plant materials in case of alternative crops and lack of storage value due to the perishable nature of alternative crops constitute technical constraints.

Economic constraints constitute the volatility of output prices and the increased risk of these crops. Farmers are generally risk averse due to the access to capital. Regardless of the net returns, increasing input process can be a disincentive to growing a certain crop. Also lack of processing facilities in rural areas. Proximity to such facilities is always a crucial factor in farmer's decision making.

Institutional constraints include small cultivated land size per household. It worsens the risk of growing crops with uncertain returns. This can be due to fact that in a shared cropping arrangement, the crop grown is prerogative of the land owner.

Chowdhary and Mathew (2004) has found that alternatives in coconut-copra – coconut value chain rise from-

- Volatile nature of prices of copra and coconut oil in markets

- Absenceof market intelligence mechanism based on real time price quotes.
- Relatively poor understanding of risk management instruments and future trading by coconut farmers,copra makers and oil –mill owners.
- Imperfection caused in the system of quality determination and grading.
- Inadequate flow of institutional finance in the cocnut-copra-coconut value chain.
- Imperfection in working of copra future exchange by First Commodities Exchange of India (FCEI) in Cochin.

Torquebiau and Penot (2006) has stated that high reliance on manual labour, limited markets for specific products, delayed return on investment are the major constraints in large sized trees in homegardens.

Sebastian (2013) concluded that farmers felt more constraints on vertical diversification rather than horizontal diversification. The major constraint was lack of availability of low cost storage facilities.

In a study entitled "Constraints to smallholder tree planting in the northern mountainous regions of Vietnam: a need to extend technical knowledge and skills" by Do and Mulia (2018) revealed that constraints within the 'input domain' that relates to inputs to tree system establishment such as land availability, or 'output domain' associated with market of tree system products. The perceived solutions include the dissemination of knowledge on tree system management, farmer's skill capacity building, and improvement in the national extension system as well as its linkage with research and education, be placed in the forefront of policy to sustainably expand and intensify tree planting in the country.

Methodology

CHAPTER 3

METHODOLOGY

This chapter deals with the brief description of methods and procedures that were used for meeting the objectives set forth in this study. The methodology followed in the study is presented under the following sub-headings

3.1 Research design

3.2 Locale of the study

3.3 Selection of the respondents

3.4 Operationalisation and measurement of the variables

3.4.1 Distribution of the home garden respondents based on their personal, socio-cultural and techno-economic factors

3.5 Extent of horizontal and vertical diversification in specialised homegardens

3.6 Characterisation of homegardens in terms of technology needs (gaps) and techno- socio- economic dimensions.

3.7 Economics of specialized components in homegardens

3.8 Risk associated with specialisations in homegardens.

3.9 Constraints experienced by specialized homegarden farmers

3.10 Data collection procedure

3.11 Statistical tools

3.12. Hypothesis set for study

3.1. Research design

'Ex-post-facto' and 'explorative' research designs were used for conducting this study. Kerlinger (1964) defined ex post facto research as that research in which independent variable or variables have already occurred when

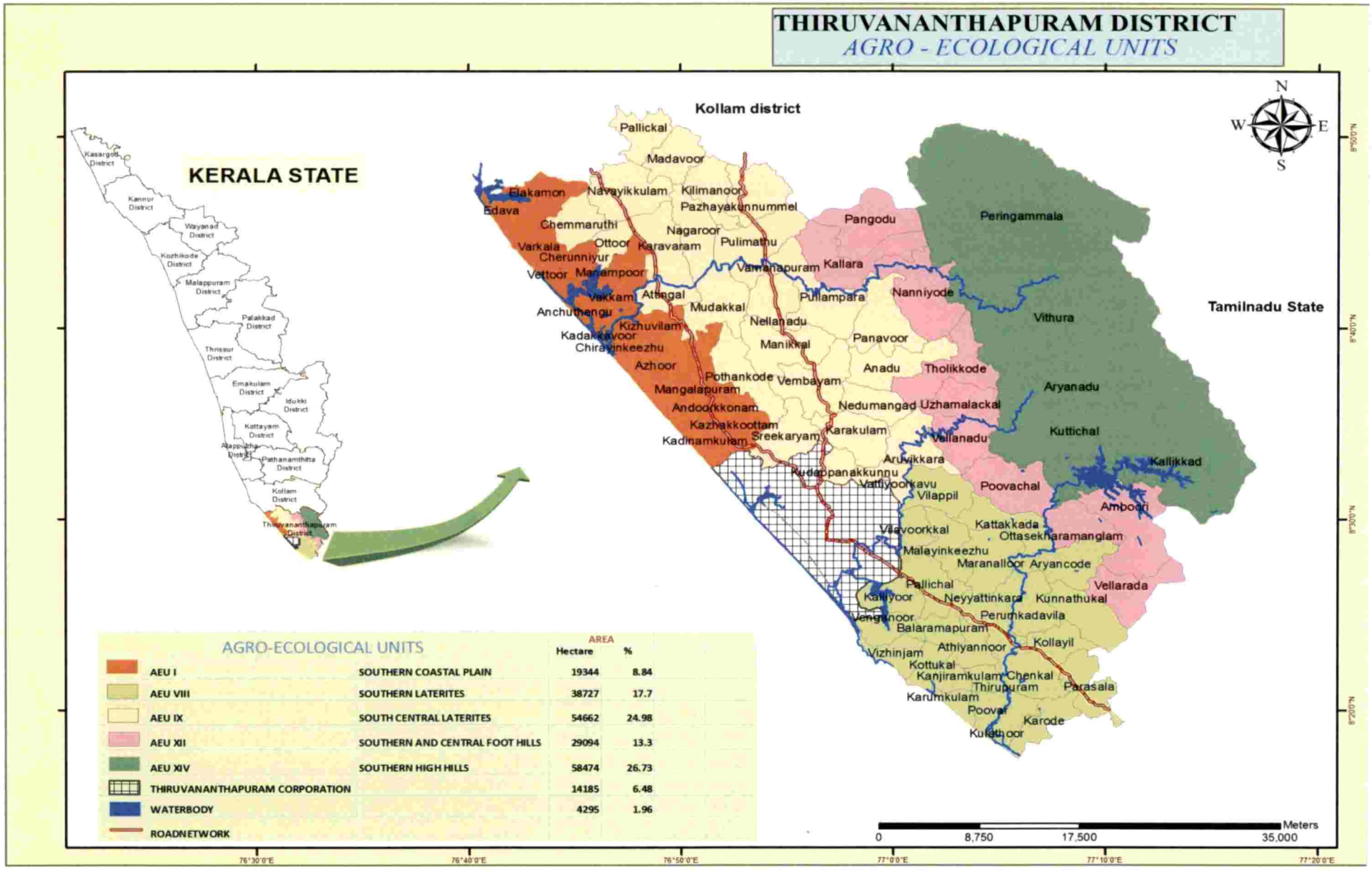


Fig 1: Location map of the study area

the researcher starts with the observation of a dependent variable or variables. The independent variables were studied in retrospect for their possible relations to, and effects on, the dependent variable or variables. This research design was resorted to in this study, as there was no scope for manipulation of any variables under study. Since the researcher had to inquest for crop resource and specialized components in the homegardens, explorative design too was used.

3.2. Locale of study

The study was conducted in the Thiruvanathapuram district comprising five agro ecological units where the specialized homegarden systems are in vogue. The agro ecological units were selected in consultation with Kerala Agricultural University and State Planning Board. It includes AEU-1, AEU-8, AEU-9, AEU-12 and AEU-14. A list of panchayats in each AEU's of study was prepared and panchayats with potentially active and operational homegarden units were identified. From each AEU, one panchayat each was selected randomly in consultation with Agricultural Officers. The panchayats include Kazhakkuttam, Pallichal, Nedumangad, Amburi and Aryanad. From each panchayat 12 specialised homegardens were selected using Simple Random Sampling, thus making a total of 60 specialised homegardens. The map showing the location of the study are given as Fig 1.

3.3 Selection of the respondents

The respondent groups of the study comprised Farmers and Extension Personnel. However, the respondent categories of Extension Personnel were confined to the study pertaining to characterization of dimensions in homegardens in terms of technology, social and economic dimensions.

a) Farmers:

Specialized homegardens identified under 'ICAR Niche Area Excellence project' were selected for the study. Sixty specialised homegardens with twelve homegardens each from each AEU were selected for data enumeration and the

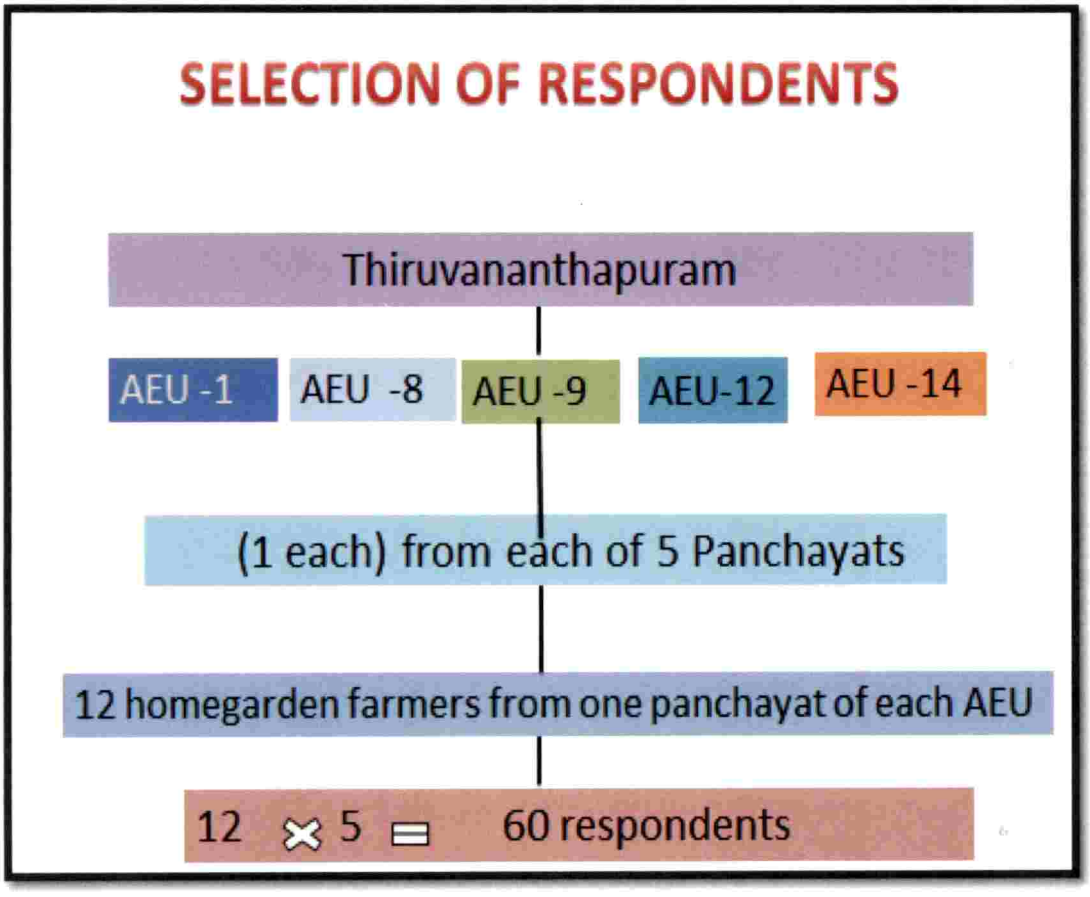


Fig 2. Sampling frame of the study area

farmers of those specialised homegardens from respective agro ecological units were selected as the respondents making a total of 60 farmer respondents.

b) Extension Personnel

Thirty Agricultural Officers were randomly selected as the respondents for the study. Preference was given to Agriculture Officers from the panchayats where the specialized homegardens were situated. This respondent category was only meant for the study pertaining to characterization of homegardens in terms of technological, social and economic dimensions.

3.4 Operationalisation and measurement of the variables

3.4.1 Distribution of the respondents based on their personal, socio-cultural and techno-economic factors

In order to assess the influence of the profile characteristics of the homegarden respondents for meeting the objectives of the study, the characteristics of the homegarden farmers were identified as detailed below

A list of 20 independent variables related to the personal characteristics of the home garden farmer respondents and important for meeting the objectives of the study were collected after detailed review of literature and discussion with subject matter specialists. The lists of variables were then sent to 30 judges comprising extension scientists and homegarden experts (Appendix-1).

The judges were asked to examine the variables critically and to rate the relevancy of each variable on a five-point continuum ranging from most relevant, more relevant, relevant, less relevant and least relevant with weightages of five, four, three, two and one, respectively. Out of 30 judges only 20 responded.

The final variables were selected based on the criterion of mean relevancy score, which was obtained by summing up the weightages obtained by variable and dividing it by the number of judges responded. The variables that attained a score more than the mean score were selected for the study.

Table 1: The selected ten independent variables with their measurement of study

Sl No	Independent variables	Measurement
1	Age	Actual chronological age and classification based on census report, 2011
2	Education	Categorised as illiterate, primary, middle, high school and collegiate
3	Family size	No. of family members dependent on the head of family at the time of interview
4	Occupation	Vocation of the farmer respondent at the time of interview
5	Annual income from homegarden	Actual income from farm and non farm.
6	Effective homegarden area	Actual homegarden area in cents
7	Attitude	Arbitrary scale developed for the study
8	Extension participation	Scale developed by Krishnan (2013)
9	Extension contact	Frequency of farmer contact with various extension personnels
10	Market orientation	Scale developed by Samantha (1977)

The variables with the mean relevancy scores are presented in Appendix II.

The personal characteristics of the homegarden respondents which constituted the independent variables thus selected for the study were age, education, family size, occupation, annual income from homegarden, effective homegarden area, attitude, extension participation, extension contact and market orientation.

The selected 10 independent variables of the study are the following:

1) Age

Age was operationalised as the number of years completed by the respondent at the time of study.

This was measured as the total number of years completed by the head of the homegarden owning family at the time of interview and was classified based on census report, 2011 classification method.

Age category	**Years**
Young	< 35 years
Middle aged	35- 55 years
Old aged	>55 years

2) Education

In this study education was operationalised as the extent of non-formal or formal learning possessed by the homegarden respondent. The scoring procedure used for the study is as follows and the distribution of respondents was expressed as frequency and percentage.

Category	**Code**
Illiterate	0
Primary	1
Middle	2
High School	3
Collegiate	4

3) Occupation

Occupation was operationalised as the main vocation and other additional vocations that the respondents were possessing at the time of interview. The scoring procedure developed for the study were as described below.

Category of occupation	**Score**
Agriculture alone	1
Agriculture +private business	2
Agriculture + Government	3

The maximum and minimum score that could be attained by the respondent was 'three' and 'one' respectively.

4) Family size

Family size refers to the number of members of either sex living in a household/family dependent on the head of the family. This was measured in numbers.

Category	Code
2-4	1
5-6	2

5) Annual income from homegarden

Annual income from homegarden refers to the total annual earnings from the farm and non-farm activities in the homegarden. This was measured in terms of rupees per year as expressed by the specialised homegarden farmers.

The total income will possess 3 components, namely, income from homegarden, specialised components and non-farm income.

6) Effective homegarden area :

Effective homegarden area was operationalised as the actual effective area of homegarden measured in cents.

The responses for area as expressed by specialised homegarden farmers were collected as given in the interview schedule (Appendix III) and the homegardens were categorised as given below:

Category	score
<25 cents	1
25-50 cents	2
50-100 cents	3
100-150 cents	4
>150 cents	5

7) Attitude

Attitude was operationally defined as the positive and negative response of farmer owning homegarden towards specialised and non- specialised components. This will be measured on a four point continuum for ten statements as 'strongly agree', 'agree', 'disagree' and 'strongly disagree 'with scores 4, 3, 2 and 1 respectively. Mean and Standard Deviation of the scores in each agro-ecological unit was taken as a check to determine the positive, not taking sides and negative attitude towards specialisations. Similarly, the Kendal's Rank Co-efficient was carried out to understand whether there was any significant difference in attitude towards specialisations in home gardens. The responses for attitude as perceived by specialised homegarden farmers were collected as given in interview schedule (Appendix-III) and later the responses were categorised into high, medium and low attitude of respondents based on the mean and standard deviation.

8) Extension participation

Extension participation was operationalised as the extent of farmer participation in various programmes organised by governmental and non-governmental initiatives. A list of agencies like KAU, Krishibhavan, Commodity Boards, friends and neighbours were given. The respondents were asked to mark their response according to the frequency of their participation and the scoring procedure is given below:

Sl. No	Extension personnel	Frequency of contact		
		Regularly (2)	Occasionally (1)	Never (0)
1	AO of agricultural department			
2	KAU Scientists			
3	Scientists of ICAR institutes			
4	Farm officers			
5	Peers and nears			

9) Extension Contact

Extension contact was operationalised as the frequency of farmer contact with various extension personnels or professionals operating in that area. A list of agencies like AO, KAU Scientists, Scientists of ICAR institutes, farm officers, peers and nears were given. The respondents were asked to mark their response according to the frequency of their extension contact.

The maximum and minimum score that could be attained by a respondent was '10' and '0' respectively.

10) Market orientation

Market orientation is defined as the degree to which a farmer is oriented towards scientific farm management comprising planning, production and marketing functions/activities of his farm enterprises. Market orientation is one of

the three sub-scales of the scale developed by Samantha (1977). It consists of five statements. The responses for market orientation as perceived by specialised homegarden respondents were collected as given in interview schedule (Appendix-3). Responses of specialised homegarden farmers were sought for six statements which was rated on a four point continuum *viz.* 'strongly agree', 'agree', 'disagree' and 'strongly disagree' with scores 4, 3, 2 and 1 respectively. The maximum and minimum score that could be attained were "24" and "6" respectively. The scores obtained by 60 respondents were computed based on "above mean" and "below mean" category.

3.5 Extent of horizontal and vertical diversification in specialised homegardens

Horizontal diversification refers to the addition of more crops to the existing cropping system. The other type of crop diversification is vertical crop diversification, in which various other downstream activities are undertaken. It could be illustrated by using any crop species, which could be refined to manufactured products, such as fruits, which are canned or manufactured into juices or syrups as the case may be. In this study, the horizontal and vertical diversification was measured as given below.

The horizontal diversification was computed based on the number of levels of crop/specialized component observed in each of the specialized homegardens with special reference to the numerical dominance and the results obtained were recorded in terms of average levels of inclusions in each of the specialized homegardens. The result of numeric dominance of crops in specalised homegardens as perceived by the respondents were rated on a 7 point continuum scale with rank 1 for the most dominant crop and 7 for the least dominant crop. Mean scale value depicted the extent of dominance of the crops. The scale ranges from 1 to 7 levels to determine the extent of horizontal diversification. Results were categorized as "more than mean" and "less than mean". A low mean score value indicates maximum dominance and a high mean score value indicates minimum dominance.

Likewise the vertical diversification was computed based on the number of levels of the entire specialized components subjected to the levels of value addition until it reaches the market. The results were expressed in terms of the mean score obtained for the different specialized components in the homegardens under study. Vertical diversification was computed based on the mean vertical diversification for each specialization. A score of one was assigned for each level of vertical diversification. Therefore, if a homegarden component fetched a score of one, it means there was only one level of vertical diversification. Then the mean level of vertical diversification was computed and the results were categorized as "more than mean" and "less than mean". The method of measurement of extent of horizontal and vertical diversification were included in the interview schedule (Appendix 3).

3.6 Characterization of homegardens in terms of technology needs (gaps) and techno- socio- economic dimensions.

a) Technological needs in specialized homegarden systems.

The technology needs assessment were worked out using score/rank used by Thomas, 2004.

Score/Rank Criteria

0- Technology not available (most needed)

1- Technology available but not applicable

2- Technology available but not sustainable

3- Technology available, applicable and sustainable

The technology needs of farmers vary according to the specialisations they incorporate, the managerial levels in which they operate, the deficits in the demand and supply of the specialised components they raise with reference to the specificities of the land they engages for raising. It was with these perspectives; grouping of technology needs of the farmers were done and classified into the

aforesaid broad categories. Technology was assessed for each specialization *viz.* dominant crops, animal husbandry components, aquaculture and other specialisations separately. Thus technology needs scores for dominant crops of all the 60 farmers of the Thiruvanathapuram district were tabulated and subjected to statistical analysis. The scores assigned being in ordinal scale, the non-parametric test of analysis of variance (chi-square test) was administered to assess the need disparities. For other specialisations, the technology need score was calculated based on the number of specialised homegarden farmers of the respective specialisations. The technology needs were further tabulated for analysis. Further mean technology need score was taken for each specialization. The parameter with minimum score was considered as most needed technology in specialised homegardens.

b) Characterization of specialized homegardens in terms of technological, social and economic dimensions.

Based on the review of literature and detailed discussion with experts, a list of dimensions that appeared to be related with specialised homegarden technologies were prepared. The list of attributes/dimensions was exposed to examination by the specialized homegarden respondents and Agricultural Officers. They were asked to examine the dimensions critically and also to include additional attributes/dimensions if found necessary. The judges were entreated to rate the relevancy of each dimension on a 3-point continuum ranging from most relevant to least relevant with the weightages of "1"' to "3" respectively. The response from all the specialised homegarden respondents and 30 agricultural officers were collected. The total score of each dimension and mean total was taken for farmers and agricultural officers. The dimensions falling above mean total were perceived to be important for the category of respondents and vice-versa. Ranking method was adopted to determine relevance of each dimension separately for respondents and agricultural officers. Dimensions perceived to be important based on the mean value were analysed estimating over class rank and venn diagram were plotted for each dimension indicating the dimensions perceived to be important by

both agricultural officers and respondents. Similarly, relevance of each dimension was analysed on agro-ecological unit wise based on mean average scores and ranking method was adopted to determine the relevancy of each dimension.

3.7 Economics of specialized homegardens

Cost-benefit analysis was worked out for each specialization considering the net income as perceived by specialised homegarden farmers. It was calculated by asking the respondents their returns and expenses for the specialisations included in their homegardens. The actual amount in rupees received by the homegarden respondent annually from those specialized components and other dominant components were arrived at and subjected to statistical analysis. Also, the extent of contribution of mean homegarden income to total annual income was also tabulated for each agro- ecological unit and expressed in percentage. The extent of contribution of specialised homegarden income to total homegarden income was also estimated for different specialisations.

3.8 Risks associated with specialisations in homegardens

Risk assessment of homegarden farmers who engaged with specialized components was assessed using the risk attitude scale developed by New England Small Farm Institute, Cornell University, Belchertown, Massachusetts with slight modifications.

The scale consist of 33 statements (Appendix-III) under 5 Dimensions namely production risks, marketing risks, financial risks, legal and environmental risks and human resource risks.

These items were administered to the respondents in a three point continuum namely high, moderate and low along with strategies to reduce risks. Quartile deviation was used to estimate the different type of risks.

Also, the entire risks were estimated for different specialisations from the perceived responses of farmers. Based on the number of specialisations, mean score was calculated for different types of risks to determine the maximum and

minimum risk for each specialization. A chi-square analysis was done to estimate any significant difference among the risks associated with specialisations.

3.9 Constraints experienced by specialized homegarden farmers

Based on discussion with farmers, experts in agriculture and also through relevant review of literature, some of the constraints faced by specialised homestead farmers were identified. A list containing fifteen such constraints was included in the final interview schedule.

Mean rank cumulative index for each constraint was worked out and the constraints were ranked. The maximum and minimum rank was '15' and '1' respectively. Minimum rank signifies the most important constraint as perceived by the respondents.

3.10 Data collection procedure

The data were collected using a well-structured interview schedule prepared for the purpose (Appendix III). A draft interview schedule was prepared which was pre-tested by conducting a pilot study in non sample area and suitable modifications were made in the final interview schedule which was then directly administered to the homegarden farmers by the investigator and responses recorded at the time of interview. Agricultural Officers were included as respondent categories in the study, only for the collection of data to rate the techno socio economic dimensions.

3.11 Statistical tools used in the study

The collected data were scored, tabulated and analysed using statistical methods as described below.

3.11.1 Mean

The respondents were grouped into categories with reference to the means of the independent variables. After grouping the respondents into categories, their percentages were worked out.

3.11.2 Percentage Analysis

After grouping the farmers into various categories based on the score attained simple percentage was worked out to find out percentage distribution of the farmers. It was also used to interpret the results of independent variables selected for the study.

3.11.3 Kendal's Rank Co-efficient

The Kendal's rank coefficient is used as a test statistic to establish whether two variables can be observed as statistically dependent.

3.11.4 Quartile Deviation

The procedure used for risk assessment homegardens on the basis of their responses. The first quartile (Q_1) is defined as the middle number between the smallest number and the median of the data set. The second quartile (Q_2) is the median of the data. The third quartile (Q_3) is the middle value between the median and the highest value of the data set.

3.11.5 Standard deviation

The standard deviation is a measure that is used to quantify the amount of variation or dispersion of a set of data values. A low standard deviation indicates that the data points tend to be close to the mean (also called the expected value) of the set, while a high standard deviation indicates that the data points are spread out over a wider range of values.

3.12 Hypothesis set up for study

A research hypothesis is the statement created by researcher when they speculate upon the outcome of the experiment. It must be testable and realistic. A hypothesis must be verifiable to allow a verification or falsification. In this study the hypothesis set and established were

1) There exist no significant technology needs for specialisations in homegardens.
2) There exists no risk for specialisations incorporated in homegardens.
3) There exists no commonality in the dimensions of specialised homegardens as perceived by homegarden farmers and Agricultural Officers.
4) There exists no significant relationship between independent variables with respect to technology needs and risk assessment.

Results & Discussion

CHAPTER 4

RESULTS AND DISCUSSION

This chapter deals with the results and discussion based on the analysis of data obtained from the study and the findings are presented in this chapter under the following heads.

4.1 Distribution of the respondents based on their personal, socio-cultural and techno-economic factors

4.2 Horizontal and vertical diversification in specialized homegardens.

4.3 Characterization of specialised homegardens in terms of technology needs (gaps) and techno- socio- economic dimensions

4.4 Risks associated with specialized components in homegardens

4.5 Perceived cost-benefit analysis of specialized components in homegardens drawn from the responses of farmers.

4.6 Influence of personal and social characteristics of respondents based on technology needs and risks

4.7 Constraints and solutions experienced by specialised homegarden farmers

4.8 Hypothesis set up for the study

4.1 Distribution of the respondents based on their personal, socio-cultural and techno-economic factors

4.1.1 Age

Age refers to the actual chronological years completed by the respondents at the time of interview and the distribution of respondents based on age for all Agro Ecological Units (AEUs) in Thiruvanathapuram district is presented in Table 2.

Table 2. Distribution of respondents based on their age

Category	AEU-1 n=12		AEU-8 n=12		AEU -9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
<35	1	8.33	0	0	0	0	2	16.67	1	8.33	4	6.67
35-55	11	91.67	8	66.67	10	83.33	9	75	11	91.67	49	81.67
>55	0	0	4	33.33	2	16.67	1	8.33	0	0	7	11.66
Total	12	100	12	100	12	100	12	100	12	100	60	100
Data score range: 28-76											Mean age : 51	

The AEU wise total distribution of respondents based on age as illustrated in Table 2 showed that vast majority of specialised homegarden farmers belonged to middle age category (81.67 %) followed by old age (11.66 %) and young age (6.67 %) irrespective of the AEU in which they belong. However maximum specialised homegarden farmers who were in middle age category belonged to AEU-1 and AEU-14 with 91.67 per cent respondents in each AEU's respectively. This was followed by respondents belonging to AEU-9 (83.33 %), AEU-12 (75 %) and AEU-8 (66.67 %).

Also it was interesting to note that except for AEU-8 (33.33 %), all the specialised homegarden farmers belonging to other AEUs were having less than 20 per cent under old age category. The table also revealed that maximum specialised homegarden farmers belonging to young age category amounted only to 16.67 per cent from AEU -12. AEU-1 and AEU-14 had 8.33 per cent falling under young age category. The mean age (51) is a clear indication that though majority of the specialised homegarden farmers belonged to middle age category, there is a tendency of the distribution to skew towards old age category.

Hence it can be inferred that majority of the farmers belonged to middle age category (81.67 %) followed by old age (11.66 %) and young age (6.67%) respectively. This could be due to the fact that farming may not be perceived as that enduring by the youngsters unlike other sectors. It indicates that when it comes to specialisations the farmers are in their middle ages unlike traditional farmers who are majorly belonging to

Fig 3. Distribution of respondents based on their age

old age category. The study was in conformity to the findings of Krishnan (2013) and Singha (1996) .

4.1.2 Education

Education refers to the formal or non formal learning possessed by the respondents at the time of study. The distribution of respondents based on education for all AEUs in Thiruvanathapuram district is shown in Table-3.

Table 3. Distribution of respondents based on their education

Category	AEU-1 n=12		AEU-8 n=12		AEU-9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
Illiterate	0	0	0	0	0	0	0	0	0	0	0	0
Primary	1	8.33	1	8.33	0	0	0	0	1	8.33	3	5
Middle	2	16.67	1	8.34	1	8.33	3	25	2	16.67	9	15
High school	4	33.33	4	33.33	7	58.34	6	50	5	41.67	26	43.33
Collegiate	5	41.67	6	50	4	33.33	3	25	4	33.33	22	36.67
Total	12	100	12	100	12	100	12	100	12	100	60	100

A perusal of results presented in Table-3 revealed that majority of the respondents 43.33 per cent possessed high school level education followed by 36.67 per cent with collegiate level education, fifteen per cent belonged to middle level education and 5 per cent were having primary education.

A detailed analysis of agro ecological unit wise distribution shows the same trend in all AEUs and was not different from overall distribution. However maximum specialised homegarden farmers (58.34%) from AEU -9 were having high school level education followed by AEU-14 (41.67%) and 33.33 per cent were from AEU-1 and AEU-8 respectively. However 41.67 per cent of the respondents from AEU-1 had college level education. Similarly, 16.67 per cent from AEU-1 and AEU-14 were having middle level education. It was interesting to note that none of the respondents were illiterate.

Hence it can be inferred that majority of the respondents belonged to high school (43.33%) and collegiate category (36.67 %). The high level of education possessed by

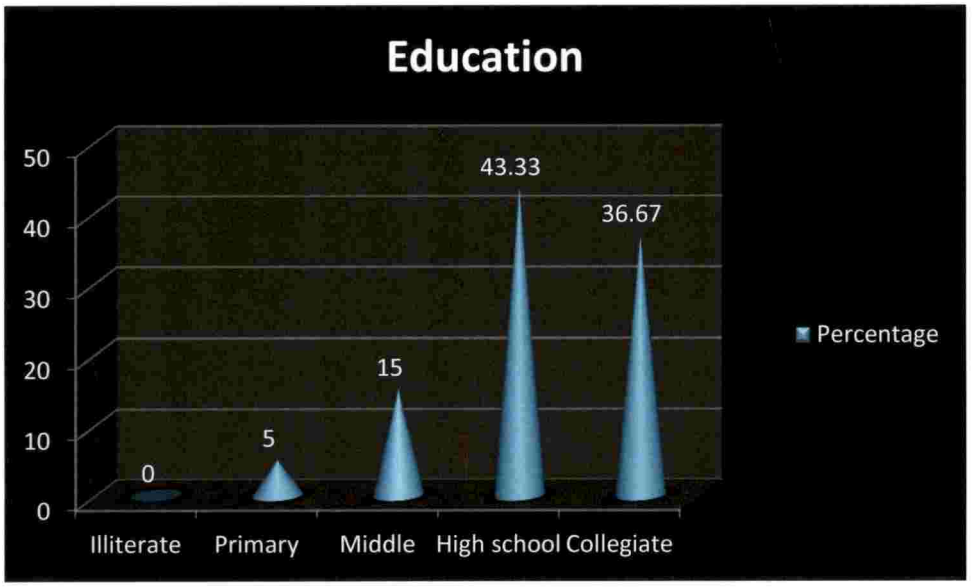


Fig 4. Distribution of respondents based on their education

the respondents is attributed to the high literacy and well established educational system prevailing in the state. Educated farmers tend to assimilate ideas in a better way and incorporate specialisations seeking profitability. The result is in accordance with the study conducted by Sebastian (2015) and Krishnan (2013).

4.1.3 Family size

The distribution of respondents based on family size for all AEUs in the study area is illustrated in Table-4.

Table 4. Distribution of respondents based on their family size

Category	AEU-1 n=12		AEU-8 n=12		AEU-9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
2--4	7	58.33	8	66.67	9	75	10	83.33	8	66.67	42	70
5--6	5	41.67	4	33.33	3	25	2	16.67	4	33.33	18	30
Total	12	100	12	100	12	100	12	100	12	100	60	100
Data score range: 2-6									Mean family size : 4			

It was evident from the Table-4 that vast majority of the respondents (70 %) were having family size 2-4 followed by 30 per cent were having family size 5-6.

A detailed analysis of agro ecological unit wise distribution shows same trend in all AEUs and was not different from overall distribution. Maximum specialised homegarden farmers of family size 2- 4 were belonging to AEU-12 (83.33 %) followed by 66.67 per cent were from AEU-8 and AEU-14 respectively. 58.33 per cent of AEU-1 were having family size of 2-4. However it was interesting to note that 41.67 per cent of AEU-1 were having family size 5-6 followed by 33.33 per cent from AEU-8 and AEU-14 respectively.

Hence it can be inferred that majority of the respondents (70 %) were having family size 2-4. This may be primarily due to the nuclear pattern of family edifice. Also, the fragmented land units seen in Kerala is a typical symptom of shrinking land availability for agriculture and increase in number of homegardens with nucleotide family structure. The results were in conformity with findings of Verma and Rao (1969) and Sebastian (2015).

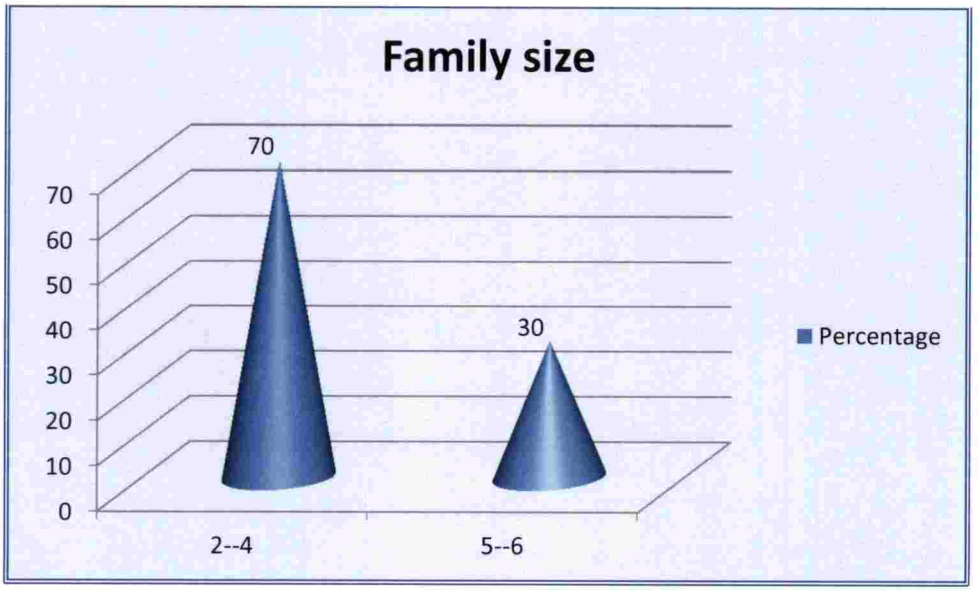


Fig 5. Distribution of respondents based on their family size

4.1.4 Occupation

The distribution of respondents based on occupation for all AEUs in the study area is shown in table 5.

Table 5. Distribution of respondents based on their occupation

Category	AEU-1 n=12		AEU-8 n=12		AEU-9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
Agriculture	9	75	4	33.33	8	66.67	11	91.67	9	75	41	68.33
Agriculture + private	1	8.33	6	50	1	8.33	1	8.33	3	25	12	20
Agriculture + Government	2	16.67	2	16.67	3	25	0	0	0	0	7	11.67
Total	12	100	12	100	12	100	12	100	12	100	60	100

The total distribution of respondents based on occupation as illustrated in Table 5 showed that that majority of the respondents 68.33% belonged to the agricultural sector followed by 20 per cent and 11.67 per cent in private and government sector along with agriculture respectively.

A detailed analysis revealed that all AEUs follow the same trend except the AEU -8 where 50 per cent of respondents own a private business in addition to agriculture. Maximum percentage of respondents (91.67 %) belonged to agriculture sector from AEU-12. This was followed by 75 per cent were from AEU-1 and AEU-14 respectively. However 25 per cent of the respondents from AEU-9 were in government sector in addition to agriculture.

Hence it can be concluded that agriculture still remains the primary occupation though it slightly varies from different agro ecological unit. This was mainly because majority of the people relied on agriculture and homegardening as their choice. Inspite of the other vocation, agriculture still remains as the primary occupation to a large sector of people. Also, the fragmented land holdings that are very marginal or small may not make agriculture remunerative solely and hence farmers might be resorting to secondary occupation aiming at economic welfare.

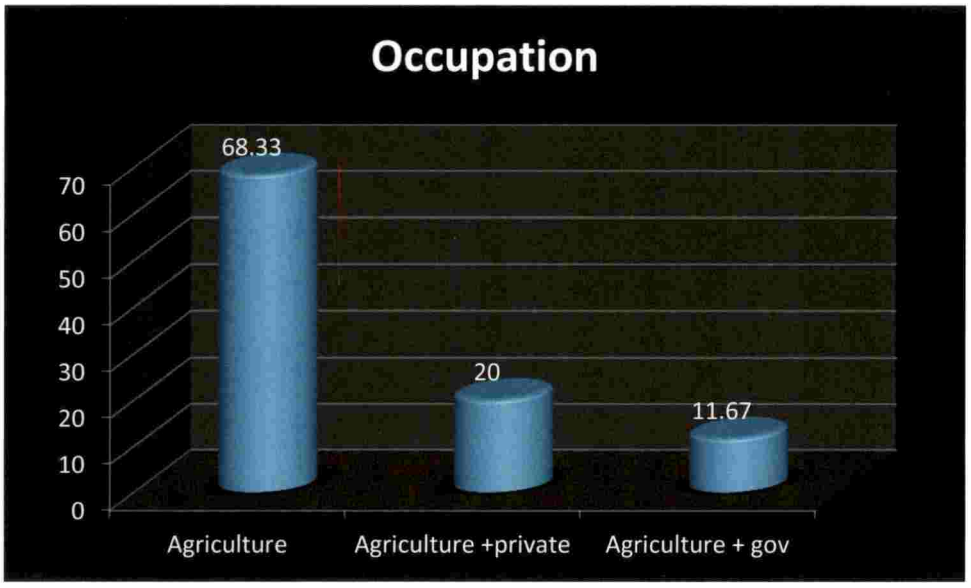


Fig 6. Distribution of respondents based on their occupation

The results are in line with Kamalakkanan (2001), Sebastian (2015) and contrary to the findings of Thomas (2004).

4.1.5 Annual homegarden income

The distribution of respondents based on annual homegarden income for all AEUs in the study area is presented in table 6.

Table 6. Distribution of respondents based on their annual homegarden income

Category	AEU-1 n=12		AEU-8 n=12		AEU-9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
Low	9	75	8	66.67	10	83.33	5	41.67	4	33.33	36	60
High	3	25	4	33.33	2	16.67	7	58.33	8	66.67	24	40
Mean	238300		233100		124500		215600		156500		193600	

A perusal of Table 6 revealed that homegarden farmers from AEU-9 followed by AEU-14 attain an annual income less than the total mean value. If the total mean value (Rs 193600) is considered as check, two out of five agro-ecological units namely AEU-9 with a mean annual income of Rs. 1,24,500/- and AEU-14 with a mean value of Rs. 1,56,500/- belonged to low income category. All the other AEU's in the study area belonged to high income category wherein the mean annual income was highest for homegarden farmers from AEU-1 (Rs 2,38,300/-) followed by AEU-8 (Rs 2,33,100/-) and AEU-12 (Rs 2,15,600/-).

As per the records of National Sample Survey Office (NSSO 70 th round, 2012-13), average farmer in India earns Rs 6426 per month excluding non- agricultural activities. Simulating the same to annual figure the mean annual income from agriculture amounts to Rs 77,112. If NSSO figures are considered as standard, then it can be clearly stated that all respondents attain an annual income more than the national average. However document of ICAR (2018) compares the average monthly agricultural income of farmers of Kerala with that of India in total and if states that Kerala farmers draw a monthly average agricultural income higher than that of national average. ICAR (2018) document revealed that the monthly net income of an agricultural household in Kerala was Rs.11,888 that amounts to an average annual net income of Rs 1,42,656.

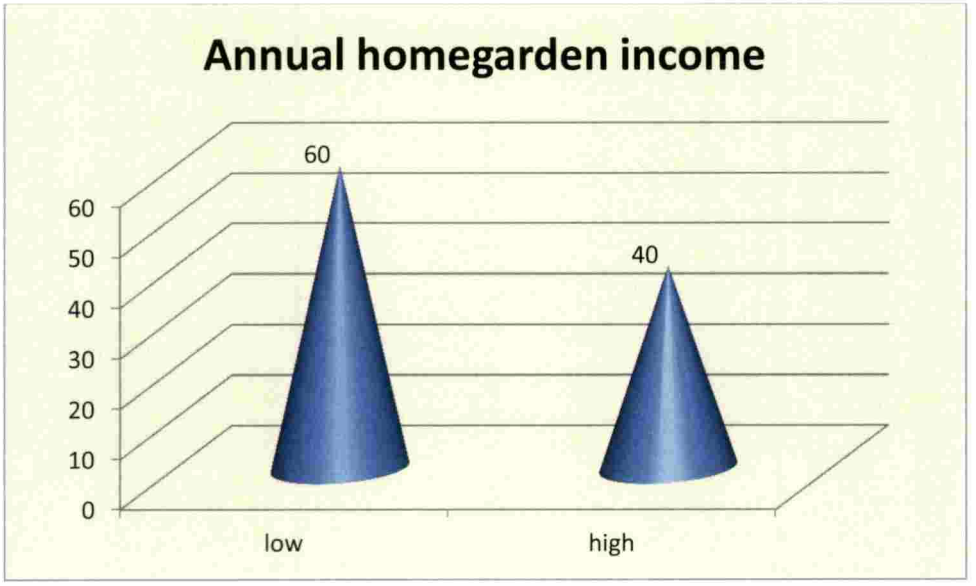


Fig 7. Distribution of respondents based on their annual homegarden income

Considering this value as the check, the Table-6 revealed that except AEU-9 (with mean annual homegarden income of Rs 1,24,500/-) all other specialised homegarden farmers of different AEU's earned an income more than the State Average.

The result could be due to the inclusions of specialised components in homegardens. It was natural that homegarden farmers go for specialisations to derive more profit. The result was in agreement to the observation of ICAR (2018) and Krishnan (2013). However, it was disheartening to note that annual mean income of specialised homegarden farmers of AEU-9 is lower than that of State average. This was quite possible and could be attributed to the fact that different AEU's follow different types of specialisations in their homegardens.

4.1.6 Effective homegarden area

The distribution of respondents based on effective homegarden area for all AEUs in the study area is presented in table 7.

Table 7. Distribution of respondents based on their effective homegarden area

Category	AEU-1 n=12		AEU-8 n=12		AEU-9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
<25	2	16.67	1	8.33	1	8.33	1	8.33	0	0	5	8.33
25-50	3	25	4	33.33	4	33.33	7	58.33	5	41.67	23	38.33
50-100	5	41.67	3	25	2	16.67	1	8.34	5	41.67	16	26.67
100-150	0	0	2	16.67	2	16.67	0	0	2	16.67	6	10
>150	2	16.66	2	16.67	3	25	3	25	0	0	10	16.67
Total	12	100	12	100	12	100	12	100	12	100	60	100
Data score range: 18-700 (cents)												

The AEU wise total distribution of respondents based on effective homegarden area as illustrated in table 7 showed that that majority of the respondents (38.33 per cent) holds an effective homegarden area of 25-50 cents followed by 26.67 per cent who holds an area of 50-100 cents and 16.67 per cent with more than 150 cents. Only 10 per cent of respondents possess an homegarden area of 100-150 cents and 8.33 per cent possess an effective area of less than 25 cents.

An agro ecological wise distribution also shows similar trend except in AEU-1 and AEU-14 where 41.67 per cent of respondents hold 50 -100 cents. Only 25 per cent

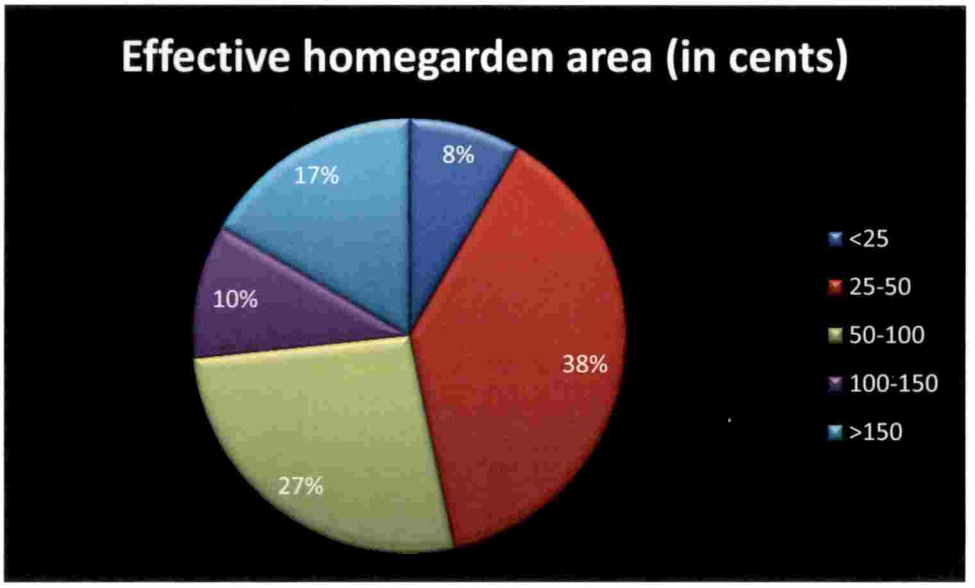


Fig 8. Distribution of respondents based on their effective homegarden area

of respondents from AEU-9 and AEU-12 were having effective homegarden area of 150 cents. Similarly 16.67 per cent of respondents from AEU-8, AEU-9 and AEU-14 were having an effective homegarden area of 100 cents. Only 16.67 per cent from AEU-1 were having less than 25 cents.

Hence it can be concluded that majority of the respondents holds an effective homegarden area of 25-50 cents. This concern of depleting land area under agriculture emphasis the importance towards the policies and schemes supporting inclusion of more specialisations and horizontal and vertical diversification at the homestead level for overcoming the constraints of land availability. The result is in conformity with Esakkimuthu (2012), Sujitha (2015) and Thomas and Ravikishore (2016).

4.1.7. Extension Contact :

The distribution of respondents based on extension contact for all AEUs in the study area is presented in Table-8.

Table 8. Distribution of respondents based on their extension contact

Category	AEU-1 n=12		AEU-8 n=12		AEU -9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
Low (6.96-2.64)	5	41.67	2	16.67	1	8.33	1	8.33	0	0	9	15
Medium (6.96+/-2.64)	6	50	10	83.33	10	83.33	0	0	10	83.33	36	60
High (6.96+2.64)	1	8.33	0	0	1	8.34	11	91.67	2	16.67	15	25
Total	12	100	12	100	12	100	12	100	12	100	60	100
Mean=6.96, SD=2.64												
Expected score range : 0-10									Data score range: 18-700 (cents)			

It was evident that majority of specialised homegarden farmers *i.e* 60 per cent have medium extension contact. This was followed by 25 per cent of respondents with high extension contact and 15 per cent with low extension contact.

The same trend follows in all AEUs with no disparity. However, it was interesting to note that 91.67 per cent from AEU-12 were having high extension contact

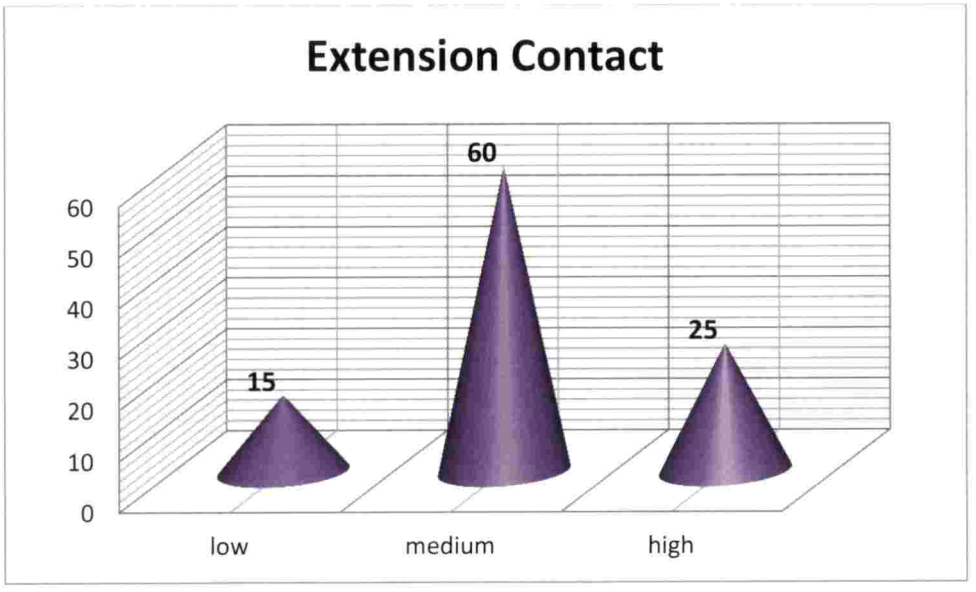


Fig 9. Distribution of respondents based on their extension contact

and 41.67 per cent of AEU-1 were having low extension contact. Among the different AEU's of study it was important to note that AEU-1 had more respondents (41.67%) belonging to the category of low extension contact.

Hence it can be inferred that majority of the respondents (60 %) belonged to the category of medium extension contact. The extension contact between farmers and extension agents being medium to high as mentioned in Table-8 could be due to the issues of availing timely inputs and services from the extension system available for them. Also, because of including specialisations, the farmers might have shown interest to meet the extension agents for support and help.

4.1.8. Extension participation :

The distribution of respondents based on extension participation for all AEUs in the study area is presented in Table 9.

Table 9. Distribution of respondents based on their extension participation

Category	AEU-1 n=12		AEU-8 n=12		AEU -9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
Regular	3	25	0	0	5	41.6	3	25	0	0	11	18.33
Occasional	9	75	10	83.3	7	58.3	9	75	10	83.3	45	75
Never	0	0	2	16.6	0	0	0	0	2	16.6	4	6.67
Total	12	100	10	83.3	12	100	12	100	10	100	56	100
Mean	4.5		5.08		6.33		7.25		5.41		21.9	
Sd	1.97		3.28		0.65		0.45		2.19		20	
Expected score range : 0-10									Data score range :1-10			

A bird's eye view of the data presented in Table 9 revealed that 75 per cent of respondents were occasionally involved in extension activities followed by 18.33 per cent who regularly involved and 6.67 per cent who never involved in any extension activity when mean (21.9) was taken as check.

The AEU –wise distribution showed the similar trend irrespective of different agro-ecological units. Similarly, 41.67 per cent from AEU-9 were regularly involved in extension activities. However, 16.6 per cent of respondents from AEU-8 and AEU-14 were never involved in extension activity. At the same time, 83.3 per cent of the

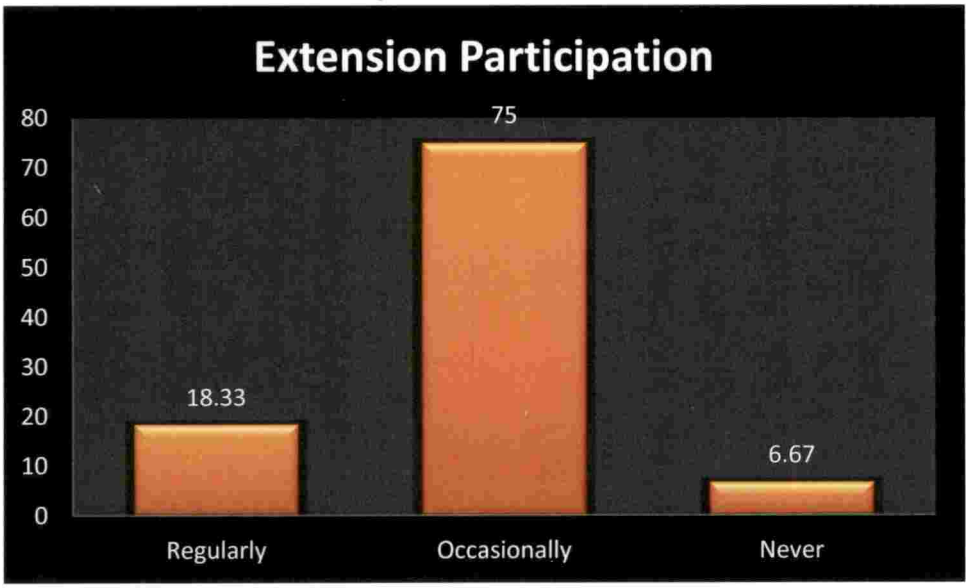


Fig 10. Distribution of respondents based on their extension participation

respondents from AEU-8 and AEU-14 were having occasional extension participation. The prevailing extension system in AEU-8 and AEU-14 should be relooked as the majority of the respondents were having low to medium extension participation.

Hence it can be inferred that high per cent (75 %) of occasional involvement in extension activities could be due to fact that a large number of extension activities from kudumbashree, SHGs and other NGO is taking place. Time is a pre requisite for managing specialised homegardens. But lack of time factor, that is requirement for full attention in specialised homegardens makes difficult for farmers to involve regularly in extension activities. The findings are in accordance Sujitha (2015).

4.1.9 Market Orientation :

The distribution of respondents based on market orientation for all AEUs in the study area was presented in Table 10.

Table 10. Distribution of respondents based on their market orientation

Category	AEU-1 n=12		AEU-8 n=12		AEU-9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No.	%	No.	%	No.	%	No.	%	No.	%	No	%
Below mean	5	41.67	5	41.67	5	41.67	6	50	6	50	26	43.33
Above mean	7	58.88	7	58.33	7	58.33	6	50	6	50	34	56.67
Total	12	100	12	100	12	100	12	100	12	100	60	100
Mean	21.25		19.58		17.91		16.5		16.5		18.35	
Expected score range : 6-24									Data score range: 11-24			

Table 10 revealed that more than 50 per cent (56.67 %) of the total specialised homegarden farmers had high market orientation considering the mean score value (18.35) as check.

Considering the AEU wise distribution it was clear that specialised homegarden farmers of AEU-1 and AEU-8 had high market orientation with a mean market orientation score value of 21.25 and 19.58 respectively. However specialised homegarden farmers of AEU-9 (17.91), AEU-12 (16.5) and AEU-14 (16.5) had low market orientation considering the total mean value as check. Market orientation score is

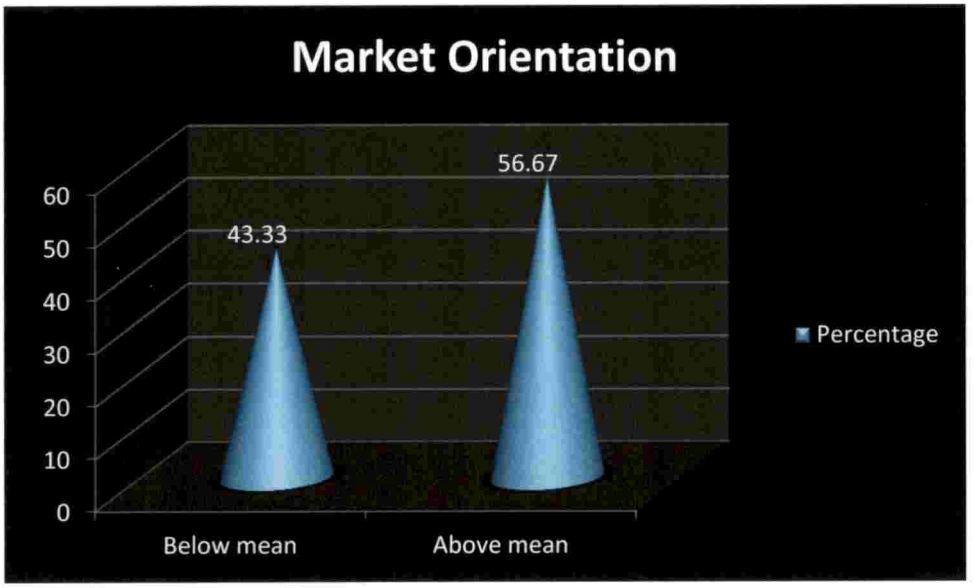


Fig 11. Distribution of respondents based on their market orientation

always an indication of the economic interest the farmers possess so as to derive profit from farming. It also points out to the progressive nature of the specialised homegarden farmers. The difference in market orientation scores among farmers of different AEU's is a reflection of the type and nature of specialisations included by the specialised homegarden farmers. The low market orientation scores in AEU's 9, 12 and 15 respectively highlights the need for more of market led extension activities by giving importance to post harvest technologies like processing, grading, transportation techniques, product standardization, price information and market access for overcoming the issues of distress sale soon after harvest. The study confirms to the findings of Maratha (2015).

4.1.10 Attitude

The distribution of respondents based on attitude for all AEUs in the study area is presented in Table-11.

Table 11. Distribution of respondents based on their attitude

Category	AEU-1		AEU-8		AEU-9		AEU-12		AEU-14		TOTAL	
	No	%	No	%	No	%	No	%	No	%	No	%
Positive	5	41.67	6	50	6	50	4	50	6	50	29	48.33
Not taking sides	5	41.67	4	41.67	5	33.33	6	41.67	6	50	24	40.00
Negative	2	16.67	2	16.67	1	8.33	2	16.67	0	0	7	11.67
Total	12	100	12	100	12	100	12	100	12	100	60	100
Mean	30.5		30.41		29.16		31.75		31		35	
SD	3.23		3.02		4.71		3.45		3.4		3.21	
Expected score range : 6-40									Data score range: 23-36			

A perusal of results presented in Table-11 revealed that 48.33 per cent have positive attitude, 40 per cent were not taking sides and 11.67 per cent have negative attitude when mean was taken as check.

The AEU wise distribution showed that the result was same with respect to all agro-ecological units. 50 per cent of respondents in all AEUs except AEU-1 show positive attitude towards specialisations while 16.67 per cent of AEU-1, AEU-8 and AEU-12 respectively shows less attitude towards specialisations when mean was taken as check.

Therefore it can be concluded that 48.33 per cent of respondents shows positive attitude. Attitude plays a pivotal role in the inclusions of specialisations in homegardens. The foot note taken from the result is that only minority have less attitude towards specialisations in homegardens. This shows that specialisations would become a common phenomenon of the homegardens in future. The result was in line with Kumari (2014). Kendall's rank correlation coefficient was worked out to understand whether there was any difference of attitude among specialised homegarden farmers of different AEU's. The distribution of respondents based on attitude in different AEUs in the study area is presented in Table-12.

Table 12. Distribution of respondents based on attitude in different agro-ecological Units

Correlations							
			AEU1	**AEU8**	**AEU9**	**AEU12**	**AEU14**
Kendall's coefficient	**AEU1**	Correlation Coefficient	1.000	.714**	.634*	.691**	.942**
	AEU8	Correlation Coefficient	.714**	1.000	.691**	.482	.782**
	AEU9	Correlation Coefficient	.634*	.691**	1.000	.395	.706**
	AEU12	Correlation Coefficient	.691**	.482	.395	1.000	.596*
	AEU14	Correlation Coefficient	.942**	.782**	.706**	.596*	1.000
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

It was evident from Table 12 that there exists significant relationship between attitude of different agro-ecological units. This was mainly because attitude towards specialisations may be different and will vary between different agro-ecological units. Type and extent of utilization of different specialisations may also vary. Hence it was

natural that respondents of different AEU's possess significant difference in attitude towards specialisations.

4.2 Horizontal and vertical diversification in specialised homegarden

4.2.1 Dominance profile of homegardens

The numeric dominance for the crops in specialised homegardens was worked out on a seven point scale where a rank of one was assigned to the most dominant crop and a rank of 7 was assigned to the least dominant. Only the first seven dominant crop components was considered for numerical dominance in each specialised homegarden. The results of the numerical dominance arrived in the study area was shown in Table-13.

Table 13. Distribution of dominant crops based on numeric dominance

Crops	Mean scale value	Rank
Coconut	1.89	1
Banana	1.94	2
Rubber	2.32	3
Tapioca	3.45	4
Vegetables	3.67	5
Yams and Colocassia	4.22	6
Arecanut	4.60	7

The Table 13 revealed that the maximum numeric dominance was observed for coconut (1.89) followed by banana (1.94), rubber (2.32), tapioca (3.45), vegetables (3.67), yams and colocassia (4.22) and arecanut (4.60) respectively in order of their mean scale values. Almost 20 crops were identified as dominant ones when rated in a 7 – point scale for numeric dominance of which only top 7 have been selected.

The results are in line with Meerabhai *et al.* (1991), Thomas (2004) and Jacob (2015). According to them, mostly coconut based farming is being followed in the state especially coastal and mid – land Kerala, where other dominant crops were more included as intercrops, thus reiterating the existing of horizontal diversification in specialised homegardens.

4.2.2 Type and extent of horizontal diversification in specialised homegardens

Horizontal diversification refers to the measure of cropping intensity and structure of homegardens. It was computed based on the number of levels of crop/specialised component observed in each of the specialised homegarden with special reference to numeric dominance.

In this study when the levels were worked out the horizontal diversification ranged from 1-7 levels. However the mean horizontal diversification value was 4.21. Hence results were categorized and distribution of specialised homegardens based on the extent of horizontal diversification under all AEUs in the study area is presented in Table 14.

Table 14. Distribution of homegardens based on the extent of horizontal diversification

Category	AEU-1 n=12		AEU-8 n=12		AEU -9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
High(>4.21)	9	75	6	50	8	66.67	5	41.67	8	66.67	36	60
Low(<4.21)	3	25	6	50	4	33.33	7	58.33	4	33.33	24	40
Mean – 4.21												

The data furnished in the table 14 revealed that majority of specialised homegardens (60%) do have more than 4 tiers of horizontal diversification whereas 40 percent have less than 4 tiers of diversification.

The overall analysis revealed that in all homegardens except AEU-12 (58.33 %) have more than 4 tiers of diversification. Also, 75 per cent of respondents in AEU-1 have more than 4 tiers of horizontal diversification and 58.33 per cent of AEU-12 were having less than 4 tiers of diversification. Hence it can be inferred that general majority of selected specialised homegardens in Thiruvanathapuram district have more than 4 tiers of horizontal diversification.

This can be attributed to the fact that all the respondents are interested in addition of more components to the existing crop production system. It can be due to the additional economic and social benefits. In Kerala homegardens have the unique nature

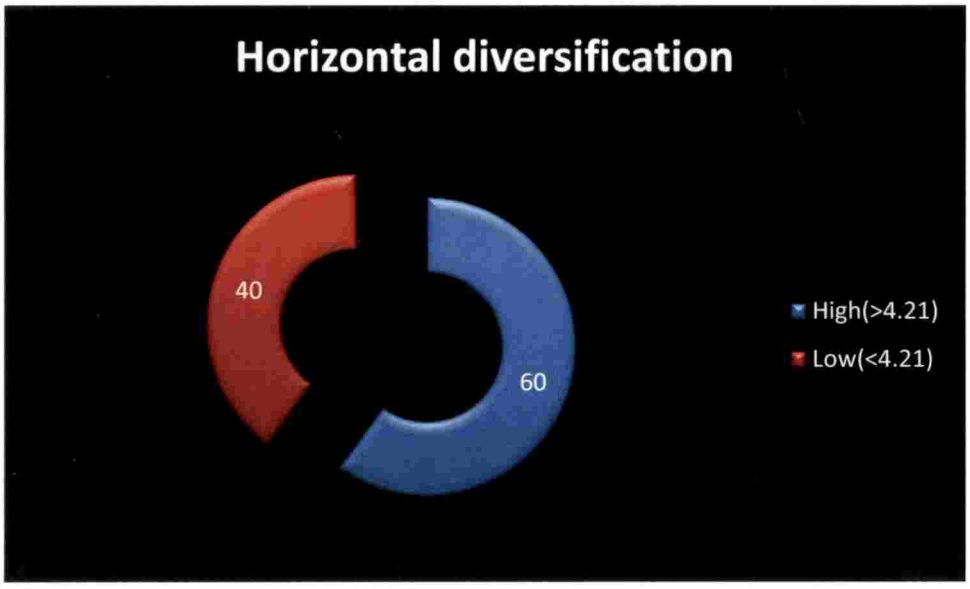


Fig 12. Distribution of respondents based on their extent of horizontal diversification

of growing multiple crops such as trees, shrubs, bushes and with the incorporation of farming components utilizing the available area in homegardens. Similarly the assured economic gain from the specialisations is another major factor resulting in increased number of specialisations. In some of the selected homegardens, horizontal diversification upto 6 levels were noticed. This was a clear indication that homegardens are transforming with more inclusions leading to horizontal diversification for making homegardens more remunerative. The result are in line with Krishnan (2013).

4.2.3. Extent of vertical diversification of specializations in homegardens .

Vertical diversification reflects more on the economic entities in homegarden as a result of product diversification or value addition. The more level of vertical diversification could be due to the fact that more inclusion of specialisations like rubber, livestock is present where generally value addition is more compared to agricultural crops. In this study when the levels were worked out the vertical diversification ranged from 1-6 levels. However the mean vertical diversification value was 3.41. Results were categorized as "more than mean" and "less than mean." The results describing levels of vertical diversification were illustrated in Table 15.

Table 15. Distribution of respondents based on the levels of vertical diversification

Category	AEU-1 n=12		AEU-8 n=12		AEU -9 n=12		AEU-12 n=12		AEU-14 n=12		Total N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
High (>3.41)	5	41.67	6	50	4	33.3	5	41.67	3	25	23	38.3
Low (<3.41)	7	58.33	6	50	8	66.6	7	58.33	9	75	37	61.6
											Mean -3.41	

The AEU wise total distribution of vertical diversification shows that 61.6 per cent have less than 3 levels and 38.3 per cent have more than 3 levels of vertical diversification.

The result was found almost same in all agro-ecological units. Highest vertical diversification of fifty percent was found in the specialised homegardens of AEU-8.

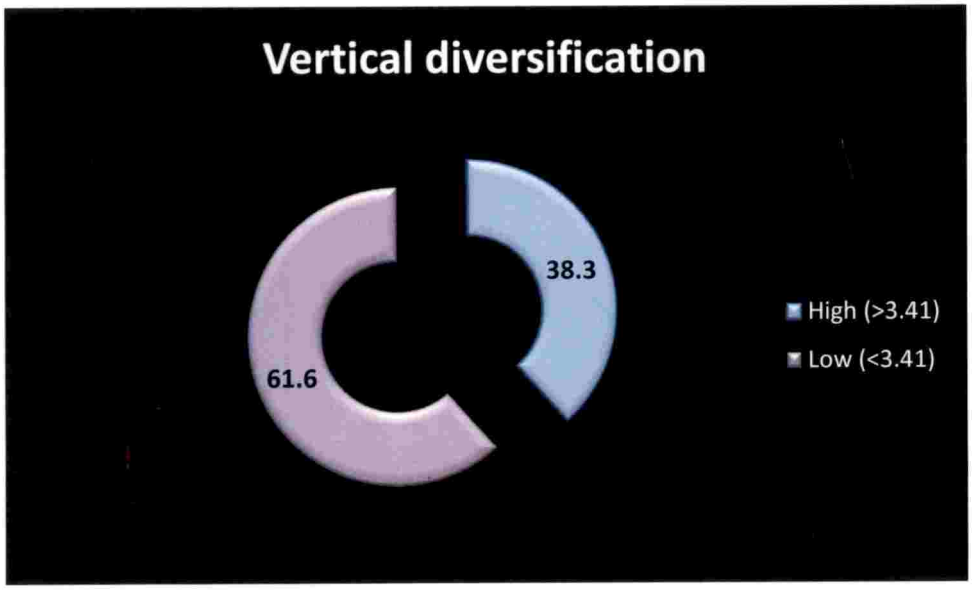


Fig 13. Distribution of respondents based on their extent of vertical diversification

However, 75 per cent in AEU-14 was having less than 3 levels of vertical diversification. At the same time, in AEU-8, 50 per cent of the respondents were having less than and more than 3 levels of vertical diversification. This may be due to the fact that in AEU-8 more specialisations like livestock, rubber etc. was present abundantly than other dominant crop components.

More than sixty per cent of vertical diversification (61.6 %) revealed the need of scaling up of extension by competent authorities to enhance vertical diversification in the homegardens inclusive of specialisations. Thus more avenues and centralized facilities should be made available to the specialised homegardens for better value addition and product diversification. Profit linked value addition should be promoted in the specialised homegardens to make the system more remunerative.

Vertical diversification was computed based on the mean vertical diversification for each specialization. Distribution of specialisations based on the extent of vertical diversification is depicted in Table 16 as follows:

Table 16. Distribution of specialisations based on the level of vertical diversification

Specialised component	**Levels**	**Mean vertical diversification**	**Total levels**
Vegetables (8)	Raw / seedlings	1.5	2
Poultry (4)	Unit/egg/manure	2.25	2
Livestock –cow (3)	Milk/Unit/manure/Milk products	3.75	4
Animal Husbandry (6)	Egg products/Unit/manure	3.25	3
Goat (1)	Unit/milk/manure	3	3
Aquaculture/Farm tourism (7)	Unit/dried/fingerlings/ Processed	2.85	3
Banana (6)	Fruits/chips	1.50	2
Coconut (4)	Nuts/copra/oil	2.75	3
Tubers (2)	Raw	1	1
Fruit trees (2)	Fruits/seedlings	2	2
Rubber (3)	Sheet/sap/saplings	2.75	3
Polyhouse	Raw/Seedlings	1.75	2

vegetables (4)			
Mushroom (1)	Raw/Processed/Spawn	3	3
Terrace garden (3)	Raw/seedlings	1.50	2
Orchids (1)	Seedlings/cut flowers	1	1
Ornamentals (4)	Unit/Seedlings/Flowers	2.25	2
Apiary (1)	Unit/ honey	2	2

The scale ranged from 1 to 3.75. It was evident from the Table 16 that mean vertical diversification was found to be highest for livestock- cow (3.75) and least was for tubers and orchids (1) each. However 3 levels of vertical diversification was noticed for rubber, animal husbandry, coconut, goat, mushroom and aquaculture.

This was due to the fact that incorporating more specialisations fetches additional economic benefits and reduces the risk factors. However considering specialised homegardening as a potential catchment sector, due framework and appropriate technology to enhance vertical diversification should be promoted thus making it remunerative and will hence attract more farmers especially youth to follow specialisations in homegardens.

4.3. Characterization of specialised homegardens in terms of technology needs (gaps) and techno- socio- economic dimensions.

Specialised homegardens were characterised based on technology needs and techno-socio-economic dimensions.

4.3.1 Technology needs (gaps) for production, protection and value addition aspects for dominant crop specialisations.

Technology needs will help us to identify the gaps with special reference to what are the technologies specialised homegarden farmers are using currently and what they ought to have being used now. For dominant crops, the technology needs were identified for production, protection and value- addition aspects and its results are presented in Table 17.

Table 17. Technology needs for dominant crop specialisations in terms of production, protection and value-addition aspects.

	AEU 1	AEU 8	AEU 9	AEU 12	AEU 14	Total N=60
Dominant crops- Production						
Technology not available (0)	1	0	0	0	0	1
Technology available but not applicable (1)	0	1	0	0	0	1
Technology available but not sustainable(2)	3	5	5	1	5	19
Technology available,applicable and sustainable(3)	8	6	7	11	7	39
Expected score range : 0-180				Data score range : 0-117		
Protection						
Technology available but not applicable(1)	4	3	7	4	5	23
Technology available,applicable and sustainable (3)	8	9	5	8	7	37
Expected score range :0-180				Data score range: 0-134		
Value addition						
Technology not available (0)	2	3	4	2	4	15
Technology available but not applicable (1)	1	1	2	1	1	6
Technology available but not sustainable (2)	1	1	1	1	3	7
Technology available, applicable and sustainable (3)	8	7	5	8	4	32
Expected score range : 0-180				Data score range: 0-116		

It was evident from Table 17 that majority (39) of the respondents were falling under the category "technology available, applicable and sustainable" for production related aspects irrespective of AEU. The data subjected to chi square test revealed that ($\chi 2$=0.284) homegarden respondents were having adequate availability of technology towards the production aspects in dominant crops. The results were in consensus with Jacob (2015) who stated that homegarden farmers perceived KAU technologies to be very effective by 42 per cent of homegarden respondents, effective by 40 per cent of respondents and 19 per cent says it was least effective.

For protection related aspects, the majority (37) of respondents unequivocally opined that technology needs were perceived to be sustainable, applicable as well as available. However the applicability of technology was a high matter of concern for more than one-third (23) of the respondents. The chi square test revealed that ($\chi 2$=0.594) homegarden respondents are having necessary technology related to protection process. This was because of the safe to eat food concept has taken away the minds of farmers to draw attention towards the protection related aspects. The result was in conformity to the findings of Sujitha (2015) who stated that adoption of technologies of farmers related to coconut based farming system was focusing on safe practices with a lean towards safe and sustainable practices.

For value addition technologies majority of respondents (32) were having adequate technology needs but availability was a major concern expressed by fifteen specialised homegarden farmers. The chi square test administered revealed that ($\chi 2$=0.060) homegarden respondents required more technologies for value addition and that too specific for each specialisations. However necessary technology needs to be delivered to safeguard the quality of food keeping in mind and provision of the avenues for value addition. The policy makers and implementors should focus on incentivising the homegarden farmers who would prefer to do value addition of the products derived from the crop components in the specialised homegarden.

4.3.2 Technology needs (gaps) for animal husbandry components

Animal husbandry components are inevitable for making homegardens dynamic and role performing. It fulfills the proper functioning conditions of homegardens. The technology needs of animal husbandry components is illustrated in Table 18.

Table 18. Technology needs of animal husbandry components

Specialisation- Cow , N=3			
Category	**Frequency**	**Technology need Score for AEUs together**	**Expected score range**
Technology not available(0)	0	0	0-9
Technology available but not applicable (1)	0	0	
Technology available, but not sustainable(2)	1	2	

Technology available, applicable and sustainable(3)	2	6	
Specialisation-Goat, N=1			
Technology available, but not sustainable(2)	1	2	0-3
Specialisation-Poultry, N=4			
Technology not available(0)	1	0	0-12
Technology available but not applicable (1)	0	0	
Technology available, but not sustainable(2)	2	4	
Technology available, applicable and sustainable(3)	2	6	
Specialisation-Other animal husbandry components, N=6			
Technology not available(0)	0	0	0-18
Technology available but not applicable (1)	0	0	
Technology available, but not sustainable(2)	3	6	
Technology available, applicable and sustainable(3)	3	9	

It was evident from Table 18 that for specialised homegardens with cow as specialization, two out of three respondents perceived that technology was available, applicable and sustainable. However one respondent perceived that even though technology was available, it was not sustainable. Similar was the opinion of the one farmer who was involved in goat rearing.

For poultry components, the technology need score was six indicating technology was available, applicable and sustainable. At the same time other half of homegarden farmers with poultry as specialization opined technology was available but not sustainable. For the other animal husbandry components in the specialised homegardens the distribution of scores shows symmetry pattern by 50 per cent respondents opining that technology was available, applicable sustainable and another 50 per cent opining it was available but not sustainable.

4.3.3 Technology needs (gaps) for aquaculture as specialisation

The technology needs for aquaculture as specialisation –edible and ornamental fish is given in Table -19.

Table 19. Technology needs for aquaculture (edible and ornamental fish) as specialisation

Aquaculture , N=7			
Category	**Frequency**	**Technology need Score for AEUs together**	**Expected score range**
Technology not available (0)	2	0	0-21
Technology available but not applicable (1)	0	0	
Technology available, but not sustainable(2)	4	8	
Technology available, applicable and sustainable(3)	1	3	

The frequency distribution and the corresponding score related to the aquaculture as specialization in reference to the technology needs (8) revealed that "technology was available but not sustainable''was opined by majority of the respondents (4). This may be due to constraints such as lack of infrastructure and area required to start up the venture.

Technology pertaining to aquaculture is also dependent on the species to be produced suiting the locality. But upgradation of locale specific technologies pertaining to fisheries may definitely create a new surge in the homegardens of Kerala.

4.3.4 Technology needs (gaps) for other specialisations

The technology needs for apiary, mushroom, ornamentals, orchids, terrace garden and fruit trees is considered as other specialisations and the result is presented in Table 20.

Table 20. Distribution of other specialisations in terms of technology needs

Other Specialisations, N=12			
Category	**Frequency**	**Technology need Score for AEUs together**	**Expected score range**
Technology not available (0)	3	0	0-36
Technology available but not applicable (1)	0	0	
Technology available, but not sustainable(2)	0	0	
Technology available, applicable and sustainable(3)	9	21	

The frequency distribution related to other specialization pertaining to technology needs reveals "technology applicable, available & sustainable''was preferred by majority of the respondents (9) in all AEUs taken together. Majority of the respondents revealed that "technology was available, applicable and sustainable'' and this may be due to the fact that farmers tend to study in depth about a particular specialization and then chose to deploy it in homegardens.

Also the literacy state of the State is another underlying factor about the perceptions of technology related to different specialisations. Similarly specialisations like rubber is not new to Kerala homegarden farmers. It also shows the strength of the public extension system prevailing in the State for the welfare of farming community.

The technology needs were further tabulated for analyzing the requirement in each specialization. The parameter with minimum score were considered as most needed technology in specialised homegardens. The distribution of specialisations based on technology needs/gaps is presented in Table 21. It was quite evident that from Table no 21 that farmers perceived the need for value addition technologies (1.93) were more when compared to production (2.58) and protection (2.23) in dominant crops. Similarly in animal husbandry components, technologies related to goat (2.00) were unavailable when compared to cow (2.67) and poultry (2.50). Farmers undertaking aquaculture (1.57) and other specialisations (1.75) perceived the need for more technologies compared to crop and animal husbandry components.

Table 21. Distribution of specialisations based on technology needs /gaps:

Technology needs related to		**Mean total score**
Dominant crops	Production	2.58
	Protection	2.23
	Value addition	1.93
Animal Husbandry	Cow	2.67
	Goat	2.00
	Poultry	2.50
	Others	2.50
Aquaculture	Edible & Ornamental	1.57
Other Specialisations	Apiary,Ornamentals & Orchids,Mushroom,Terrace garden,Fruit trees	1.75

Also, special focus should also be given for value addition technologies that will aid to enhance the vertical diversification that was believed to improve the remunerativeness of specialised homegardens. However, a specialised homegarden farmer require technology that is of cost-effective, low input oriented and high productive nature.

4.3.5 Different dimensions related to specialized components in homegarden situations

The distribution of different dimensions related to specialised components is shown in Table 22.

The distribution of dimensions perceived to be important by specialised homegarden farmers and agricultural officers is presented in table-22.

Table 22: Dimensions perceived to be important by specialised homegarden farmers and agricultural officers

Dimensions	Specialised homegarden farmers, N=60				Agricultural Officers, N=30			
	Total	Mean total	Rank over class	Rank over total	Total	Mean total	Rank over class	Rank over total
Economic dimensions								
1.Initial cost	158.00	2.63	3	3	81	2.70	2	2
2.Income generation potential	159.00	2.65	2	2	80	2.67	3	3
3.Employment generation potential	149.00	2.48	5	8	73	2.43	5	7
4.Commercialisation	157.00	2.62	4	4	72	2.40	6	8
5.Regularity of returns	166.00	2.77	1	1	86	2.87	1	1
6. Rapidity of returns	146.00	2.43	6	11	76	2.53	4	4
Total	155.83	2.59			78	2.6		
Technical Dimensions								
7.Physical compatability	148.00	2.47	5	9	68	2.27	7	12
8.Efficiency	143.00	2.38	7	12	71	2.37	3	9
9.Trialability	150.00	2.50	3	8	68	2.27	6	13
10.Complexity	139.00	2.32	8	14	69	2.30	5	12
11.Predictability	146.00	2.43	6	11	73	2.43	2	7
12. Flexibility	154.00	2.57	2	6	75	2.50	1	5
13.Viability	149.00	2.48	4	8	68	2.27	6	12
14.Desirability	155.00	2.58	1	5	70	2.33	4	11
15.Availability of supplies	155.00	2.58	1	5	71	2.37	8	9
Total	148.77	2.47			70.11	2.33		
Environmental dimensions								

16.Energy saving potential	112.00	1.87	3	15	70	2.33	2	11
17.Local Resource Utilisation	155.00	2.58	1	5	69	2.30	3	12
18. Sustainability	154.00	2.57	2	6	72	2.40	1	8
Total	140.33	2.34			70.33	2.34		
Socio-cultural dimensions								
19.Social acceptability	153.00	2.55	1	7	71	2.37	1	9
20.Social approval	108.00	1.80	2	16	67	2.23	2	14
Total	130.5	2.17			69	2.3		
Psychological dimensions								
21 Attitude	150.00	2.50	1	8	72	2.40	2	8
22. Perceptions of technology	139.00	2.32	3	14	74	2.47	1	6
23.Perceived social status	142.00	2.37	2	13	63	2.10	3	15
Total	143.66	2.39			69.67	2.32		
Human Resource Dimensions								
24. Family labour	143.00	2.38	4	12	62	2.07	3	16
25 Hired labour	148.00	2.47	1	9	61	2.03	4	17
26.physical labour requirement	147.00	2.45	2	10	68	2.27	2	13
27 .Skilled labour requirement	146.00	2.43	3	11	70	2.33	1	10
Total	146.00	2.43			65.25	2.17		

Table no 22 revealed the perceptions of specialised homegarden farmers and Agricultural Officers as to which dimension is more important. The same was estimated based on mean total and was expressed in ranks. The result showed that relevancy pattern differed for both specialised homegarden farmers and Agricultural Officers. Some dimensions perceived to be important by respondents were actually not a concern for Agricultural Officers and vice versa.

Under the economic dimensions, regularity of returns (2.77) was perceived to be the most important dimension for specialised homegarden respondent followed by the income generation potential (2.65), initial cost (2.63) and commercialization (2.62). For Agricultural Officers, the dimensions perceived to be important was regularity of returns (2.87), initial cost (2.70) and income generation potential (2.67). Commercialisation was an important factor as perceived by the respondents since majority of the homegarden farmers incorporate specialisations for economic returns. Specialised homegarden farmers perceived income generation potential more than initial cost due to the fact that without continuous income generation the specialization will be vague and of no use. Farmers will be in a position to manage the specialised homegarden to overcome initial cost.

Under the technical dimensions, desirability (2.58) and availability of supplies (2.58) followed by flexibility (2.57) were important to the specialised homegarden farmers. Flexibility (2.50), predictability (2.43) and efficiency (2.37) were considered important by the Agricultural Officers. Desirability and availability of supplies were considered important because unless there is resource availability one cannot continue farm activities. Flexibility in all aspects helps to mitigate risks and overcome crisis situation in a better manner especially in specialised homegardens. Complexity was perceived to be least important dimension by both specialised homegarden farmers as well as Agricultural Officers. It implies irrespective of complex nature of technology farmers tend to adopt it due to profit motive of the farmers.

Local resource utilization (2.58) was perceived to be important by the specialised homegarden farmers were not actually important to the Agricultural Officers. Sustainability was a mutual concern for both Agricultural officers and specialised homegarden farmers under environmental dimensions. Optimum usage of available

resources was considered important to the farmers for sustaining a specialization in homegarden. Energy saving potential (2.33) was perceived to be important by Agricultural officers since it can help to reduce the hazards on the environment as well as helps to reduce the financial costs to the farmers.

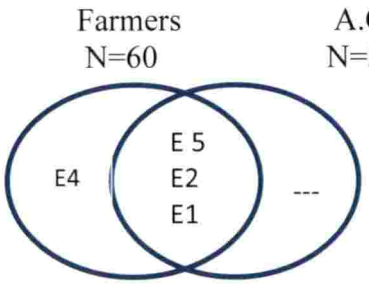
Under socio-cultural dimensions, social acceptability was unequivocally considered important by both Agricultural Officers and specialised homegarden farmers. Acceptability from the society in turn can help the farmers to generate additional economic benefits when the specialization becomes commercialised.

In case of psychological dimensions, attitude (2.50) was important to both the category of respondents while perceptions of technology (2.47) was important to the Agricultural Officers. Technology plays a very pivotal role starting from the germination of specialization till marketing of its products. Hence attitude became pivotal for farmers adopting new technologies in their specialised homegardens.

Under human resource dimension, hired labour (2.47) and family labour requirement (2.38) was a concern expressed by specialised homegarden farmers. Scarcity of labour was a major problem expressed by majority of the farmers. Whereas skilled labour was a pivotal factor in homegardens inclusion of specialisations requiring complex technology. Hence skilled labour (2.33) was considered pertinent by both the Agricultural Officers and specialised homegarden farmers as well.

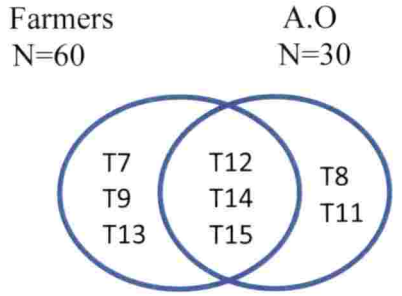
Six major dimensions mainly economical dimension, technical dimension, environmental dimension, socio-cultural dimension, psychological dimension and human resource dimensions with 27 sub dimensions in total (as given in Appendix-2) were given for rating to both specialised homegarden farmers and Agricultural Officers for its rating so as to identify the most important dimension as perceived by the respondents. The results of the same based on the mean values as check for both farmers and agricultural officers were delineated and the same is presented in Fig 14.

1. Economic dimension



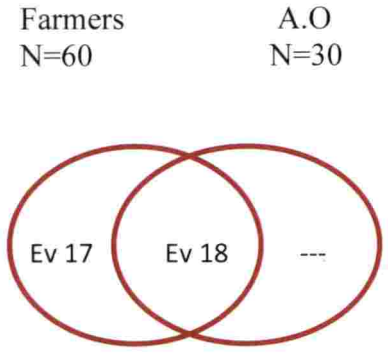
Mean (farmers): 2.59
Mean (A.O's) : 2.60

2. Technical dimension



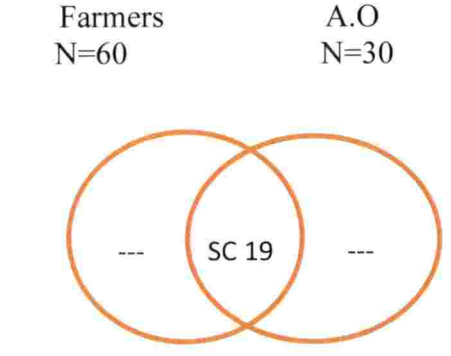
Mean (farmers): 2.17
Mean (A.O's) : 2.3

3 Environmental dimension



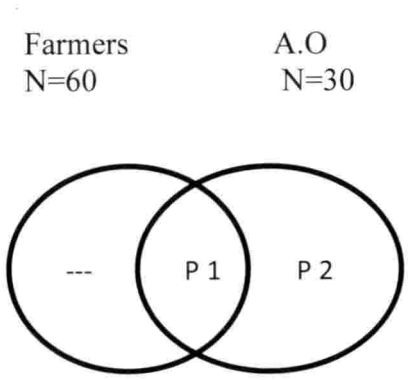
Mean (farmers) : 2.34
Mean(A.O's): 2.34

4. Socio-cultural dimension



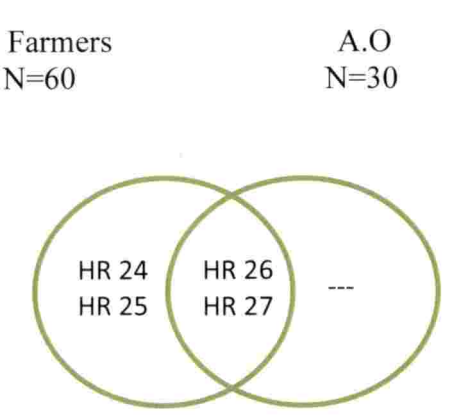
Mean (farmers) : 2.17
Mean(A.O's) : 2.3

5. Psychological dimension



Mean (farmers) : 2.39
Mean (A.O's) : 2.32

6. Human resource dimension



Mean (farmers) : 2.43
Mean (A.O's) : 2.17

Fig 14: Dimensions perceived to be important to both the categories of respondent

Fig 14 represent venn diagram for each dimension. The venn diagram were plotted for emphasizing the common dimensions perceived to be most important by both categories of respondents. It was interesting to note that from Fig 11, the total of 11 dimensions were felt to be important by both category of respondents where in the dimensions were E5, E2 and E1 under economic dimension; T12, T14 and T15 under technical dimensions; Ev18 under environmental dimensions; SC19 under socio-cultural dimensions; P1 under psychological dimensions and HR26, HR27 under human resource dimension.

Under economic dimension, the dimensions that felt important by specialised homegarden farmers and Agricultural Officers were regularity of returns (E5), income generation potential (E2) and initial cost (E1). Economic dimension are very important for any farmer because that determines the profitability of the specialised homegarden. Moreover farmers venture into specialised components expecting profit. Rabin (2013) and Shepherd (2004) reported that profit is always a motivating factor for farmers to continue with farming. However the results also point to the fact under economic dimension, commercialisation (E4) that was felt important by farmers was not felt important by Agricultural Officers. Farmers might have perceived commercialization as an important dimension because they chose specialization for economic interest and to be not just a farmer but an agripreneur.

Similarly under technical dimension, the dimensions that felt important by both category of respondents include flexibility (T12), desirability (T14) and availability of supplies (T15). At the same time the dimensions that were felt important by the specialised homegarden farmers but not by the Agricultural officers include physical compatability (T7), viability (T9) and trailability (T13). The farmers might have perceived that for a proper growth and sustainance of homegarden, the inclusion of specialisations should be compatable with the physical environment as well as to the existing non-specialised components. Viability and trailability could be referred to as twin pillars of any successful venture. When it comes to the specializations, requiring high risks and complex technology trailabilty, of the same becomes more accentuated. However according to the Agricultural Officers, efficiency (T8) and predictability (T11) were pertinent. Unlike traditional homegardens, the specialised homegarden require high

risks, thus having the ability to foresee the outcomes and track the growth of the venture might help to mitigate unexpected lossess.

Under environmental dimensions, sustainability (Ev18) was perceived to be important to both Agricultural Officers and the specialised homegarden farmers. Sustainability which has become watchword of the policy makers is not a new concept in agriculture too. So it was unequivocally preferred by both category of respondents. However the results also reflects that local resource utilization (Ev17) was felt important by the specialised homegarden farmers but not the Agricultural Officers. Tapping the available local resources may help in the easy mobility and effective resource utilisation particularly when value additions are taking place.

Social acceptability (SC19) was perceived to be important by both specialised homegarden farmers as well as the Agricultural Officers. Finally any specialization that is incorporated symbolically should match with the culture and co- exist in the framework of the society.

Psychological dimensions that were important to both the categories of respondents include attitude (P1). Perceptions of technology (P2) was considered important by agricultural officers solely not by the farmers. Agricultural officers believed that farmers should have full faith in the agricultural extension system that includes the extension workers for positive adoption to take place. This will enable a productive perception on the technologies among the farming community which will ensure more trust between the farmer and extension system.

Human resource dimensions that were commonly perceived by both category of respondents include physical labour reqirement (HR26) and skilled labour (HR27). Specialised homegardens require additional skilled labour to carry out the complex technology. Family labour (HR24) and hired labour (HR25) were perceived important by the specialised homegarden farmers. Labour shortage was a serious constraint expressed by the specialised homegarden farmers. The government should initiate more schemes for developing the skill set of labourers through training so that skilled labour can be strenghthened. This will enable both labourers as well as specialised homegarden farmers to derive more profit.

The distribution of respondents based on mean average scores of all dimensions were presented in Table 23.

Table 23 . Distribution of respondents based on mean average scores of all dimensions

	Mean average scores in AEUs						Rank
Dimensions	**AEU-1**	**AEU-8**	**AEU-9**	**AEU-12**	**AEU-14**	**Total**	
Economic dimension	2.83	2.78	2.50	2.43	2.45	2.60	1
Technical dimension	2.56	2.54	2.69	2.31	2.31	2.48	2
Human resource	2.29	2.25	2.75	2.44	2.44	2.43	3
Psycological dimension	2.50	2.58	2.44	2.17	2.28	2.39	4
Environmental	2.44	2.53	2.36	2.22	2.14	2.34	5
Socio-cultural	2.34	2.34	2.17	2.09	1.96	2.18	6

Distribution of dimensions of technology for each agro-ecological unit as per mean average scores in the decreasing ranking order are as follows- economical dimensions (2.60) followed by technical dimension (2.48), human resource dimension (2.43), psychological dimension (2.39), environmental dimension (2.34) and socio-cultural dimension (2.18).

It can be inferred that economic dimensions was perceived to be most important dimensions among all. Specialisations require more complex technology henceforth to make it remunerative, economic factors were a prime concern. Technical dimensions were also equally determinant because of different specialisations. Human resource dimension was also pertinent since specialisation requires proper skilled labour utilisation.

4.4 Risks associated with specialized components in homegardens

Farmers are encountered with different types of risks during farming. This risk factor increases when specialisations are incorporated and the types of risks can be differentiated *viz.* production risks, marketing risks, legal and environmental risks and human resource risks. The results are presented as follows:

1) Production risks

The distribution of respondents based on production risks is as illustrated in Table 24.

Table 24. Distribution of respondents based on production risks

Category	Frequency	Percent
Low (< 7)	24	40.0
Moderate (7-9)	31	51.6
High (>9)	5	8.3
Total	60	100.0
Q1-7, Q2-9		
Expected score range : 5-15	Data score range: 6-12	

An overall analysis of production risks among the specialised homegarden farmers as presented in table 24 revealed that 40 percent face low risk, followed by 51.6 per cent who face moderate risk and 8.3 per cent high risks. Crop and livestock performance also depend on biological processes that are affected by the weather, by pests and diseases. Low rainfall or drought may adversely affect the yields. Heavy rains could damage or even wipe out crops. Outbreaks of pests or diseases could also cause major yield losses in crops and livestock. Risk factors especially in homegardens are quite high. Specialisations in fact helps to manage and curb risks to certain effect through horizontal and vertical integrations.

2) Marketing risks

Marketing risk is potential for losses and failures of marketing. This includes risks related to pricing, product development and distribution especially in case of value addition. The distribution of respondents based on marketing risks is as illustrated in Table 25.

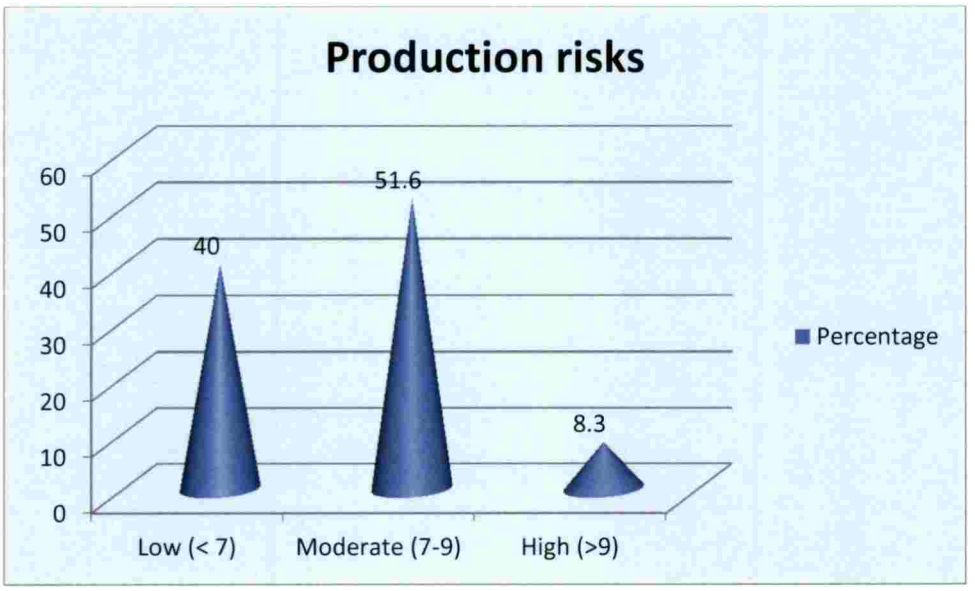


Fig 15. Distribution of respondents based on their production risks

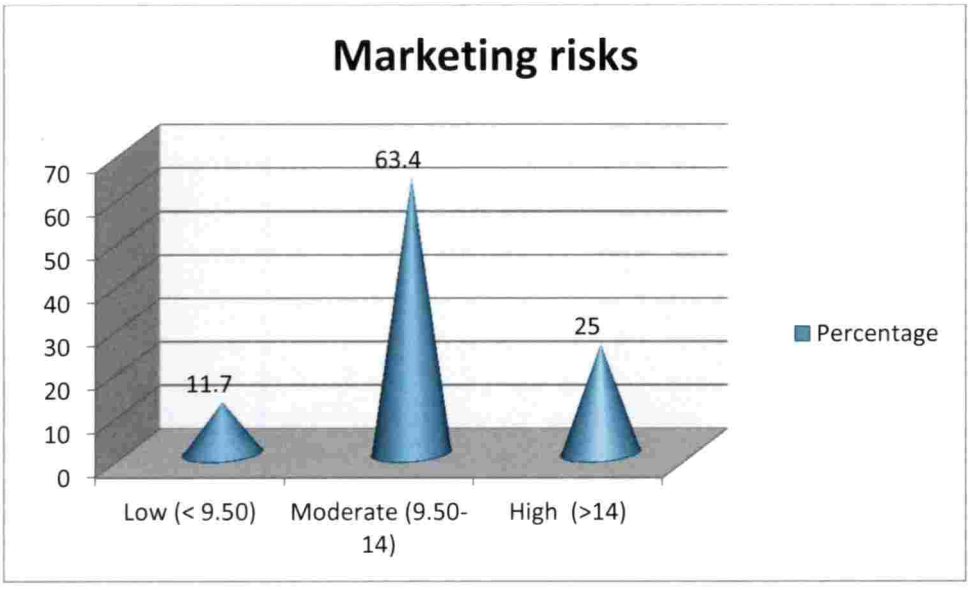


Fig 16. Distribution of respondents based on their marketing risks

Table 25. Distribution of respondents based on marketing risks

Category	Frequency	Percent
Low (< 9.50)	7	11.7
Moderate (9.50-14)	38	63.4
High (>14)	15	25
Total	60	100
Q1-9.50, Q2-14		
Expected score range : 6-18 Data score range : 6-15		

Table 25 revealed that 11.7 per cent farmers face low risk, 63.4 per cent have moderate risk and 25 per cent have high risk. Twenty five per cent respondents perceived high risk due to the fact that avenues for product diversification and value addition were lacking in specialised homegardens unlike traditional homegardens, who sell their produce as raw without any value addition.

The various strategies to overcome the marketing risks could be resource pool marketing, market intelligence and cluster marketing for specialised homegardens. Similarly generation of more post-harvest technology and proper storage facilities will further help to mitigate marketing risks.

3) Financial risks

Financial risk results when the farm business borrows money and creates an obligation to repay debt. Rising interest rates, the prospect of loans being called by lenders, and restricted credit availability are also aspects of financial risk. The distribution of respondents based on financial risks is as illustrated in table-26.

Table 26. Distribution of respondents based on financial risks

Category	Frequency	Percent
Low (<10.00)	19	31.7
Moderate (0.00-14.00)	31	51.7
High (14.00+)	10	16.6
Total	60	100.0
Q1 – 10, Q2 - 14		
Expected score range : 7-21 Data score range : 7-16		

Results from Table 26 revealed that 31.7 per cent are under low risk, 51.7 per cent under moderate risk, 10.6 per cent under high risk. A considerable per cent under low risk may be due to the high B-C ratio and incorporation of diversification helps the homegarden respondents to meet additional requirements.

Strategies to mitigate financial risks include conducting trend analysis to assess change in farm profits and owners equity over time. Diversification is the best choice. Opting for lease and rental options rather than purchasing implements aids in reduction of financial risks.

4) Legal and environmental risks

Legal risks relay to fulfilling business agreements and contracts.If failed to meet the above conditions, it causes legal risks. Another foremost cause of legal risk is liability causing injury to person or property due to laxity. Lastly, legal risk is related to environmental liability and trepidations about water quality, erosion and pesticide use. The distribution of respondents based on legal and environmental risks is as illustrated in Table 27.

Table 27. Distribution of respondents based on legal and environmental risks

Category	**Frequency**	**Percent**
Low (<10)	19	31.7
Medium (10-12)	34	56.7
High (>12)	7	11.6
Total	60	100.0
Q 1-10, Q2-12		
Expected score range : 5-15	Data score range : 9-15	

The results revealed that 31.7 per cent are under low risks, 56.7 per cent face moderate risks and only 11.6 per cent face high risks. From this, we can infer that farmers are satisfied with existing legal protection which prevent farmers to resort to illegal acts in farming. However, it should be noted that implementation of rules and regulations without bias would further build confidence among farming community so that farmers opt for more specialisations that will help farmers derive more profit and improve the State's economy.

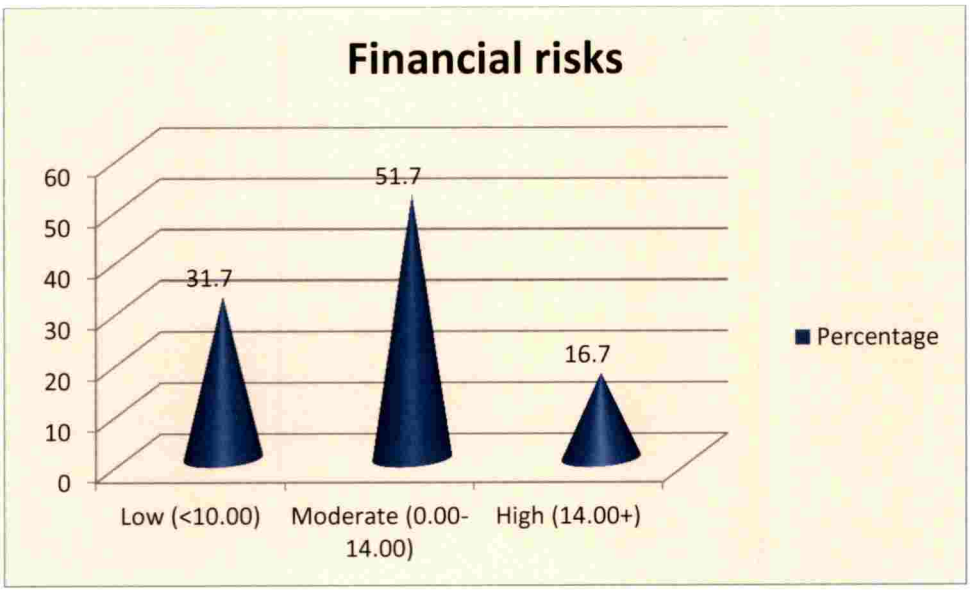


Fig 17 Distribution of respondents based on their financial risks

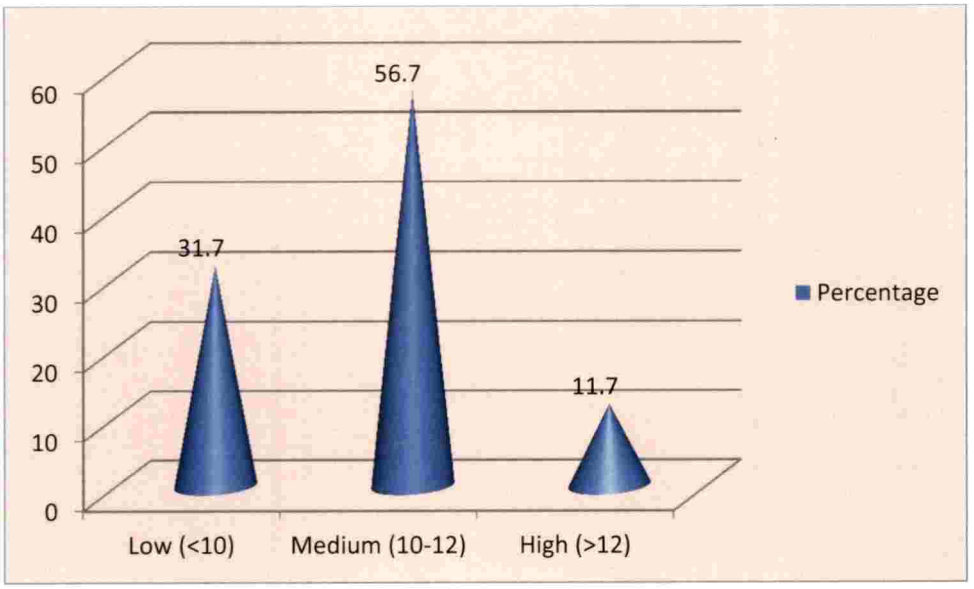


Fig 18 Distribution of respondents based on their legal & environmental risks

5) Human Resource risks

Human resource risks concern to risks associated with individuals and their relationships to each other: These relationships include family members, farm employees and customers. Key sources of human resource risk arise from one of the "three D's" — divorce, death, or disability. The impact of any of these events can be demoralizing to a farm. It also include the negative impacts arising from a lack of people management skills and poor communications. The distribution of respondents based on human resource risk is as illustrated in Table 28.

Table 28. Distribution of respondents based on human resource risks

Category	**Frequency**	**Percent**
Low (< 10.00)	19	31.7
Moderate (10.00-14.00)	31	51.7
High (14.00+).	10	16.6
Total	60	100.0
Q1- 10, Q2- 14		
Expected score range : 5-15 Data score range : 8-15		

The result states that nearly 31.7 per cent are under low risk, 51.7 per cent face moderate risk and 16.6 per cent face high risks. It was evident that high per cent (31.7 %) of the homegarden respondents face lower risks when compared to other type of risks. Homegardens rely more on family involvement and hence majority of respondents opined that they face only moderate to low risks.

4.4.1 Risk assessment in specialisations

Specialisations when done with commercial interest can lead to different types of risk. Hence an attempt was made to draw risks assessment in specialisations and the results are presented in table 29.

Table 29. Risks assessment in specialisations

Specialised component	Pdn risk	Ptn risk	Va risk	Mk risk	Fi risk	Le risk	Hu risk	Total risks
Vegetables (8)	9.88	14.13	10.00	10.00	10.25	8.36	8.25	70.86
Poultry (4)	12.41	13.54	9	13.24	13.41	13.23	9	83.83
Livestock –cow(3	12.21	14.52	9.11	12.85	12.83	8.63	8.13	78.28
Animal Husbandry-(6)	12.54	12.2	9.34	13.65	13.14	10.42	8.25	79.54
Goat-(1)	9.37	9.27	12.54	12.41	13.52	9.41	11.47	77.99
Aquaculture/Farm tourism-(7)	12.21	14.23	10.21	11.23	14.32	13.14	9.25	84.59
Banana-(6)	10.21	11.23	8.23	10.21	11.87	8.62	8.47	68.84
Coconut –(4)	10.21	11.35	8.62	12.35	9.11	8.11	12.14	71.89
Tubers-(2)	10.41	10.11	9.13	13.52	9.68	8.41	8.96	70.22
Fruit trees –(2)	9.32	10.26	10.41	12.87	9.32	8.32	9.28	69.78
Rubber –(3)	9.68	8.63	9.23	11.63	9.11	12.85	10.17	71.30
Mushroom-(1)	14.21	13.21	10.62	14.22	11.68	9.65	8.11	81.70
Terrace garden(3)	12.24	9.36	10.23	13.21	10.87	8.25	7.52	71.68
Orchids-(1)	12.11	11.23	13.21	13.58	13.98	10.11	12.19	86.41
Ornamentals –(4)	12.35	10.35	12.11	14.32	13.57	8.12	12.87	83.69
Apiary-(1)	11.2	12.11	8.93	12.58	12.52	13.52	10.21	81.07
Total risks	195.6	199.2	172.0	213.72	203.4	169.2	162.2	1315
Pdn –Production risk, Ptn -Protection risk,Va- Value addition risk, Mk-Marketing risk, Fi- Financial risk, Le- Legal & environmental risk, Hu- Human resource risk								

From Table 29, it can be inferred that maximum risks was for specialised homegarden with floriculture (orchids) (86.41) followed by aquaculture (84.59), poultry (83.33) and the least was observed for banana (68.84) as perceived by the specialised homegarden farmers. However an analysis of the different type of risk in relation to the different specialisations, it was noticed that for crop based specialisations, protection risks (14.12) was the highest followed by value addition (10). In case of animal husbandry components, marketing risks (13.65) was highest followed by financial risks (13.14) and for fisheries, financial risks (14.32) was highest followed by protection risks (14.23). For other components, marketing risk (14.32) was highest followed by financial risks (13.57). Further the results of the risk assessment for different specialisations with respect to production, marketing, financial, legal and environmental risks and human resource risks revealed that marketing risks was the highest with a score of 213.72 and legal and environmental risks was perceived to be least with a score of 162.27. This was

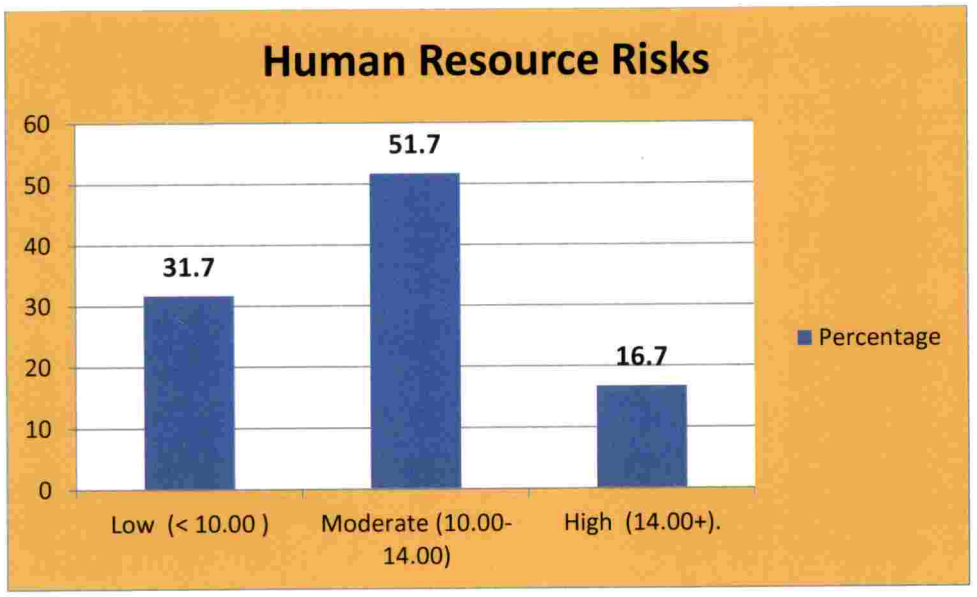


Fig 19 Distribution of respondents based on their Human resource risks

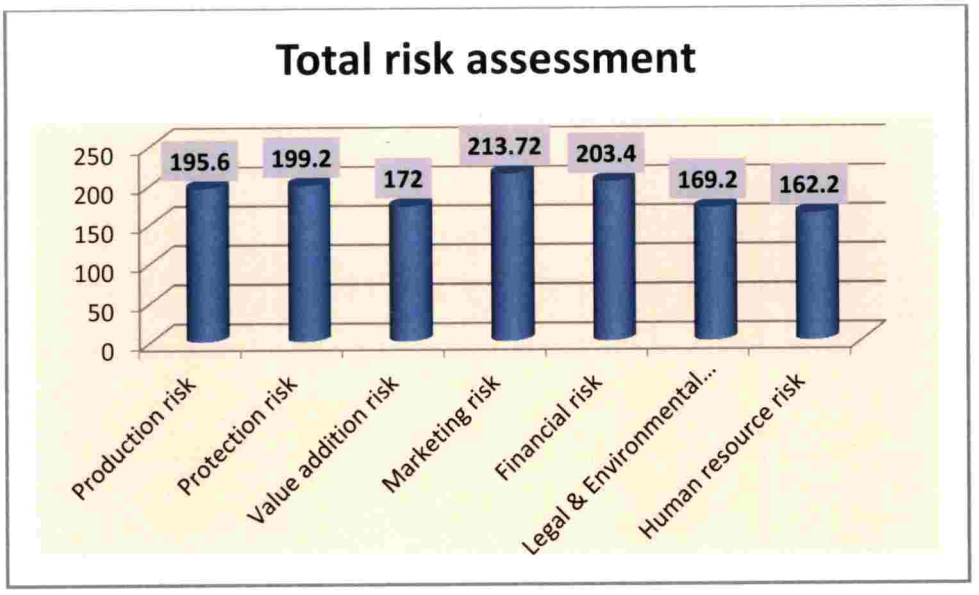


Fig 20. Distribution of respondents based on their total risk assessment

because marketing risks tends to be highest in homegardens because of purposive inclusions of specialisations with intend for profit.

4.4.2 Interpretation of risk assessment in specialisations

Interpretation of risk assessment in specialisations was carried out and the results are presented in table 30.

Table 30. Interpretation of risk assessment in specialisations

Chi-square (Observed value)	21.86
Chi-square (Criticalvalue)	119.81
DF	96
p-value	1.000
alpha	0.05

Since the computed p value was greater than the significance level alpha =0.05, there exists no significant difference among specialisations and total risks. This was due to the fact that risks are independent of the specialisations. Different specialisations may encounter different risks at various time right, from its production stage till marketing.

4.5 Perceived cost-benefit analysis of specialized components in homegardens drawn from the responses of farmers

The perceived benefit-cost ratios of the specialized components in the homgardens under study analysed is presented in Table 31.

Table 31 : Cost-benefit analysis in specialisations

Specialisations	Class Size	Average farm size	B :C Ratio
Vegetables	3	3.4	1.07
Poultry	4	0.45	1.16
Livestock -cow	8	2.52	2.76
Animal Husbandry	6	2.64	1.03
Goat	1	1.32	0.88
Aquaculture/Farm	7	2.6	2.15
Banana	6	3.8	1.02
Coconut	4	3.6	1.98
Tubers	2	2.6	0.79
Fruit trees	2	1.8	2.40
Rubber	3	4.5	3.15
Polyhouse	4	2.5	0.98
Mushroom	1	0.5	1.10
Terrace garden	3	0.4	0.417
Orchids	1	0.9	0.680
Ornamentals	4	2.3	3.44
Apiary	1	0.3	0.750

The benefit-cost ratio as perceived by the farmers undertaking specialisations at the time of data enumeration showed that ornamentals derived maximum profit (B:C ratio: 3.44) followed by rubber (3.15), livestock –cow (2.76), fruit trees (2.4) and aquaculture (2.15).

The statistical analysis revealed that the there does not exists any significant relation among the specialization he chose. B:C ratio was worked out for each specialization and the result was that high B:C ratio was obtained for the ornamentals, followed by rubber, livestock –cow, fruit trees and aquaculture. Ornamentals and rubber was said to have high B: C ratio due to high expected returns and least affected by risks. Commercialisation tend to overrule the farming sector and has not spared the specialised homegarden sector. Ornamentals have a high export quality and play significant role in the marketing sector. Terrace garden was said to have least B :C ratio due to the fact that vegetables grown are mainly utilized for household consumption than marketing purpose. Aquaculture sector framed with modern and advanced yet simple technology had high returns irrespective of initial expenditure. Similarly due to perennial nature of fruit trees, expenditure is comparatively less hence B:C ratio was high enough.

4.5.1 Contribution of mean homegarden income to mean annual income

The percentage contribution from mean homegarden income to mean annual income is illustrated in Table 32.

Table 32. Percentage contribution from mean homegarden income to mean annual income

AEU	Mean AI (Rs)	Mean HI (Rs)	Per Cent Contribution (HI/AI) (%)
1	449916	198558	44.12
8	426166	194258	45.58
9	194000	103746	53.47
12	3438333	179666	52.25
14	2766666	134166	48.49
AI-Annual income, HI- Homegarden income			

The highest per cent contribution of mean HI to mean AI was found to be highest for AEU -9 (53.47%) followed by AEU-12 (52.25%) and AEU- 14 (48.49%). Similarly it can be noticed that in all the homegardens contribution of mean homegarden income to mean annual income is 50 per cent or tending to 50 per cent. The incorporation of more specialisations further contributes to the annual income. Similarly results cannot be generalised owing to a relatively small sample size under each AEUs.

4.5.2 Contribution of specialised components to total homegarden income

The extent of contribution of income from specialized components to total homegarden income of the respondent family is illustrated in table 33.

Table 33. Extent of contribution of income from specialized components to total homegarden income of the respondent family

Specialised component	TAI (Rs)	THI (Rs)	SI (Rs)	SI/THI (%)
Vegetables	338562	158275	118725	75
Poultry	395625	225000	157500	70
Livestock -cow	290714	185000	172500	93.24
Animal Husbandry	431500	250766	180733	72.07
Goat	153000	100000	53000	53

Aquaculture/Farm tourism	139865	177160	121854	68.78
Banana	278750	450180	236937	52.63
Coconut	294571	416640	198400	47.61
Tubers	297500	202300	95200	47.05
Fruit trees	210000	125000	250000	20
Rubber	266250	129500	127200	98.22
Polyhouse vegetables	345000	198000	147000	74.24
Mushroom	300000	120000	110000	40
Terrace garden	125000	100000	25000	25
Orchids	267000	122500	102000	83.26
Ornamentals	236250	126750	113250	90.57
Apiary	125000	100000	75000	75
TAI – Total annual income, THI- Total homegarden income, SI- Income from Specialised components				

It is significantly understood that livestock-cow (93.24), rubber (98.22) and ornamentals (90.57) significantly contribute to the total homegarden income. This large contribution could be also due to large area under homegarden and already established units at the time of investigation. Fruit trees (20) and terrace garden (25) contribution was comparatively less. This is because these components satisfy the subsistence need of homegarden farmers.

It can be generalized that incorporation of more and more specialisations fetches more income and contributes significantly to the total homegarden income. Similarly, it can be concluded that more than 50 per cent of income is contributed from specialization irrespective of its type and nature that signifies the importance of studies in specialised homegardens.

4.6. Influence of personal and social characteristics of respondents based on technology needs and the risks

The relationship of 10 personal and social characteristics with technology needs and risks assessment were established using co-relation and the results are summarized as follows.

Table no 34 : Relationship of independent variables with technology needs and risks assessment

	r_t	r_p	r_m	r_f	r_e	r_h
Age	-0.2004	-0.10633	-0.01562	-0.0591	0.11996	-0.0219
Family size	0.0055	-0.19872	-0.18319	-0.0831	-0.05627	-0.1554
Education	0.16387	-0.12394	-0.01057	-0.1398	0.03819	0.11766
Occupation	-0.1991	-0.05149	**0.28099***	0.14386	**0.30673 ***	**0.37996****
Annual income	0.16309	0.20458	-0.01789	-0.123	-0.22194	-0.1839
HI	0.21455	0.22598	0.14678	0.03964	-0.11182	0.01811
Specialised HI	0.09095	0.12551	-0.05467	-0.1674	-0.20506	-0.1565
Effective homegarden area	0.2179	0.23784	**0.27994***	0.11425	0.12358	0.01432
Attitude	0.15332	**0.29947***	0.14552	0.18861	-0.15002	0.0936
Market orientation	-0.0372	0.02844	-0.02378	0.03075	0.04466	-0.039
Extension Contact	**0.36363****	**0.31998****	0.14326	0.10178	-0.21912	-0.137
Extension Participtation	**0.35013****	**0.34148****	0.2122	**0.30112***	0.01602	0.01801

r_t -technology needs, r_p- production risks, r_m- marketing risks, r_f - financial risks, r_e- environmental risks, r_h- human resource risks, HI- homegarden income

* significant at 5 per cent level **significant at 1 per cent level

Table 34 revealed that extension contact and extension participation were positively and significantly related to technology needs at 1 per cent level significance. This could be due to the fact that majority of the respondents are at least occasionally involving with extension activities and have good contact with various extension agencies.

Homegardens with inclusions of specialised components requires adequate and complex technologies to be effectively administered and monitored by extension agencies. Table 34 also revealed that extension contact and extension participation were positively and significantly related to production risks at 1 per cent level. Similarly attitude was positively co-related with production risks at 5 per cent level.

Type and extent of specialization significantly influences the attitude of the respondent and is associated with the specialised components. It also reflects the various

production risks one needs to encounter and highlights importance of increasing level of extension contact and extension participation.

Similarly occupation and effective homegarden area are positively associated with marketing risks at 5 per cent level significance. Marketing risks are more for specialised homegardens and the area under each component have a significant impact on the marketing risks. The scale of space for farming is definitely a reason for determining the quantity of input, labour, capital and other factors of production. Therefore it was natural that homegarden area and markeing risks are associated or interdependent.

Occupation was positively associated with financial risks at 5 per cent level significance. Also, it was evident that occupation was positively associated with human resource and legal and environmental risks. Respondents who are established farmers or have other private occupation can afford the labour charges and are aware of the legal and environmental issues in comparison to emerging farmers.

Also, those farmers who incorporate specialisations could be educated, progressive and are enabled to understand and internalise intracacies of problems related to risks, rules and regulations and issues of human resources. This could be the reason that occupation was positively associated with human resource, legal and environmental risks.

4.6 Constraints experienced by specialised homegarden farmers

The distribution of constraints experienced by specialised homegarden farmers is illustrated in Table 35.

Table 35. Constraints experienced by specialised homegarden farmers

SI NO	Constraints	RANK Means	RANK
1	Low cost of inputs	22.2	6
2	Non availability of labour	21.5	11
3	Inadequate employment opportunities	21.3	13
4	Lack of technology	19.6	14
5	Non availability of credit	21.4	12
6	Lack of post harvest and storage facilities facilities	22.8	2

7	Lack of timely and skill based extension service	22.9	1
8	Lack of involvement in management	22.6	4
9	Lack of awareness	21.9	8
10	Poor economic status	22.5	5
11	Lack of markets or products of specialised homegarden	22.7	3
12	Lack of motivational factors	21.8	9
13	Poor storage facilities	22.2	7
14	Interrupted power supply	21.6	10
15	Others (specify)	18.9	15

From the Table 35, it can be observed that lack of timely and skill based extension service was the major constraint attaining a mean score of 22.9. This was followed by lack of post harvest and storage facilities (22.8), lack of markets or products of specialised homegarden (22.7), lack of involvement in management (22.6), poor economic status (22.5), low cost of inputs (22.2), poor storage facilities (22.2), lack of awareness (21.9), lack of motivational factors (21.8), interrupted power supply (21.6), non availability of labour (21.5), non availability of credit (21.4), inadequate employment opportunities (21.3), lack of technology (19.6) are the constraints in the decreasing order of importance as perceived by specialised homegarden farmers.

Lack of timely and skill based extension service, lack of poor harvest and storage facilities, lack of markets or products of specialised homegarden were the primary constraints which needed utmost importance. Whereas non availability of credit, inadequate employment opportunities, lack of technology were considered to be of least importance. The lacuna of adequate extension services were reported largely. Small scale farmers should be brought into limelight and appropriate strategies should be framed for meeting their constraint. Frequent meetings and further aid definetly can improve the small scale farms or specialised homegardens to a large extent. Similarly in case of specialised homegardens lack of post harvest technology was adequately found which was a constraint with reference to vertical diversification.

4.6.1 Perceived solutions of specialised homegarden farmers and Agricultural Officers

The distribution of perceived solutions of specialised homegarden farmers and agricultural officers are illustrated in table -36.

Table 36. Perceived solutions of specialised homegarden farmers and Agricultural Officers

SI no	Suggestions	No N=60	% (Specialised homegarden farmers)	No N=30	% (A.O)
1	Market clusters to increase profit and reduce risk	29	48.33	8	26.67
2	Frequent field visit by extension officials	51	85	8	26.67
3	Farmer –friendly implements to meet labour shortage	26	43.33	9	30
4	Incentives and rewards for performing specialised homegardens	12	20	12	40
5	Innovation -platform	18	30	13	43.34
6	Market intelligence –Resource pool marketing	21	35	18	60
7	Provision of subsidies easy availing loans	31	51.67	10	33.33

Solutions as perceived by the specialised homegarden farmers include frequent field visit by extension officials, provision of subsidies, market clusters to increase profit and reduce risks and farmer friendly implements to face labour shortage. However, agricultural officer's primary suggestions for sustaining and scaling up specialised homegarden farming system include market intelligence-resource pool marketing, innovation platform, provision of incentives and rewards for performing specialised homegardens. If these strategies are implemented, it will enhance the functionality of specialised homegarden systems making it more remunerative and sustainable production systems.

4.8 Hypothesis set up for the study

A research hypothesis is the statement created by researcher when they speculate upon the outcome of the experiment. It must be testable and realistic. A hypothesis must be verifiable to allow a verification or falsification. In this study the hypothesis set and established were

1 There is no significant technology needs for specialisations in homegardens.

The results from Table 20 revealed that technology needs pertaining to value addition (1.93) dominant crops was needed. Simlilarly for animal husbandry components including goat (2.00) requirement of technology were needed. This proves that technology requirement was more needed in specialised homegardens when compared to the traditional homegadens. Hence the hypothesis was falsified.

2 There exists no risks for specialisations in homegardens.

From Table 21, it was found that maximum risks was for homegarden with floriculture as specialisation (86.41) followed by aquaculture (84.59), poultry (83.33) and the least was observed for banana (68.84) as perceived by the farmers with specialisations. Marketing risks was the highest with a score of 213.72 and legal and environmental risks were perceived to be least with a score of 162.2 when overall risks were considered. Thus the hypothesis is falsified.

3 There exists no commonality in the dimensions of specialised homegardens as perceived by homegarden farmers and Agricultural Officers.

From Fig 14, it was found that, the total of 11 dimensions out of 27 dimensions were felt to be important by both specialised homegarden farmers and Agricultural Officers where in the dimensions were E 5, E 2 and E 1 under economic dimension: T 12, T 14 and T 15 under technical dimensions: Ev 18 under environmental dimensions: SC 19 under socio-cultural dimensions: P 1 under psychological dimensions and H R 26, H R 27 under human resource dimension. Thus null hypothesis is rejected.

4 There exists no significant relationship between independent variables with respect to technology needs and risk assessment.

Table 34 reveals that extension contact and extension participation are positively and significantly related to technology needs at 1 per cent level significance. Similarly, extension contact and extension participation are positively and significantly related to production risks at 1 per cent level. Similarly attitude is positively co-related with production risks at 5 per cent level. Also, occupation and effective homegarden area are positively associated with marketing risks at 5 per cent level significance. Thus null hypothesis is rejected.

To conclude, in general the results revealed that risk factors are predominantly high in homegardens inclusive of specialisations. Moreover, it requires the addition of simple low cost technologies for the healthy growth and sustainability of the specialised homegarden. Hence it can be pointed that with the upgradation of scientific technologies and delineating the needs of dimensions of technology and scaling up of value- addition technologies by competent authorities together with the strategies to mitigate risks can all together make the specialised homegarden system a sustainable and remunerative agricultural production system. Keeping an eye on the constraints and perceived solution by the specialised homegarden respondents together with the effective extension interventions at ground level would certainly make the specialised homegarden a better agricultural system in Kerala. Hence the study has proven that incorporation of specialisations has undoubtly proven the enhanced productivity of homegardens thereby, bringing about socio-economic welfare of the farming community and the potential benefits derived from the system would further contribute to development of the State.

Summary

CHAPTER 5

SUMMARY

Homegarden is one of the age old forms of sustainable production system where homegarden farmers utilize the available land around their house for poly cropping with a variety of crop components along with or without animal husbandry components or other specialized components like aquaculture, floriculture, sericulture, animal husbandry of their choice for production of various produces based on their household requirements and surplus production, if any for marketing according to market demand. The United Nations General Assembly has declared the year 2014 as International Year of Family Farming, recognizing the importance of this system of farming in conserving biodiversity, household nutritional security, and in maximizing production. The subsistence production system, today has transformed to a means of additional income generation system as a result of commercialisation. The inquisitive homegarden farmer with the introduction of specialized components and hence, this study on specialized homegardens was taken up. Against this background, the present study was undertaken with the following specific objectives.

- To delineate the technology needs, categorize the different dimensions and the risks of specialisations in homegardens.
- The study also aims to delineate extent of horizontal cum vertical integrations, constraints and solutions as perceived by the homegarden farmers incorporating specialisations.

The study was conducted during 2016-2018 in Thiruvanathapuram district in Kerala. A total of 60 homegardens were purposively selected from five agro ecological units wherein different form of specializations could be observed. In addition to it thirty agricultural officers were randomly selected for the study.

The independent variable selected for the study were age, education, occupation, family size, attitude, annual income from homegarden, extension contact, extension participation, effective homegarden area and market orientation.

The technology need assessment of homegarden farmers was worked using a 'three-point ordinal scale' and technology need score was estimated. The dimensions of technology were identified using total and mean total under each dimension for both the categories of respondents. Similarly risk assessment was done on a 'three-point ordinal scale' risk attitude scale developed by New England Small Farm Institute, Cornell University, Belchertown, Massachusetts.

The economics of specialized homegardens was assessed through Benefit-Cost analysis of specialized components in terms of extent of contribution of annual income from specialized components. A constraint index was worked out for identifying the constraints experienced by specialized homegarden farmers. The independent variables were quantified using already existing scales or following established procedures. The data were collected by conducting personal interviews with the homegarden farmers, using well-structured and pre-tested interview schedule developed for the purpose. Percentage analysis, mean, kendall's co-relation coefficient, chi-square analysis, and standard deviation using mean were employed in the analysis of the data and interpreting the results.

The salient findings of the study include

1. Majority of the farmers belonged to middle age category (81.67 %) followed by old age (11.66 %) and young age (6.67%) respectively.
2. Majority of the respondents 43.33 per cent possessed high school level education followed by 36.67 per cent with collegiate level education, fifteen per cent belonged to middle level education and 5 per cent were having primary education.

3. More than 70 per cent of the sampled farmers had a family size of 2-4 whereas only 30 per cent of farmers were having family size 5-6.
4. Majority of the respondents 68.33% belonged to the agricultural sector followed by 20 per cent and 11.67 per cent in private and government sector along with agriculture respectively.
5. More than 60 per cent of the sampled farmers were having low farm income and 40 per cent were having high family income when mean (Rs.193600/-) was used as check in respective agro-ecological units.
6. Majority of the respondents (38.33 per cent) holds an effective homegarden area of 25-50 cents followed by 26.67 per cent holds an area of 50-100 cents and 16.67 per cent with more than 150 cents. Only 10 per cent of respondents possess an homegarden area of 100-150 cents and 8.33 per cent possess an effective area of less than 25 cents.
7. Majority of specialised homegarden farmers *i.e* 60 per cent have medium extension contact. This was followed by 25 per cent of respondents with high extension contact and 15 per cent with low extension contact.
8. About 75 per cent of respondents were occasionally involved in extension activities followed by 18.33 per cent were regularly involved and 6.67 per cent were never involved in any extension activity when mean (21.9) was taken as check.
9. More than 50 per cent (56.67 %) of the total specialised homegarden farmers had high market orientation with the mean score value (18.35) as check.
10. About 48.33 per cent have positive attitude, 40 per cent were not taking sides and 11.67 per cent have negative attitude when mean was taken as check. There exists significant relationship between attitude of different agro-ecological units.

11. The types of specialized homegardens were delineated based on the added components to homegardens primary structure. The animal husbandry components constituted four types of homegardens due to the addends like, livestock including cow, goat, poultry and other animal husbandry components. Other types of homegardens were identified based on specialized components like mushroom, aquaculture, terrace farming, nursery, floriculture and apiary. Other specializations noted were rubber nursery/apiculture, organic tubers, minor horticultural fruits and dominant vegetables.
12. The maximum numeric dominance was observed for coconut (1.89) followed by banana (1.94), rubber (2.32), tapioca (3.45), vegetables (3.67), yams and colocassia (4.22) and arecanut (4.60) respectively in order of their mean scale values. Majority of specialised homegardens (60%) do have more than 4 tiers of horizontal diversification whereas 40 percent have less than 4 tiers of diversification. Similarly, 61.6 per cent have less than 3 levels and 38.3 per cent have more than 3 levels of vertical diversification.
13. Analysis for technology need using chi square analysis it was inferred that among the homegarden respondents all of them had the same levels of technology needs over the dominant crop as specialised component with regard to production, protection and value addition. The need for value addition technologies (1.93) were more when compared to production (2.58) and protection (2.23) in dominant crops. Similarly in animal husbandry components, technologies related to goat (2.00) were unavailable when compared to cow (2.67) and poultry (2.50). Farmers undertaking aquaculture (1.57) and other specialisations (1.75) perceived the need for more technologies compared to crop and animal husbandry components.
14. Characterisation of specialized homegardens based on technological, social and economic dimensions revealed that under the dimensions of technology for economic dimension, the dimensions that felt important by specialised

homegarden farmers and Agricultural Officers were regularity of return (E 5), income generation potential (E 2) and initial cost (E 1). Similarly under technical dimension, the dimensions that felt important by both category of respondents include flexibility (T 12), desirability (T 14) and availability of supplies (T 15). Under environmental dimensions, sustainability (Ev 18) was perceived to be important to both agricultural officers and the respondents. Social acceptability (SC 19) was perceived to be important by both specialised homegarden farmers as well as the agricultural officers. Human resource dimensions that were commonly perceived by both category of respondents include physical labour requirement (HR 26) and skilled labour (HR 27). Psychological dimensions that were important to both the categories of respondents include attitude (P 1). When mean average scores were estimated for all dimensions, economic dimension (2.60) was highest and socio-cultural dimension (2.18) was least.

15. The benefit-cost ratio as perceived by the farmers undertaking specialisations at the time of data enumeration showed that ornamentals derived maximum profit (B:C ratio-3.44) followed by rubber (3.15), livestock –cow (2.76), fruit trees (2.4) and aquaculture (2.15). Extent of contribution of income from specialized components to total homegarden income of the respondent family was worked out and revealed that rubber (98.22%) , livestock-cow (93.24%) and ornamentals (90.57 %) significantly contributed to the total homegarden income.
16. On analysis of risks it was found that maximum risks was for homegarden with floriculture as specialisation (86.41) followed by aquaculture (84.59), poultry (83.33) and the least was observed for banana (68.84) as perceived by the farmers with specialisations. However an analysis of the different type of risk in relation to the different specialisations, it was noticed that for crop based specialisations, protection risks (14.12) was the highest followed by

value addition (10). In case of animal husbandry components, marketing risks (13.65) was highest followed by financial risks (13.14) and for fisheries, financial risks (14.32) was highest followed by protection risks (14.23).For other components, marketing risk (14.32) was highest followed by financial risks (13.57). Further the results of the risk assessment for different specialisations with respect to production, marketing, financial, legal and environmental risks and human resource risks revealed that marketing risks was the highest with a score of 213.72 and legal and environmental risks was perceived to be least with a score of 162.27.

17. Chi-square test revealed there exists no significant difference among specialisations and total risks.
18. Lack of timely and skill based extension service was the major constraint attaining a mean score of 22.9. This was followed by lack of poor harvest and storage facilities (22.8), lack of markets or products of specialised homegarden (22.7), lack of involvement in management (22.6), poor economic status (22.5), low cost of inputs (22.2), poor storage facilities (22.2), lack of awareness (21.9), lack of motivational factors (21.8), interrupted power supply (21.6), non- availability of labour (21.5), non - availability of credit (21.4), inadequate employment opportunities (21.3), lack of technology (19.6) are the constraints in the decreasing order of constraints order in importance as perceived by specialised homegarden farmers.
19. To conclude, if the competent authorities consider the technology needs as perceived by the specialised homegarden farmers and its various dimensions of technology giving due emphasis to the risk encountered in these specialisations and giving thrust to the availing constraints as perceived by the homegarden farmer, then definitely homegardens with inclusion of specialisations will prove to be sustainable and remunerative system.

Suggestions for future research

1. A multidisciplinary research team must explore the prospect of developing farmers practices in homegarden farming systems taking into consideration specialized components like animal husbandry components, sericulture, apiculture, aquaculture etc. in homegardens
2. As this study was concentrated only to the Thiruvanathapuram district, similar studies should be initiated in other parts of the state
3. Research activities must also focus on the value addition aspects and technology pertaining to vertical diversification as well. A handful of small and marginal farmers should also be brought to limelight rather than well established farmers.

Plate 1: Survey of the homegarden farmer with cow as specialisation

Plate 2: Survey of the homegarden farmer with terrace farming as specialisation

Plate 3: Aquaculture as specialisation

Plate 4: Ornamentals as specialisation

Plate 5: Survey of the homegarden farmer with buffalo unit as specialisation

Plate 6: Rubber as specialization in homegarden of Nedumangad

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CHAPTER 6

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Abstract

TECHNOLOGY NEEDS AND RISKS ASSESSMENT OF SPECIALISED HOMEGARDENS

By

SREELAKSHMI. C

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ABSTRACT

TECHNOLOGY NEEDS AND RISKS ASSESSMENT OF SPECIALISED HOMEGARDENS

The study entitled 'Technology needs and risks assessment in specialised homegardens' was conducted at Thiruvanathapuram district covering 60 homegardens with 12 respondents each from the five agro-ecological units. The objective of the study was to delineate the technology needs, categorize the different dimensions and the risk of specialisations in homegardens. The study also focused to delineate extent of horizontal cum vertical integrations, constraints and solutions as perceived by the homegarden farmers who incorporated specialisations in their homegardens.

The personal characteristics (independent variables) of the specialised homegarden farmers include age, education, family size, occupation, annual homegarden income, effective homegarden area, attitude, extension contact, extension participation and market orientation. The technology needs and risk assessment as perceived by specialised homegarden farmers were the other variables of the study.

The maximum crop dominance (numeric dominance) was noticed for coconut (1.89) followed by banana (1.94), rubber (2.32), tapioca (3.45), vegetables (3.67), yams and colocasia (4.22) and arecanut (4.60) in the decreasing order of dominance. The extent of horizontal diversification revealed that 60 per cent of the specialised homegardens had 4 or more than 4 tiers of diversification, whereas 61.6 per cent of the specialised homegardens had less than 3 levels of vertical diversification.

Value addition technology needs (1.93) were more when compared to production (2.58) and protection (2.23) in dominant crops as perceived by the respondents. Similarly for Animal Husbandry components, technologies related to goat (2.00) were more required when compared to cow (2.67) and poultry (2.50). Under the dimensions of technology delineated, economic dimension was felt the most important by both specialised homegarden farmers and Agricultural Officers. Under economic dimension, regularity of returns (E5), income generation potential (E2) and initial cost (E1); under technical

dimension, flexibility (T12), desirability (T14) and availability of supplies (T15); under environmental dimensions, sustainability (Ev18): under socio-economic dimension, social acceptability (SC19); under psychological dimensions, attitude (P 1); under human resource dimensions, physical labour requirement (HR 26) and skilled labour (HR 27) were perceived to be important by both specialised homegarden farmers and Agricultural Officers. There also exists positive and significant relationship between the independent variables *viz.* extension contact and extension participation with technology needs at 1 % level significance.

The benefit cost ratio as perceived by the farmers undertaking specialisations at the time of data enumeration showed that ornamentals derived maximum profit (B:C ratio-3.44) followed by rubber (3.15), livestock - cow (2.76), fruit trees (2.4) and aquaculture (2.15).

On analysis of risks it was found that maximum risks was for homegarden with floriculture as specialisation (86.41) followed by aquaculture (84.59), poultry (83.33) and the least was observed for banana (68.84) as perceived by the farmers with specialisations. However an analysis of the different types of risk in relation to the different specialisations, it was noticed that for crop based specialisations, protection risks (14.12) was the highest followed by value addition (10). Further the results of the risk assessment for different specialisations with respect to production, marketing, financial, legal and environmental risks and human resource risks revealed that marketing risks was the highest with a score of 213.72 and legal and environmental risks was perceived to be least with a score of 162.27. When different types of risk was co-related with independent variables, it was found that extension contact (0.319) and extension participation (0.341) were positively and significantly related with production risks at 1 per cent level of significance. Similarly occupation (0.280) and effective homegarden area (0.279) were positively and significantly related with marketing risks at 5 per cent level significance.

Lack of timely skill based extension service, lack of poor harvest and storage facilities, lack of markets for specialised homegarden products were the primary constraints which needed utmost importance as perceived by the specialised homegarden farmers. Solutions as perceived by the respondents included frequent field visit by extension officials,

provision of subsidies, market cluster approach to increase profit and reduce risks and farmer friendly homegarden suited implements to face labour shortage. However, agricultural officer's primary suggestions include market intelligence-resource pool marketing, nurturing innovation platform, provision of incentives and rewards for performing specialised homegardens for augmenting the specialised homegardens in terms of space all over Kerala. Technology interventions suitable to the specialisations, appropriate dimensions of technology perceived by the farmers along with risk mitigating strategies could definitely make homegardens a well-established agricultural production system. Scaling up of extension activities for promoting specialisations in homegardens by competent authorities combined with effective action from policy makers can enhance the welfare of the farmers and also the economic development of the state.

Appendices

APPENDIX I

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Date: 16-01-2018

Sir/Madam,

Ms. Sreelakshmi.C. (Ad. No. 2016-11-071), the post graduate scholar in the Department of Agricultural Extension, College of Agriculture, Vellayani is undertaking a research study entitled "**Technology needs and risks assessment in specialised homegardens**" as part of her research work. Variables supposed to have close association with the study have been identified after extensive review of literature.

Considering your vast experience and knowledge on the subject, I request you to kindly spare some of your valuable time for examining the variables critically as a judge to rate the relevancy of them. Kindly return the list duly filled at the earliest in the self-addressed stamped envelope enclosed with this letter.

Thanking you,

Yours faithfully

(Dr.Allan Thomas)

OPERATIONAL DEFINITION AND OBJECTIVES OF THE STUDY

In this study a specialized homegarden is operationally defined as an agro forestry farming system with homegarden primary structure supplemented with specialized components like sericulture, apiculture, aquaculture, floriculture, nursery units etc making way for the homegardens to be categorized as subsistence with subsidiary commercial interest and/or made for a particular purpose to the extent that it becomes visibly different from the general types of the traditional types of homegarden farming system.

The overriding objective of the study is to delineate the technology needs,categorise the different dimensions and the risks of specializations in homegardens.The study also aims to delineate the extent of horizontal cum vertical integrations ,constraints and solutions as perceived by the homegarden farmers incorporating specializations.

Please rate the independent variables to be included in the study based on its relevancy from the most relevant to the least relevant by ticking against each variable under the respective rating scale.

Sl. No.	Independent variables	Relevancy rating- R (relevant)				
		Most R	More R	R	Less R	Least R
1.	**Age** –number of years completed by the respondent at the time of investigation.					
2.	**Education** –extent of non-formal or formal learning possessed by the homegarden respondent.					
3.	**Occupation**- the main vocation and other additional vocations that the respondents were possessing at the time of interview					
4.	**Family size**- number of members of either					

	sex living in a household/family dependent on the head of the family					
5.	**Effective homegarden area**-The actual area of homegardens inclusive of the home area in hectare(s)					
6.	**Market orientation**-degree to which a farmer is oriented towards the market in terms of the profit from his homegarden/specialised components and marketing channels					
7	**Extension contribution-** extent of contribution of technology for the specialised components in homegardens as perceived by the homegarden farmers					
8	**Scientific orientation-** extent of awareness/ knowledge of a homegarden respondent in relation to the different scientific recommend ations of the specialised enterprise in the homegarden					
9.	**Labour utilisation-** extent of utilisation of family labour and hired labours for homegarden activities					
10.	**Annual income from specialised component (s) in homegarden-** total annual earnings from the specialised components in the homegarden.					
11	**Livestock possession**-the degree to which respondents possess livestock					

12.	**Homegarden farming experience**-total years of experience in farming.					
13.	**Mass media participation**- degree of exposure to different mass media sources by the homegarden to avail information on specialised components and general farming in homegardens					
14.	**Knowledge on scientific practices in homegarden farming**-Knowledge on horizontal and vertical diversification in homegarden farming					
15.	**Credit availability**-the degree to which respondents are accessible to various credit sources					
16.	**Social participation**-Extent of participation of the homegarden farmer with social and public organizations especially related to agriculture.					
17.	**Extension participation**-homegarden farmers gain a lot of information especially on specialised components by participating in extension programmes organized by developmental agencies and input dealers which would help them in implementing profitable technologies in the homegardens					
18.	**Knowledge**- on scientific practices in homegarden farming and its specialised components					
19.	**Economic motivation**- degree of awareness					

	on incentives (subsidy etc.,) available for home gardens and specialised components in it.					
20.	**Attitude**-degree of positive and negative response of farmer oweing towards specialised and non-specialised farming.					
21	**Extension contribution**-degree with which various extension agencies contribute towards specialised homegardens					

APPENDIX-II

Variables with mean relevancy score

SI NO	INDEPENDENT VARIABLES	MEAN RELEVANCY SCORE
1	Age	**3.97**
2	Education	**3.83**
3	Occupation-	**3.67**
4	Family size	**4.60**
5	Effective homegarden area	**4.58**
6	Market orientation	**3.98**
7	Attitude	**3.68**
8	Extension contact	**4.93**
9	Scientific orientation	2.56
10	Extension contribution	2.98
11	Labour utilisation	1.76
12	Mass media participation	2.07
13	Livestock possession	2.46
14	Homegarden farming experience	2.42
15	Annual income from homegarden	**4.52**
16	Knowledge on scientific practices	2.33
17	Credit availability	2.16
18	Social participation	2.34
19	Extension participation	**4.92**
20	Knowledge	1.96
21	Economic motivation	1.42
	Mean	3.15

APPENDIX-III
INTERVIEW SCHEDULE

1. Mobile/House No.

2.Name of district : 3.Taluk: 4.Village

5.Details of respondent:

SI NO	Name	Relationship with head	Age	Sex	Education	Caste	Income	
							1	2

6.Effective homegarden area (in acres/cents) :

7.Specialised Components in homegarden :

SI NO.	Components	Size	Source of information	Area	Products	Value (Rupees per year)	Utilisation	Extent of specialisation
Specialisations								
1	Terrace garden							
2	Apiary unit							
3	Biogas unit							
4	Compost unit							
5	Aquaculture							
6	Processing unit							
7	Other Components							

8. Attitude towards specialized and non specialized component :

Please state whether you Strongly agree, Agree, Disagree, Strongly disagree with each of the statement pertaining to component.

SI NO	Statement	SA	A	DA	SDA
1	Specialised component becomes different from non –specialised component in terms of high supplementary income				
2	Specialised component becomes visibly different from non-specialised component				
3	Profit from specialised component makes it different from other components				
4	Less effort and easiness in handling do not make component specialised				
5	Specialised component is not focused than non- specialised component				
6	Utility and interrelatedness of other components towards specialised component cannot be measured.				
7	Specia;lised component do not make significant difference.				
8	Risk mitigation became more effective due to specialisation incorporation				
9	More availability of resources caters to focus on one component				
10	Market opportunities make significant difference in specialisations				

9.Livestock components in homegarden:

SI No	Name	Breed	No	Age	Type of product	Yield	Returns	Product used for home
Livestock Cow Goat Buffalo Rabbit Pig Poultry Others								

10.Training received:

SI NO	No of training	Source of training	Duration of training

If yes complete the following tables

S.No	Name of the programme	Convenient time of the training	Place, time of training	Topics on which training was given

11. . Market orientation:

Please state whether you Strongly agree, Agree, Disagree, Strongly disagree with each of the statement pertaining to marketing orientation

S.No	Statement	SA	A	DA	SDA
		4	3	2	1
1	Market proves to be extremely useful to a farmer				
2	Middlemen fetches better market price				
3	Better market facilities can help farmersto get good prices for her produce				
4	One should produce those products which have more market demand				
5	Market news is not so much useful to farmers				
6	Cooperatives help farmers to get better price for farmers				

12. Extension contact

Please state your frequency of contact with different extension workers .

S.No	Extension personal	Frequency of contact		
		Regularly (2)	Occasionally (1)	Never (0)
1	AO of agricultural department			
2	KAU Scientists			
3	Scientists of ICAR institutes			
4	Farm officers			
5	Peers and nears			
6	If any others please specify			

13. Extension participation :

SI NO	Agency	Frequency of visit		
		Regularly	Often	Not Often
KAU				
Krishibhavan				
Commodity board				
Friends and neighbours				

14. Credit Utilisation:

SI NO	Source of loan	Nature of loan	Amount repaid	Purpose of loan	Diversification of fund in case of non-utilisation

15. Technology need assessment

Sl no	Technology related to	Technology not available	Technology available but not applicable	Technology available but not sustainable	Technology available, applicable and sustainable
1	Dominant crops Production Protection Value addition				
2	Animal Husbandry Cow Goat Poultry Others				
3	Aquaculture				

4	Others				

16. Cost-benefit analysis of specialised components in homegardens as perceived by the farmers :

SI NO	Components	Area coverage	Investment per year	Returns per year	
				Home	Sales
1 2 3 4 5					

17.Dimensions for Technology in home gardens :

The items for judgement are rated as effective,moderately effective and least effective as perceived by the homegarden farmers

DIMENSIONS	Very important(3)	Important (2)	Least important(1)
ECONOMIC DIMENSION			
Initial cost			
Income generation potential			
Employment generation potential			
Commercialisation			
Regularity of returns			
Rapidity of returns			

TECHNICAL DIMENSION			
Physical compatibility			
Efficiency			
Trialability			
Complexity			
Predictability			
Flexibility			
Viability			
Desirability			
Availability of supplies			
ENVIRONMENT DIMENSIONS			
Energy saving potential			
Local resource utilisation/recycling capacity			
Sustainability			
SOCIO-CULTURAL DIMENSIONS			
Social acceptability			
Social approval			
PSYCOLOGICAL DIMENSIONS			
Attitude			
Perceived social			

status			
Perceptions of technology			
HUMAN RESOURCE DIMENSIONS			
Family labour			
Hired labour			
Physical labour requirement			
Skilled labour requirement			

18. Risk Assessment :

The items for judgement are rated as high , moderate, low and N/A along with strategies to reduce risks:

Production Risks :

Description of risk	High-1	Mod-2	Low-3	N/A	Strategies to reduce risks
Lack of production experience					
Untested production methods					
Yield variability					
Unpredictable weather					
Lack of equipment or equipment failures					

Marketing risks :

Description of risk	High-1	Mod-2	Low-3	N/A	Strategies to reduce risks
Lack of marketing experience					
Lack of marketing channels					
Role of middle men					
Direct competition					
Indirect competition					
Consumer health and safety concerns					

Financial risks :

Description of risk	High-1	Mod-2	Low-3	N/A	Strategies to reduce risks
Lack of financial management experience					
Lack of capital to invest in needed equip. or other assets					
High debt					
High production to yield costs					
Lack of seasonal operating cash					
Recurring costs					
Insufficient profit to provide adequate pay to owner(s)					

Legal and environmental risks :

Description of risk	High-1	Mod-2	Low-3	N/A	Strategies to reduce risks
Lack of knowledge about legal and environmental issues					
Unsafe conditions for farm workers or customers					
Pollution to or from neighboring property					
Community not "farm friendly"					
Land development pressures					

Human Resource Risks :

Description of risk	High-1	Mod-2	Low-3	N/A	Strategies to reduce risks
Lack of farm management experience					
Sick or injured farm labor or managers					
Lack of appropriate labor resources					
Lack of appropriate timely labor resources					
Competing goals among farm family members or partners					
Any others- specify					

19. Constraint Analysis :

Sl.No	Constraints	Rank
1	Low cost of inputs	
2	Non availability of labour	
3	Inadequate employment opportunities	
4	Lack of technology	
5	Non availability of credit	
6	Lack of poor harvest facilities	
7	Lack of extension service	
8	Lack of involvement in management	
9	Lack of awareness	
10	Poor economic status	
11	Lack of markets or products of homegarden	
12	Lack of motivational factors	
13	Poor storage facilities	
14	Interrupted power supply	
15	Lack of time in homegarden activities	
16	Others (specify)	

APPENDIX-IV

The operationalisation of selected dimensions of technology in homegardens

1 Initial cost

It is defined as the initial investment that covers all the costs of a technology enterprise that has to be accepted for adoption by the homegarden farmers.

2 Income generation potential

It is the ability of a technology to generate additional income in the homegardens under the existing conditions.

3 Employment generation potential

It is the ability of a technology to generate employment opportunities.

4 Commercialisation

It is the ability of technology to commercialise the new innovation

5 Regularity of returns

It is defined as the capability of a technology to generate returns on a regular basis in the homegardens.

6 Rapidity of returns

It is defined as the temporal ability of technology to ensure immediate or quick returns to the homegarden farmer on use of the technology.

7 Physical compatability

It is defined as the temporal ability of technology to ensure compatability among the existing conditions

8 Efficiency

It is defined as the degree to which the successful results of a technology used in could be effective homegarden could be effective

9 Trailability

It is the perception by an individual about the degree to which an innovation is easy to be experimented

10 Complexity

It is defined as the extent of adequate and timely availability of technology is difficult to understand and use.

11 Predictability

It is defined as the perception by the individual about the future relevance as a result of adoption of a technology

12 Trailability

It is the perception by an individual about the degree to which an innovation is easy to carry out a number of times

13 Efficiency

It is defined as the degree to which the successful results of a technology used in the homegarden can be effective

14 Local resource utilisation

It is defined as the capacity of the technology used in the homegarden to make best use of the available resources of the homegarden for productive purposes.

15 Sustainability

It is defined as the degree to which a technology fits in most appropriately with ones homegarden conditions or its environment without causing any problem to his or her surroundings.

16 Social acceptability

It is defined as the degree to which a technology for homegarden is considered useful, practical and feasible by the majority of the members of a social system.

17 Social Approval

It is defined as the perception by an individual about the degree to which an homegarden farmer would achieve the approval of others and gains in prestige or esteem by adopting a particular technology.

18 Complexity

It is defined as the extent of adequate and timely availability of technology is difficult to understand and use.

19 Availability of supplies

It is defined as the adequate amount of timely availability of supplies required for the right and efficient use of any homegarden technology.

20 Social acceptability

It is defined as the degree to which a technology for homegarden is considered useful, practical and feasible by the majority of the members of a social system.

21 Social Approval

It is defined as the perception by an individual about the degree to which an homegarden farmer would achieve the approval of others and gains in prestige or esteem by adopting a particular technology.

22 Attitude

It is defined as the positive or negative feeling of the homegarden farmer towards a specialization that is to be used in homegarden.

23 Perception of technology

It is defined as the clear understanding on selection, organisation and interpretation of a technology to be used by a homegarden farmer in a situation according to prior learning, activities, interest, experiences etc.

24 Family Labour

It is defined as the perception by an individual about the extent of family labour involvement or participation in practising a technology in the homegarden

25 Hired Labour

It is defined as the perception by an individual about the extent of hired labour involvement or participation in practising a technology in the homegarden

26 Physical labour requirement

It is defined as the perception by an individual about the extent of physical labour involvement or participation in practising a technology in the homegarden

27 Skilled Labour requirement

It is defined as the perception by an individual about the extent of skilled labour involvement or participation in practising a technology in the homegarden.

APPENDIX-V

CORRELATION MATRIX

	Technology needs	Production risk	Marketing risk	Financial risk	Legal & Env risk	Human resource risk
Age	-0.2004	-0.10633	-0.0156	-0.0591	0.11996	-0.0219
	0.1248	0.4188	0.9057	0.654	0.3613	0.8679
Family size	0.0055	-0.19872	-0.1832	-0.0831	-0.0563	-0.1554
	0.9667	0.128	0.1612	0.5278	0.6694	0.2359
Education	0.16387	-0.12394	-0.0106	-0.1398	0.03819	0.11766
	0.2109	0.3454	0.9361	0.2866	0.772	0.3706
Occupation	-0.1991	-0.05149	0.28099	0.14386	0.30673	0.37996
	0.1272	0.696	0.0296	0.2728	0.0171	0.0027
Annual income	0.16309	0.20458	-0.0179	-0.123	-0.2219	-0.1839
	0.2131	0.1169	0.8921	0.3493	0.0883	0.1597
Total homegarden income	0.21455	0.22598	0.14678	0.03964	-0.1118	0.01811
	0.0997	0.0825	0.2631	0.7636	0.395	0.8908
Specialised homegarden income	0.09095	0.12551	-0.0547	-0.1674	-0.2051	-0.1565
	0.4895	0.3393	0.6782	0.2012	0.116	0.2326
Effective homegarden area	0.21798	0.23784	0.27994	0.11425	0.12358	0.01432
	0.0943	0.0673	0.0303	0.3847	0.3469	0.9135
Attitude	0.15332	0.31947	0.14552	0.18861	-0.15	0.0936
	0.2422	0.0128	0.2672	0.149	0.2526	0.4769
Market orientation	-0.0372	0.02844	-0.0238	0.03075	0.04466	-0.039
	0.7775	0.8292	0.8569	0.8156	0.7348	0.7674
Extension contact	0.26363	0.25998	0.14326	0.10178	-0.2191	-0.137
	0.0418	0.0448	0.2748	0.439	0.0925	0.2965
Extension participation	0.35013	0.34148	0.2122	0.30112	0.01602	0.01801
	0.0061	0.0076	0.1036	0.0194	0.9033	0.8913

APPENDIX-VI

Chi-square table for technology needs related to dominant crops

Table value of χ^2 @ 0.05			21.0261
		0.01	26.217
Degrees of freedom			12
1	Production	χ^2	**0.28422**
2	Protection	χ^2	**0.59427**
3	Value addition	χ^2	**0.06047**