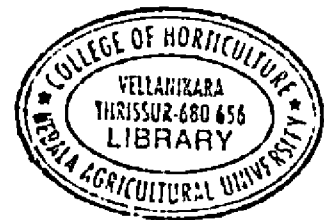


**EFFECTIVENESS OF KERALA AGRICULTURAL
UNIVERSITY IN TECHNOLOGY FACILITATION
FOR ENTREPRENEURSHIP**

By

L. D. LEAROU

(2014-11-212)



THESIS

**Submitted in partial fulfilment of the
requirement for the degree of**

MASTER OF SCIENCE IN AGRICULTURE

Faculty of Agriculture

Kerala Agricultural University



DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR – 680656

KERALA, INDIA

2016

DECLARATION


I, L. D. Learou (2012-11-212), hereby declare that the thesis entitled “Effectiveness of Kerala Agriculture University in technology facilitation for entrepreneurship” 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.

Vellanikkara
27-02-2017

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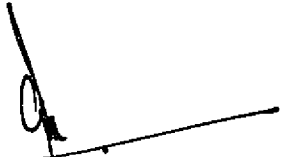
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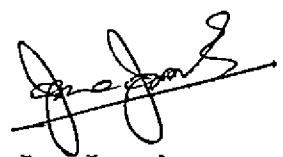
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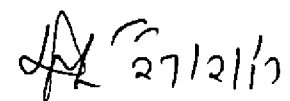
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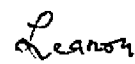
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L.D. Learou

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LIST OF ABBREVIATIONS

ABI	-	Agri Business Incubator
ACABS	-	Agri-clinic Agribusiness Scheme
ACCER	-	Academy for Climate Change Education and Research
AMOSE	-	Agro Machinery Operations Service Executives
AR & T	-	Agriculture Research and Training
AINP	-	All India Network Project
AO	-	Agriculture Officer
CCBM	-	College of Cooperation, Banking and Management
CTI	-	Central Training Institute
DoR	-	Director of Research
ECOCASD	-	Ecosystem Conservation, Climate Change and Sustainable Development
ESAF	-	Evangelical Social Action Forum
EU	-	European Union
FSSAI	-	Food Safety Standard Authority of India
FRC	-	Faculty Research Council
GSK	-	Glaxo Smith Kline
GI	-	Geographical Indications
ICAR	-	Indian Council of Agricultural Sciences
IDM	-	Integrated Disease Management
IPR	-	Intellectual Property Rights

KAU	-	Kerala Agricultural University
KVK	-	Krishi Vigyan Kendra
KCAET	-	Kelappaji College of Agricultural Engineering and Technology
KSIDC	-	Kerala State Industrial Development Corporation
LLP	-	Limited Liability Partnership
MANAGE.	-	National Institute of Agricultural Extension Management
MRL	-	Maximum Residue Limit
MoU	-	Memorandum of Understanding
NABARD	-	National Bank for Agriculture and Rural Development
NGO	-	Non-Governmental Organization
NSTEDB	-	National Science and Technology Entrepreneurship Development Board
PG	-	Post Graduate
PI	-	Principal Investigator
PoP	-	Package of Practices
RAWE	-	Rural Agricultural Work Experience
RARS	-	Regional Agricultural Research Station
SAU	-	State Agricultural University
SFAC	-	Small Farmers Agribusiness Consortium
SHG	-	Self Help Group
ToT	-	Transfer of Technology
UG	-	Under Graduate
UGC	-	University Grants Commission

USA - United States of America
VAT - Value added Tax
ZREAC - Zonal Research and Extension Advisory Council

I. Introduction

“My greatest strength as a consultant is to be ignorant and ask a few questions”

– Peter F. Drucker

‘Surreal’ is named 2016 Word of the Year. Donald Trump’s upset win in the U.S. presidential election astonished people so much that they rushed to the dictionary to look up the word everyone was using to describe the event. Surreal was their choice. Merriam-Webster’s dictionary has named ‘surreal’ its ‘Word of the year 2016’, the honour given to the word or term with the sharpest spike in look-ups over the previous year. By definition, the word surreal refers to phenomena marked by the intense irrational reality of a dream. Stephen Bannon, who led Donald Trump’s campaign to give him an unexpected win the U.S. presidency, had seen the victory of Sri. Narendra Modi in the 2014 national election of India as the beginning of a global revolt against a capitalist system that had lost its moral moorings and has turned against the working class and the middle class. Bannon argued that entrepreneurial capitalism has declined, even as State capitalism and corporate capitalism took over. According to Bannon the success of capitalism in providing prosperity to people was due to the beliefs of its pioneers. But now, under global corporatist capitalism, people are looked at as commodities. The corporatists garner all the benefits for themselves. Bannon’s politics involved rescuing capitalism from corporations and State power. And that phenomenon is really a global revolt that propelled the victories of Brexit and Trump (George, The Hindu, 16 Nov. 2016).

India’s economy grew 7.1 per cent in the first quarter of 2015-16, slowing from 7.9 per cent a year earlier. Jobless economic growth continues to haunt India’s youth, with the country’s unemployment rate rising to a five-year high of five per cent in 2015-16, according to the latest annual household survey on employment

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conducted by the Labour Bureau. The country's unemployment rate, as measured by the bureau stood at 4.9 per cent in 2013-14, 4.7 per cent in 2012-13 and 3.8 per cent in 2011-12. Female job seekers were the worst hit as the pace of unemployment rose sharply to 8.7 per cent in 2015-16 (Jha, 2016). Secure jobs in government are no longer a hope for the Indian youth. Moreover, according to the Hay Group division of Korn Ferry, India has seen a salary growth of just 0.2 per cent since the great recession eight years back, while China recorded the largest real salary growth of 10.6 per cent during the period under review (The Hindu, 16 Sept. 2016). The time is ripe for a major thrust on entrepreneurship.

According to the Wealth X report the number of dollar millionaires in India in 2014 rose to 2.5 lakh from 1.96 lakh in 2013, an increase of 27 per cent. The report also predicted that India will have 4.37 lakh millionaires by 2018, and potentially double that number by 2023. Terming the next 10 years as 'India's decade', the report said that the nation also has a young, well-educated population with high levels of entrepreneurship and business ownership, underpinned by a well-developed legal system that in turn would help in wealth creation. The report attributed this rise in millionaires and conspicuous consumption to "renewed economic optimism and performance, further propelled by the election of a new, reformist government" (Raghavan, 2015).

World Bank Doing Business reports, introduced in 2004, review business regulations and their enforcement across 190 countries. The latest edition which takes into account developments up until June 1, 2016, indicates that India has improved its position to 130 in the World Bank Ease of Doing Business 2017 report. The report said that the Government of India has embarked on a fast-pace reform path. It scored well on protecting minority investors and is one of only six economies in the world that earn the highest possible score on the extent of shareholder rights index, which

measures shareholders' rights in corporate governance (George, The Hindu, 26 Oct. 2016).

As per the World Bank ranking, Kerala had dropped two rungs to the 20th position among States in terms of ease of doing business (The Hindu, 19 Nov. 2016). The ease of doing business in the State may improve significantly with the government set to introduce a slew of measures to take effect by January 2017.

There has been a definite shift to e-business models. Nasscom and Akamai Technologies in their 'The Future of Internet in India,' report state that there were about 330 million Internet users in the country as on December 2015. They predict that the number of Internet users in India is likely to more than double to 730 million by 2020. India, which has an internet user base next only to China, will remain the fastest growing market and 75 per cent of the new users would come from rural areas (The Hindu, 18 Aug. 2016).

The SME Business Environment Index found that India has among the strongest small and medium-sized enterprises sector in the Asia Pacific region but poor infrastructure and insecurity over government regulations are a dampener. The report however stated that business owners feel positive about their ability to respond to changes and adapt to new situations (The Hindu, 1 Aug. 2016).

The National Science and Technology Entrepreneurship Development Board (NSTEDB), was established in 1982 with the aim of promoting knowledge-driven enterprise. A part of this effort goes into inculcating the spirit of entrepreneurship in educational institutions. There are various schemes and programmes under which support is offered to colleges that wish to cultivate the entrepreneurial instinct in their students. The schemes include support for entrepreneurship awareness camps, faculty development programmes, technology business incubators and so on (Desikan, 2016).

KAU has made specific interventions towards enhancing entrepreneurship amongst the people. A few of the most significant interventions are detailed below:

Rural Agricultural Work Experience (RAWE) Programme

KAU is distinct in employing innovative techniques in teaching and pedagogy. The University follows a unique model spearheading learning of agriculture as an art, science and business. Unlike conventional dependence of classroom system, the students are given an opportunity to experience in their field of interest through a six-month experiential learning programme. This programme enables students to gain hands-on experience as well as develop their entrepreneurial skills. This programme empowers the student community in enhancing their trouble shooting skills. The Rural Work Experience Programme (RAWE) is also an entire six months' period set apart to provide the students an exposure to the real-time farm situations so as to have a thorough understanding of the rural scenario and problems encountered in adoption of technologies. Building self-confidence in the agricultural graduates by honing their professional skills is the key objective of this programme. The entire programme is split into eight modules through which the students are exposed to the current and emerging opportunities and challenges in agriculture and rural development. Farm Planning, Watershed Development Programme, Entrepreneurship Development Programme, Agro-clinics, Krishi Bhavan training, Research Stations & KVKs training, NGO training and Village Stay are the main modules of the RAWE programme. During the village stay, the students stay along the rural households for a fortnight, which provides a rare opportunity to rediscover the farmer. Besides acquiring first hand field experience, the RAWE programme brings about positive changes in the students' mind-set, outlook, personality, managerial and entrepreneurial skills.

Food Security Army

Food Security Army aims at creating a technically competent and professional group to operate various agricultural machineries suited to different crops. Cadets are recruited into the Food Security Army / Paddy Regiment / Coconut Regiment / Vegetable Regiment and / or as Agro Machinery Operations Service Executives (AMOSE). Presently the focus is on Total Paddy Mechanization, Mechanized Paddy transplanting, Plant Security Special Task Force, Mechanical Coconut Climbing, Coconut Crown and Basin Force, Vegetable Mechanisation and Small Farm Mechanisation Force. Nearly 1500 people have been trained in Kerala. People from Andaman & Nicobar Islands, Karnataka, Tamil Nadu and Andhra Pradesh have also been trained to form their own regional regiments. The Food Security Army training given to youth who devote themselves to serve the primary sector is a unique programme through which the renaissance of agricultural sector is being realized. More than two hundred batches of the Food Security Army have been trained in operation, maintenance and servicing of farm machinery.

Green Cadet Corps

Green Cadet Corps is a corps of disciplined and dedicated school students who are given basic input on soil, water, plants, climate and the need for production of food in harmony with conservation of these resources. They imbibe the notion that even if they do not become a doctor, engineer or IT professional, they can contribute to the society in no less a way by being the food providers of tomorrow. Self-esteem, punctuality, discipline and dedication are values imbibed through the programme.

Vocational Training

Apart from student education, KAU scientists are involved in a series of informal education programmes like vocational trainings. Long and short duration training programmes are given to rural youth, house wives and agri entrepreneurs to enhance their knowledge and skill in agriculture and allied subjects. The Central Training Institute (CTI) functioning under the Directorate of Extension at Mannuthy facilitates training activity for various categories of stakeholders.

Agri-clinic and Agri-business Scheme

Agri-clinic and Agri-business scheme was a unique programme launched in 2002, by the Ministry of Agriculture, Government of India, with National Bank for Agriculture and Rural Development (NABARD), Small Farmers Agribusiness Consortium (SFAC) and National Institute of Agricultural Extension Management (MANAGE) to inculcate better methods of farming through educated and unemployed Agri graduates to the farming community. Agri-clinics are envisioned to give expert services and advice to farmers on cropping practices, dissemination of technology, crop protection from pests and diseases, market trends and prices of various crops in the markets and clinical services for animal health, etc. which would improve productivity of crops/animals. Agri-Business Centres are established by trained agriculture professionals, they maintain and hire out farm equipment, sell inputs and provide other allied agriculture services such as including post-harvest management and market linkages for income generation and entrepreneurship development. Agri-clinics and agri-business scheme aims to expertise available in large pool of graduates in agriculture and allied sectors. MANAGE as the nodal agency scheme was implemented. Specialized training imparted to unemployed graduates in Agriculture and allied areas like Horticulture, Sericulture, Veterinary Sciences, Forestry, Dairy, Poultry Farming, Fisheries. This helps them to become self

employed by obtaining loans from banks and provide extension services directly or indirectly to the farming community. This scheme aims to help Agriculture graduates, whether fresh graduates or experience or currently employed graduates can start their own Agri-clinic or Agri-business Centres. Government helps in providing start-up training to the graduates in Agriculture, Horticulture, Sericulture, Veterinary Sciences, Forestry, Dairy, Poultry farming, Fisheries, etc.

Agri Business Incubator

The Agri Business Incubator (ABI) at Kelappaji College of Agricultural Engineering and Technology (KCAET), Tavanur is a pioneering incubation centre launched in 2013 encompassing agri-market-oriented development plan that seeks to improve farmer's livelihoods through agri-business incubation. The components include mentoring support in business and technology plans, entrepreneurship cum skill development, identification of appropriate technology, hands on experience on processing machineries, product development (process protocols for various value added products) projects report preparation, marketing assistance, professional assistance to make the enterprise successful and achieve higher growth. The centre at KCAET, Tavanur has provided entrepreneur support to several food processing industries. The ABI also conducts regular workshops on entrepreneurship development in food processing sector to potential food entrepreneurs.

KAU Technology Hub, CTI, Mannuthy

Initiated in 2014, this facilitates technology consolidation, incubation, dissemination, consultancy and hand holding for start-up ventures and entrepreneurs. It serves as a meeting place of science, technology and business where Public Private Partnerships are also being explored. The KAU Technology Hub has effectively represented KAU at the Global Agri Meet 2014 and the Young Entrepreneurs

Summit 2014. The KAU Technology Hub liaisons to offer professional guidance and support for potential investors through a comprehensive set of services that include developing business ideas, identifying viable projects and hand holding consultation during the implementation stage.

The KAU Technology Hub functions from the Central Training Institute (CTI), Mannuthy. It has taken a lead role in the process of consolidation and showcasing of KAUs technologies. The KAU Technology Hub offers professional guidance and support for potential investors in agri-business sector. Around 50 technologies have been processed, refined through discussions and provided with a ready-to-use set of business plans. The technologies selected were suited for different categories: big entrepreneurs who need large initial investments, medium business investors, and some were for unemployed youth, women, and self-help groups (KAU, 2014).

Today, entrepreneurship is often equated with business startups. In the last five years, KAU has very few start-ups by alumni. The few include, Sijin B.T., alumnus of the College of Cooperation, Banking and Management (CCBM), Vellanikara ventured into 'LIWING' - an innovative performance management company. LIWING who helps businesses, non-business organizations and human beings to perform the maximum with minimum investment and intervention. The leadership of LIWING includes India's leading innovative thinkers and managers. The uniqueness of LIWING is its ability to influence positively and use bold thinking to solve complex societal and business challenges. LIWING delivers rapid, sustainable results to any type of business. LIWING always works with the partners for making desirable performance changes. LIWING specializes in People Management, Perception Management and Profit Management. The services offered include mentoring, training, employee branding, employee engagement, business

transformation, creative consultancy, business consultancy, marketing solutions (LIWING, 2016).

Shijit Kumar alumnus of CCBM, Vellanikkara launched Kaizen Agro Solutions and Farm Machinery Consultancy in the year 2013. The venture facilitates custom hiring of farm machinery and provides consultancy services, thus saving small and marginal farmers from investing huge amounts in machinery. The venture was started under the Agri-clinic Agribusiness Centre (ACABC) of NABARD.

Arun Aravind and Abhilash Gopal alumni of CCBM, Vellanikkara initiated a consultancy christened Progress Planners Financial Solutions LLP during 2015. The firm concentrates on activities auxiliary to financial intermediation.

That being so, it must not go unmentioned that one of the most successful startups in the recent history of Kerala is the Evangelical Social Action Forum (ESAF) that is headquartered at Mannuthy and whose founder is an alumnus of KAU.

Objectives of the study

The objectives of the present study were:

1. To study the entrepreneurship orientation of teachers in the Kerala Agricultural University (KAU)
2. To document the experiences of aspiring/practicing agri-entrepreneurs in relation to KAU
3. To suggest reforms to foster a better entrepreneur interface for the Kerala Agricultural University and integration of teaching and research for technology facilitation of entrepreneurship

Scope of the study

When it comes to academics, Kerala Agricultural University (KAU) has been adjudged best in the nation for five years in a row (2007-11). Undoubtedly KAU has a pool of very good teachers. But how does this translate into technology facilitation for entrepreneurship? Some of the questions that this study proposes to address are: How oriented are KAU teachers in converting research output into entrepreneur usable technology? Is there a need for a change in the mind set? Are teachers keeping the technology to themselves for fear that once released they will never get due credit for the effort they have put in? Are intellectual property rights at stake? Is innovation duly rewarded? Where does KAU stand on ease-of-doing business parameters? What issues need to be addressed to make KAU gain the status of being an entrepreneur friendly destination? Can technology transfer procedures be simplified? Is there a mechanism for aspiring entrepreneurs to redress their grievances? The study will provide insight on how KAU can reinvent itself to remain relevant in the changing agricultural scenario.

Limitations of the study

The study was a part of master's research programme of the student and it had all the limitations of time, money and other resources. Further, the study was based on perceived opinions of the respondents in which there was chance of personal bias.

Organisation of the Thesis

The thesis has been arranged in five chapters. The first chapter is an introduction that highlights the objectives, scope and limitations of the study. The second chapter gives an outlook of the literature relevant to the objectives of the study. Methodology of the study is presented in the third chapter, which includes

research design, location of the study, selection of the respondents, selection of variables for the study, operationalization and measurement of the variables, tools used for data collection and statistical methods used for analysis of data. The fourth chapter deals with the results and discussion of the study and the fifth chapter summarizes the major findings and conclusion drawn from the study. References, appendices and abstract are furnished at the end.

Review of literature

2. Review of Literature

The objectives of the study were as follows:

- To study the entrepreneurship orientation of teachers in the Kerala Agricultural University (KAU)
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- To suggest reforms to foster a better entrepreneur interface for the Kerala Agricultural University and integration of teaching and research for technology facilitation of entrepreneurship

The review of literature was prepared under the following sub heads:

2.1 Entrepreneurship – the concept and its nuances

2.2 Profile Characteristics of the respondents

2.1 Entrepreneurship – the concept and its nuances

The term entrepreneur is derived from French word '*entreprendre*' which means 'to undertake'. It was first used by Cantillon (1755) who was a French economist. He defined entrepreneur as an agent who buys factors of production at certain prices in order to combine them into a product with a view to selling the product at certain prices in future.

Say (1827) differentiating between entrepreneurs and a capitalist, said that capitalists are financiers while entrepreneurs are organizers. He also stated that an entrepreneur, is one who co-ordinates, organizes and oversees activities. Entrepreneurs combine the land owned by one person with the finance owned by

another person and the labour of yet others to produce and make profit by selling the produce.

According to Cole (1949) entrepreneurship comprises any purposeful activity that initiates, maintains or develops a profit-oriented business in interaction with the internal situation of the business, or with the economic, political and social circumstances surrounding the business.

Cole (1959) described an entrepreneur as a decision maker.

Schumpeter (1965) defined an entrepreneur as a person who exploits opportunities in the market through scientific/technical and organizational innovation.

Johl and Kapur (1973) defined entrepreneur as one who organizes and operates his business and is responsible for the losses and gains from his business.

Agarwal (1975) defined an entrepreneur as someone who has the ability to identify resources, to distinguish their economic potential and the capability and enthusiasm to exploit these resources for their development.

Watkins and Allen (1987) defined entrepreneurship as an attribute correlated with individuals who have the drive and the potential to acquire and handle a variety of inputs essential for undertaking a business.

Dixit (1988) conceptualised an entrepreneur as one person who catalyses resources and risks managing them to establish a workable environment for employment.

According to Khan (1992) entrepreneurs should be men of skill, experience, dexterity, expertise and flair.

Entrepreneurship orientation has been considered the first and foremost parameter to bring change in rural development of Slovenia (Mesl, 1996).

Rekha (1998) found out that students of the Agricultural Engineering College had higher perception of entrepreneurship, followed by students of the Veterinary College, the College of Agriculture and none from Home Science College. It also stated that age was significantly correlated with organizational ability and managerial skill. Further, it was suggested to organize entrepreneurial motivational training and group discussions especially for internship students.

Entrepreneurial orientation is the propensity of someone to be innovative, take risk and be proactive. Such people can influence performance of the firms (Wiklund, 1999).

In a study conducted by Prasad (2001), agricultural students' entrepreneurial orientation was found to be at the medium level for 52 per cent and only 10 per cent were found to at the high level.

Khanka (2002) defined an entrepreneur as one who creates new things, organizes production and is ready to take risks involved in the enterprise and defined entrepreneurship as a process involving various activities undertaken to start an enterprise.

Narayan (2002) conceptualized entrepreneurship as a purposeful activity aimed at initiating, promoting and maintaining economic activities for the production and distribution of wealth. He also reported that majority of the respondents 63.33 per

cent had high level commitment of their enterprises and 36.67 per cent had medium level commitment.

Ahire (2003) revealed that the universities have well experienced, highly qualified and committed teachers, but lack in training for entrepreneurship.

Bheemappa (2003) defined entrepreneur as an innovator who introduces something new into the economy. Under uncertain conditions they are able to take calculated risks, make wise decisions and invest in business and defined entrepreneurship as multi-dimensional variable encompassing financial, managerial and functional aspects of an enterprise.

Entrepreneurship is creating innovations, bringing change and improvement in competition (Davidsson, 2003)

Srivastava (2005) found that experienced and qualified teachers were available in the college, but were not properly trained in the educational technology. Teachers had medium levels of attitude and achievement towards their profession and they also lacked in instructional skill.

Niskanen (2006) observed that forest owners only tried to improve the recreational, environmental and aesthetic benefits from their forests rather than economic welfare, which becomes a challenging factor for entrepreneurs to develop their enterprise especially access to international markets. They were not able to understand consumer preferences too. The major barrier faced by the entrepreneurs in that area was the lack of entrepreneurial thinking and market orientation.

Paul and Sharma (2007) observed that the respondents had excellent degree of dedication and time keeping in enterprises, which were followed by market

orientation and technical background, but they were very low in goal setting, planning for the future, accepting challenges and were not able to tolerate failure, nor be competitive. Overall performance of entrepreneurial behaviour of the poultry farmers was found to be very low.

An entrepreneur is an economic man who strives to maximize his profit by adopting innovation (Shirke *et al.*, 2007).

Eglite (2008) states that entrepreneurs were facing problems in purchasing raw materials, different government policies and labour shortage. But with the support of European Union and government, they were able to promote their agri-entrepreneurs.

Nybakk (2009) defined an entrepreneur as the one who tries to identify the opportunities and is willing to take the risk to make changes in the service they provide.

A study conducted by Rena (2009) stated that entrepreneurship was to accelerate economic development especially in rural areas. Entrepreneurial orientation can be stimulated by local entrepreneurial talent and it will lead to subsequent growth of enterprise. This will also create job opportunities for the local people and help in adding economic value to the area/community. It will help to keep the scarce resources within the area/community.

Mehta *et al.*, (2011) describe an entrepreneur as someone who has new ideas, who is directly related with the creation of employment and helps in improving their financial status leading to growth and development.

Entrepreneurship is the art of combining innovation, finance and business expertise into profitable goods (Upadhyay 2011).

Vehkamäki *et al.*, (2011) examined entrepreneurial characteristics of South Ostrobothnia, Finland, and found that entrepreneurship grew between the year 2003 and 2009. As a result, farm size, herd size and milk production were more in 2009 compared to 2003. Educational level, professional qualities had improved and half of the entrepreneurs were developing their enterprises actively.

Kahan (2012) states that an entrepreneur is someone who produces for the market. He is an inventive leader, always seeking for opportunities to expand and improve his business. He takes calculated risks and owns the responsibility for both profits and losses.

Ezeibe *et al.*, (2013) states that entrepreneurs are risk takers who employ themselves in the uncertainties of creating new ventures, trying to generate something from nothing by putting together an exclusive or exceptional package.

A study conducted by Hosseini and Eskandari (2013) found out that business owners with higher entrepreneurial orientation were more pro-active, innovative, took risks and were found to be performing better in the market.

For encouraging economic activity, small entrepreneurs play a very important role in creating employment opportunity and helping to raise the standard of living. Women, especially if they were self-employed by starting their own enterprises, became independent and could support their family financially. But most of the women faced problems because they were not aware about the latest information regarding credit sources and other business support, had no proper place for starting their enterprises and lacked management skill. (Temengen and Wodajo, 2013).

Gondkar and Singh (2014) conducted an analysis of problems faced by agri-entrepreneurs and in the study, they found out that for a farmer to start enterprises, the cost involved for procuring technology was a problem, proper credit facilities were not available, lack in market information, fluctuation of price both in national and international market.

A study conducted by Hari and Chander (2014) stated that in villages, the farming sector acts as an important source for entrepreneurship development. So, development of agri-preneurs was necessary.

An entrepreneur is the one who tries to change a product into a better one by incorporating his ideas such that he will have complete control over the new product (Nagesh and Halakatti, 2014).

Mason and Gos (2014) stated that entrepreneurial orientation was very important, as it practically and theoretically played a significant role.

Patel *et al.*, (2014) revealed that entrepreneurial behaviour of majority of the respondents was medium, followed by high and low level entrepreneurial behaviour. Economic motivation, market orientation, education, scientific orientations were all positively and significantly related with entrepreneurial behaviour.

Perlines (2014) examined that entrepreneurial orientation in terms of innovativeness, pro-activeness, and risk bearing ability for agri-food cooperatives was found to be positively related to export activities.

Pisure *et al.*, (2014), in a study conducted in Latur district of Maharashtra showed that independent variables like education, social participation had positive

correlation and were found to be highly significant whereas occupation and family size were non-significant with entrepreneurial behaviour.

Sharma *et al.*, (2014) conducted a study on entrepreneurial behaviour of potato grower in Kohima district, Nagaland. The study showed that majority of the respondents had medium level of knowledge, scientific orientation, decision making, market orientation and economic motivation.

Yadav *et al.*, (2014) evaluated entrepreneurial behaviour of the farm women in vegetable enterprise of Mandi district, Himachal Pradesh and found that majority of the respondents had low to medium levels of management orientation, economic motivation, risk orientation, self-confidence, moderate to high level of achievement motivation and leadership ability. Majority of the respondents were in the low-level category when it came to utilization of available assistance. However, 92 per cent had low overall entrepreneurial behaviour.

Valencia *et al.*, (2014) studied entrepreneurial skills for start-up entrepreneurs in age group 18 to 29 years of Mayan region, Campeche, Southeastern Mexico. The study found that those youths were not able to take full advantage even though they were having the qualities for starting an enterprise, as they were lacking in technical skill and required professional and vocational training. The study also suggested identifying those individuals in an institution who have the entrepreneurial skills and encouraging them to start enterprises and providing them with all necessary training and information.

Avhad *et al.*, (2015) found that almost three-fourth of the respondents 72.50 per cent belonged to medium level in entrepreneurial behaviour, followed by 14.17 per cent in the high and 13.33 per cent in the low level.

According to Ginting (2015) the global scenario demands entrepreneurs who are innovative and proactive, who have the ability to take risks which uncompromisingly seek to compete with others. For adding value in agro-industry an entrepreneur needs to have the ability to create a new product based on consumer preference, utilize hitherto unutilized materials and have a proper link with other external parties to become successful in business.

Joshi (2015) found that middle-aged groups were more oriented towards entrepreneurship and highly committed towards their business.

Kharga *et al.*, (2015) define entrepreneurship as a process which involves innovation, profit maximization and entrepreneur capacity to bear risk.

Makhijani *et al.*, (2015) observed that 40 per cent of the respondents faced problems like lack of credit facilities, 32 per cent respondents faced problems like inaccessibility to place of work. Other problems faced by the agri-entrepreneurs were in appropriate marketing places, lack of transportation facilities and complex loan procedure.

An entrepreneur is one who organises, operates and assumes the risk in a business venture in an expectation of making a profit (Oxford Dictionary, 2015).

Seilov (2015) said that customer and competitor orientation of small hospitality enterprises in Kazakhstan were found to have positive relationship with entrepreneurial orientation.

Sreeram *et al.*, (2015) conducted a study in Palakkad district of Kerala on study the entrepreneurial behaviour of Kudumbashree members. The study shows that age and credit orientation has no significant relationship whereas education,

income, mass media exposure, social participation, training received, extension contact, marketing facilities, value orientation and management orientation were significant and have positive relationship with the entrepreneurial behaviour.

Subadi and Dewi (2015) found that project-based learning improved student's entrepreneurial profile. They were able to implement strategic procedures, evaluate progress and thus becomes more responsible in taking up initiative.

Micheels and Boecker (2016) found that those agri-businesses who were entrepreneurial and market oriented adopted new improved technology and providing better services or products.

Nikraftar and Hosseini (2016) observed that individual effectiveness, past understanding and social networks have positive effects on entrepreneurial activities, which also give better opportunities in entrepreneurial recognition.

Saadi *et al.*, (2016) showed that social capital had a positive significant impact on rural women entrepreneurial orientations in Islamabad.

Sikora *et al.*, (2016) examined entrepreneurial orientation and learning orientation and found that both have a positive and significant effect on financial performance.

2.2 Profile Characteristics of the respondents

The term profile characteristic of the respondents refers to parameters such as designation of the respondent, age, gender, qualification, professional experience, recognitions received, number of publications, research contributions and research guidance.

2.2.1 Designation

Kumar (1997) observed that majority of the respondents in the study were found to be Associate Professors and few were Professors.

Sharma and Kaur (2003) observed that 56 per cent of the respondents were Assistant Professors.

Bella (2006) observed that 63 per cent of the respondents were Assistant Professors, 35 per cent were Associate Professors and two per cent were Professors.

Jogaratnam and Tse (2006) showed that performance was positively associated with entrepreneurial orientation, whereas expectation was negatively associated with performance of the entrepreneurs.

Jyothi *et al.*, (2009) revealed that 66.66 per cent were Assistant Professors and 16.67 per cent were equally distributed as Associate Professors and Professors in the under graduate campuses, whereas in the post graduate campuses half of the respondents were Associate Professors, which was followed by 27.08 per cent of Assistant Professors and 22.92 per cent of Professors. As a whole 43.33 per cent were Associate Professors, 35 per cent Assistant Professors and 21.67 per cent Professors.

Debbarma *et al.*, (2013) observed that 41 per cent were Associate Professors, 31 per cent were Assistant Professors, 16 per cent were Professors and nine per cent were found to be Heads of Departments.

2.2.2 Age

Narayan (2002) reported half of the respondents 50 per cent started their enterprise between the ages of 31 to 40 years, and 33.3 per cent between the ages of 21 to 30 years. The age group 31 to 40 years (58.33 %) was also actively participating in entrepreneurial development, followed by the aged group 41 to 50 years (21.66 %).

Reddy (2003) reported that majority of the respondents 57.33 per cent were in the middle age group, 28 per cent were young age group and 14.67 per cent were found to be in the old age group.

Jyothi *et al.*, (2009) revealed that teachers teaching the under-graduate students mostly belonged to the young aged group (50.0 %) which was followed by the middle-aged group 33.33 per cent and the old (16.67 %). Whereas, teachers teaching post graduates students were mostly in middle aged group (62.50 %), followed by the young aged (22.92 %) and (14.58 %) in the old aged group. Majority of the teachers belonged to the middle-aged group (56.67 %), followed by (28.33 %) the young aged group and only (15 %) the old aged group.

Hajong and Sharma (2010) revealed that people in younger aged group were more entrepreneurial oriented than those with older aged group.

Padmaja and Prabhakar (2011) revealed that majority of the teacher respondents belonged to old age category.

Nagesh *et al.*, (2011) reported that 48.33 per cent of the respondents were found to be in the middle-aged category.

Debbarma *et al.*, (2013) revealed that majority of the respondents 59 per cent of the respondents belonged to middle aged category, while 30 per cent belonged to old aged group and 11 per cent belonged to young aged group.

Tamesgen and Wodajo (2013) found that 50 per cent of the respondents were aged between 20 to 40 years.

Dollisso and Koundinya (2014) observed that 41 years was the mean age of the teachers and the range was between 21 to 61 years.

Sakai *et al.*, (2014) observed that education played an important role and majority of the respondents had their doctorate by the age 30.

Makhijani *et al.*, (2015) found that majority of the respondents were in the age group of 36 to 45 years.

2.2.3 Gender

Ismail (1996) observed that even though women were less oriented towards entrepreneurship, women had more exposure to entrepreneurship, business management training, a system of mentoring and career counseling, networking and had better access to credit facilities and better involvement in male-dominated business.

Bella (2006) observed that majority of the respondents 61 per cent were female and 39 per cent were male.

Contrary to the above finding, Rezaei *et al.*, (2008) found that 85 per cent of the teachers were male and only 15 per cent were female.

Jyothi *et al.*, (2009) observed that majority of the respondents 83.33 per cent teaching the under-graduate students were male and only 16.67 per cent were found to be female, whereas in post graduate level teaching an almost equal distribution was found. As whole 56.67 per cent of the teachers were male and the remaining female.

Dieguez-Castrillon *et al.*, (2012) reported that female entrepreneurs play an important role especially in diversification of agriculture as they are able to take better decisions.

2.2.4 Qualification

More than half of the respondents (55 %) had education level up to upper primary, followed by school final (25 %) and (20 %) pre-degree (Narayan, 2002).

Manjunath *et al.*, (2008) reported that half of the respondent teachers 50.75 per cent had low educational category, 25.37 per cent had medium educational category and 23.88 per cent had high educational category for those respondents in the teaching group. Among the researcher respondents 40.40 per cent belonged to the low educational category, 42.85 per cent belonged to the medium educational category and 16.67 per cent belonged to the high educational category, and for those who were extension workers 71.43 per cent had medium educational category, followed by 23.81 per cent low educational category and 4.76 per cent had high educational category.

Rezaei *et al.*, (2008) observed that 45 per cent had obtained M.Sc. degree, 36.6 per cent had diploma and 18.4 per cent had B.Sc. degree.

Jyothi *et al.*, (2009) observed that 58.33 per cent of the teachers in under graduates' campuses were doctorate holders and 41.67 per cent were master degree

holders, whereas in the post graduates' campus, majority of them had doctorate degree 83.33 per cent and 16.67 per cent were master degree holders. In the university, as a whole majority were found to be doctorates 78.33 per cent and 21.67 per cent master degree holders. It was also found that none of the respondents had any were post-doctoral qualifications.

Vickerman and Coates (2009) observed that teachers with more experience were ready to provide their services to meet the special educational needs of students whereas, those with less experience were not ready to do so, as they were not confident.

Padmaja and Prabhakar (2011) revealed that 100 per cent of the teacher respondents were doctorate holders.

Debbarma *et al.*, (2013) found that more than half of the respondents 53 per cent had PhD, 32 per cent had MSc degree and 15 per cent had post doctorate and other degree.

Muchiri *et al.*, (2013) revealed that qualifications and teaching experience had no significant relationship with perception of secondary school agriculture teachers.

Dollisso and Koundinya (2014) observed that more than half of the respondents 55 per cent had bachelor's degree, 43 per cent had master's degree and only two per cent had a doctoral degree.

2.2.5 Service Details/Experience

Ha *et al.*, (2008) conducted a study to compare teachers with different years of teaching experience. The results showed that teachers with more experience

Debbarma *et al.*, (2013) observed that 64 per cent belonged to the medium experience category, 20 per cent to the low experience category and 16 per cent were found to be in high experience category.

Dudorova (2013) noted that teachers should also keep up-to-date with the latest technologies both in general and professional education. He further stated that teachers need training from time to time from well experienced professionals.

Experience of teachers was found to range from between eight months to 36 years, and the mean years of experience was 16 years (Dolliso and Koundinya, 2014).

2.2.6 Recognition Received

Alam and Farid (2011) found that 84 per cent of the teacher respondents stated that incentives were not given according to their abilities and only 16 per cent stated that incentives were given according to their abilities.

Padmaja and Prabhakar (2011) observed that 26.6 per cent of the teacher respondents had awards at the ICAR level, followed by 13.3 per cent the national level, 6.6 per cent at the university level and 6.6 per cent at the state level. Whereas 40 per cent of the teacher respondents had not received any awards.

Nyakundi (2012) found that 53 per cent of the teacher respondents were totally against giving rewards and stated that the pay given to the teacher is worth the service they provide. 35 per cent of the teacher respondents strongly disagreed to the notion that hard-working teachers were encouraged by giving them rewards.

A survey conducted by Organisation for Economic Co-operation and Development (2012) states in the Teaching and Learning International Survey

showed positive attitude towards teaching on a voluntary basis. Teachers with less experience were less concerned about learning new things. The experienced teachers were interested to learn and change the existing procedures for a better way. Experienced teachers also showed strong commitment towards their career while less experience teachers were not secure about their jobs.

Manjunath *et al.*, (2008) reported that 31.34 per cent of the teachers had low experience, 53.73 per cent belonged to the medium experience category and 14.93 per cent had high experience. Among the researchers 50 per cent were found to be in low experience category, 42.66 per cent in medium experience category and 7.14 per cent in high experience category. When compared to teachers and researchers, extension workers were found to be having more experience, 95.24 per cent.

Jyothi *et al.*, (2009) observed that 83.33 per cent of the teachers in under graduate campuses had up to 10 years' experience, 16.67 per cent had 21 to 30 years' experience and only a meager per cent had 11 to 20 years' experience. Whereas, in post graduate campuses 50 per cent of the respondents belonged to the 11 to 20 years' experience category, followed by 27.08 per cent in the up to 10 years' experience category and 22.92 per cent in the 21 to 30 years' experience category. On the whole, 40 per cent had 11 to 20 years of experience, followed by 38.33 per cent with up to 10 years' experience and 21.67 per cent with 21 to 30 years of experience.

Padmaja and Prabhakar (2011) found that less than half of the teacher respondents 46.67 per cent belonged to medium level teaching experience.

Nyakundi (2012) found that 47 per cent of the teacher respondents had between 11 to 15 years' experience, 24 per cent between 6 to 10 years' experience, 14 per cent between 16 to 20 years' experience, 9 per cent above 20 years' experience and 7 per cent between 2 to 5 years' experience

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(TALIS) that 75 per cent of the teachers would not receive any recognition for improving their teaching and for being more innovative.

2.2.7 Publications

With respect to publications of popular articles, Bella (2006) observed that 8.77 per cent of her respondents were in the high category, 14.03 per cent in the low category and 77.19 per cent in the medium category. With respect to publishing research articles 70.17 per cent of her respondents were in the medium category, 17.54 per cent were in the low category and 12.28 per cent in the high category.

Debbarma *et al.*, (2013) revealed that 68 per cent had contributed in various popular and research articles, 55 per cent had contributed in publishing manuals for under graduate or post graduate courses and contributed one or more chapters of a book, 49 per cent had published booklets and 37 per cent had published books.

Parmar *et al.*, (2016) reveal that majority of the agricultural scientists had not published a single research paper at the state and national level.

2.2.8 Research contributions

Satapathy and Choudhary (1990) observed that the teacher respondents who handled and completed more number of research projects was one of the parameters for measuring scientific productivity.

Sabarathnam (1992) revealed that number of projects handled by a scientist showed negative correlation with scientific man power efficiency in the ICAR research system.

Bella (2006) found out that 56.1 per cent of KAU projects as Principal Investigator were completed and 36.8 per cent were ongoing; 64 per cent of KAU projects as Co Principal Investigator were completed and 31.5 per cent were ongoing.

2.2.9 Research guidance

Satapathy and Choudhary (1990) had selected guiding of MSc and PhD scholars as one of the parameters for the measurement of scientific productivity of scientists.

Bella (2006) found that 43.9 per cent of the teacher respondents had guided PhD scholars as Major Advisor and 66.7 per cent of the teacher respondents had guided MSc students as Major Advisor. More than half of the teacher respondents (59.6 %) had guided PhD scholars as an advisory committee member and 61.4 per cent of the teacher respondents had guided MSc students as advisory committee members.

2.2.10 Extension activity

Krumphuber (1998) stated that extension staff and teachers should keep up to date with new developments, so they will be able to keep farmers informed of possible assistance and risks.

Ahmad *et al.*, (2007) field survey carried out in Peshawar and Charsada in Pakistan revealed that extension workers were not playing a very good role. Majority (85 %) of the farmers were unaware about services of the extension workers. Only 12 per cent of the farmers got some benefits like technical advice and demonstration.

Methodology

3. METHODOLOGY

In this chapter, the research methods and procedures employed in the study are presented in detailed under the following headings.

3.1 Research design

3.2 Location of the study

3.3 Selection of respondents

3.4 Selection of variables for the study

3.5 Operationalization and measurement of the variables

3.6 Tools used for data collection

3.7 Statistical methods used for analysis of data

3.1 Research design

Ex post facto design was adopted for the study. Kerlinger (1973) defined *ex post facto* research as “systematic empirical enquiry where direct control of independent variables is not possible as they already occur prior to producing their effects”.

3.2 Location of the study

The study was done among teachers of Kerala Agricultural University (KAU) and agri-entrepreneurs who had contacted the KAU Technology Hub. KAU with its headquarters at Vellanikkara in Thrissur district, has six constituent colleges and one academy. There are three faculties, viz; faculties of Agriculture, Forestry and Agricultural Engineering and Technology. KAU has 30 departments, all of which are accredited by the Indian Council of Agricultural Research. Other than the colleges, there are 90 research/extension centres spread across the length and breadth of

Kerala. These include research stations, Krishi Vigyan Kendras (KVKs) and All India Co-Ordinated Research/Network Projects (AICRP/AINP). At the time of this study, there were 2075 students, 421 teachers and 886 non-teaching staff in KAU. KAU has to its credit released over 300 varieties and during the period April 2015 to June 2016 alone KAU has brought out 156 viable technologies documented in the KAU Package of Practices Recommendations (Crops), 2016. During the same period the scientists of KAU have published over 400 research papers in peer reviewed journals, conducted 29 outreach programmes and 175 not-less-than-three-day seminars / conferences. The clientele of the KAU are students, agriculture officers, farmers and agri-entrepreneurs. A very modest average of three to four farmers/small entrepreneurs come/call/email each centre of the KAU on a normal working day for consultancy purposes. Thus, over one lakh farmer/entrepreneur consultations take place annually through the various institutions of KAU spread across the length and breadth of Kerala (KAU, 2016).

3.3 Selection of respondents

Simple random sampling technique was used to select 90 teacher respondents from among the teachers of Kerala Agricultural University and the same technique was used to select 30 aspiring or practicing agri-entrepreneurs from among those who had contacted the KAU Technology Hub operational at the Central Training Institute, Mannuthy.

3.4 Selection of variables

Variables related to the study were selected based on the objectives and discussion with the experts. Experts were randomly selected within the KAU main campus Vellanikkara and requested to select variables most relevant choice for the study. The variables were examined critically and subject to relevancy rating on a

four-point continuum ranging from 4 to 1 as most relevant, relevant, less relevant, and not relevant. Space was provided for additional opinions. Three dependent variables and ten independent variables were selected as per rating given by 30 judges.

List of dependent variables finally selected are listed below:

- Entrepreneurship orientation of KAU teachers
- Entrepreneurship interface of KAU as perceived by the teachers
- Entrepreneurship interface of KAU as perceived by aspiring/practicing entrepreneurs

List of independent variables selected are:

- Designation
- College/Research Station/Unit
- Age
- Gender
- Qualification
- Service
- Publications
- Research
- Recognitions
- Extension activity

3.5 Operationalization and measurement of the variables

3.5.1. Designation

This refers to the official status of the teacher respondent at the time of the study. They were categorized as Assistant Professors, Associate Professors and Professors and scores assigned as done by Jyothi *et al.*, (2009).

Sl. No.	Designation	Score
1	Assistant Professor	1
2	Associate Professor	2
3	Professor	3

3.5.2 Place of work

This refers to the present place of work at which the teacher respondent was working in the Kerala Agricultural University: college, research station or extension centre and scores given as detailed below:

Sl. No.	Category	Score
1	College	1
2	Research Station	2
3	Extension Centre	3

3.5.3 Age

This refers to the completed years of age of the respondent at the time of investigation. Interpretation of the result was done by frequency and percentage

analysis by adopting the scale followed by Debbarma *et al.* (2013). The respondents were categorized as follows:

Sl. No.	Category	Years
1	Young	35 and below
2	Middle age	36 to 50
3	Aged	51 and above

3.5.4 Gender

This refers to the respondent being male or female and scores given as detailed below:

Sl. No.	Category	Score
1	Male	1
2	Female	2

3.5.5 Qualification

Educational qualification was operationally defined as the highest qualification attained by the respondent at the time of study. Educational status was classified as MSc, PhD and Post Doc/other. Interpretation was done by frequency and percentage analysis by adopting the scale used by Bella (2006).

Sl. No.	Category	Score
1	MSc	1
2	PhD	2
3	Post Doc/Other	3

3.5.6 Service Details

Years of service in KAU were further probed in terms of total completed years of service (1) in a college of KAU (2) in a research station of KAU (3) in an extension centre of KAU.

3.5.6.1 Total service prior to/outside KAU

This refers to the total completed years of service that the teacher respondent had worked prior to joining the Kerala Agricultural University.

3.5.6.2 Total Service in KAU

This refers to the total completed years of service that the teacher respondent had served in the Kerala Agricultural University at the time of the study. Class limits were determined using the equation below:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

SL. No.	Class interval
1	1-12
2	13-25
3	>26

3.5.6.3 Years of service in a college of KAU

This refers to the total completed years of service that the teacher respondent had served in a college of KAU. Teacher respondents who had not served in any

colleges were given the value zero. Those with 'zero' were taken separately as one category and class limits for the remaining scores were determined using the equation:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

Sl. No.	Class interval
1	0
2	1 to 11
3	12 to 23
4	>24

3.5.6.4 Years of service in a research station of KAU

This refers to the total completed years of service that the teacher respondent had served at a research station of KAU. Teacher respondents who had not served in any research stations of KAU were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were determined using the equation:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

Sl. No.	Class interval
1	0
2	1 to 9
3	10 to 19
4	>20

3.5.6.5 Years of service at an extension centre of KAU

This refers to the total completed years of service that the teacher respondent had served at an extension centre of KAU. Teacher respondents who had not worked in extension centres of KAU were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were determined using the equation:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

Sl. No.	Class interval
1	0
2	1 to 5
3	6 to 10
4	>11

3.5.6.6 Years of service as a head of office/institution in KAU

This refers to the total completed years of service that the teacher respondent had served as a head of office/institution of KAU. Teacher respondents who had not served as head of office/institution in KAU were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were determined using the equation:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

Sl. No	Class interval
1	0
2	1 to 6
3	7 to 12
4	13 to 19

3.5.7 Faculty improvement program participation

This refers to the total number of seminars/symposia/winter/summer schools attended by the teacher respondent during the past five years. Teacher respondents who had not participated in any seminars/symposia/winter/summer schools were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were determined using the equation:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

Sl. No.	Class interval
1	0
2	1 to 5
3	6 to 10
4	11 to 15

3.5.8 Publications

This refers to the total number of publications brought out by the teacher respondent during the past five years. Teacher respondents who had not contributed in any publication were given the value zero. Those with 'zero' score were taken

separately as one category and class limits for the remaining scores were determined using the equation for all the items under publications:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

3.5.8.1 Number of Popular Articles

This refers to the total number of popular articles published by the teacher respondent during the past five years.

Sl. No.	Class interval
1	0
2	1 to 10
3	11 to 20
4	21 to 30

3.5.8.2 Number of Research Articles

This refers to the total number of research articles published by a teacher respondent during the past five years.

Sl. No.	Class interval
1	0
2	1 to 26
3	27 to 52
4	53 to 79

3.5.8.3 Number of Research Notes

This is the total number of research notes published by the teacher respondent during the past five years.

Sl. No.	Class interval
1	0
2	1 to 10
3	11 to 20
4	>21

3.5.8.4 Author of books/technical publications

This refers to the total number of books or technical publications published by the teacher respondent during the past five years.

Sl. No.	Class interval
1	0
2	1 to 4
3	5 to 8
4	9 to 13

3.5.8.5 Editor of books/technical publications

This is the total number of books or technical publications for which the teacher respondent has been the editor during the past five years.

3.5.8.6 Contributor of one or more chapters of a book/technical publication

This refers to the total number of chapters of a technical publication and/or book published by the teacher respondent during the past five years.

Sl. No.	Class interval
1	0
2	1 to 3
3	4 to 6
4	7 to 11

3.5.9 Research involvement

This refers to total number of research projects handled by the teacher respondent during the past five years. Teacher respondent who had not taken up any research projects were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were determined using the equation for both items under this variable:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

3.5.9.1. Principal Investigator

This refers to the total number of research projects (completed and/or ongoing) handled by the teacher respondent as a Principal Investigator during the past five years.

Sl. No.	Class interval
1	0
2	1 to 13
3	14 to 27
4	28 to 41

3.5.9.2 Co-Principal Investigator

This refers to the total number of research projects (completed and/or ongoing) handled by the teacher respondent as a Co-Principal Investigator during the past five years.

Sl. No.	Class interval
1	0
2	1 to 8
3	9 to 17
4	18 to 25

3.5.10 Student Research Guidance

This refers to the total number of students guided by the teacher respondent in the capacity of major advisor or advisory committee member. Teacher respondents who had not guided any students were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were determined using the equation:

$$\frac{\text{Maximum value} - \text{minimum value}}{\text{Number of classes}}$$

3.5.10.1 Number of M.Sc. students guided as major advisor

This refers to the total number of M.Sc. students guided in the capacity of major advisor by the teacher respondent during the past five years.

Sl. No.	Class interval
1	0
2	1 to 4
3	5 to 8
4	9 to 12

3.5.10.2 Number of MSc students guided as advisory committee member

This refers to the total number of MSc students guided in the capacity of advisory committee member by the teacher respondent during the past five years.

Sl. No.	Class interval
1	0
2	1 to 8
3	9 to 17
4	18 to 26

3.5.10.3 Number of PhD Scholars guided as major advisor

This refers to the total number of PhD scholars guided in the capacity of major advisor by the teacher respondent during the past five years.

3.5.10.4 Number of PhD scholars guided as advisory committee member

This refers to the total number of PhD scholars guided in the capacity of advisory committee member by the teacher respondent during the past five years.

Sl. No.	Class interval
1	0
2	1 to 3
3	4 to 6
4	7 to 10

3.5.11 Recognition's Received

Recognitions are given to the best of the lot. Teacher respondents who had not received any kind of recognition were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were determined using the equation:

$$\frac{\text{Maximum value} - \text{minimum value}}{\text{Number of classes}}$$

3.5.11.1 Number of state level awards

This refers to the total number of state level awards received by the teacher respondents during the past five years.

3.5.11.2. Number of national level awards

This refers to the total number of national level awards received by the teacher respondents during the past five years.

3.5.11.3. Number of international level awards

This refers to the total number of international level awards received by the teacher respondents during the past five years.

3.5.11.4. Number of patents or GI registrations

This refers to the total number of patents or geographical indication registrations facilitated by the teacher respondent during the past five years.

3.5.11.5. Number of recommendations included in PoP

This refers to the total number of recommendations proposed by the teacher respondents which have been included in the Kerala Agricultural University Package of Practices (Crops).

Sl. No.	Class interval
1	0
2	1 to 7
3	8 to 14
4	15 to 22

3.5.12. Extension Activity

Teacher respondents who had not taken up any extension activities were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were determined using the equation:

$$\frac{\text{Maximum value} - \text{Minimum value}}{\text{Number of classes}}$$

3.5.12.1. Number of radio talks or television interviews

This refers to the total number of radio talks or television interviews done by the teacher respondents during the past five years.

Sl. No.	Class interval
1	0
2	1 to 8
3	9 to 16
4	17 to 25

3.5.12.2. Number of field visits undertaken by them

This refers to the total number of field visits undertaken by the teacher respondents in the last six months.

Sl. No.	Class interval
1	0
2	1 to 28
3	29 to 56
4	57 to 85

3.5.12.3. Number of farmers who had contacted

This refers to the total number of farmers who had contacted the teacher respondent for getting information in the past one month. Teacher respondents who were not contacted by any farmers at all were given the value zero. Those with 'zero' score were taken separately as one category and class limits for the remaining scores were uniformly divided into three categories with the upper limit being 30 days (for one month).

Sl. No.	Class interval
1	0
2	1 to 10
3	11 to 20
4	21 and above

3.5.13 Entrepreneurship orientation of KAU teachers

It may be pointed out that the focus of the present study was not the entrepreneurship behavior of the agri-entrepreneur but rather the entrepreneurship orientation of the teachers in KAU who are supposed to facilitate the transfer of technology to agri-entrepreneurs. Thus, Entrepreneurship Orientation of KAU teachers was defined as the predisposition of a teacher respondent in facilitating agri-

entrepreneurs with respect to the idea and process of making money by starting or running businesses, especially when this involved taking financial risks.

The variable was measured using a scale developed for the study prepared after culling relevant parameters from literature and subjecting those parameters to detailed discussion with the experts. The 25 items thus delineated were subjected to judges rating and the most relevant 17 statements were finalized for the study.

Thus, the scale to measure Entrepreneurship Orientation consisted of 17 statements (fifteen positive statements and two negative statements) each rated on a nine-point continuum to ensure that the slightest nuance of varied response got its true value. The response options included: never, rarely, seldom, occasionally, sometimes, often, frequently, usually, and always and a score of 1 to 9 assigned to the above options for positive statements. The scoring was reversed in the case of negative statements. The total score was obtained by adding all the scores for each statement. Thus, the minimum and maximum possible scores were 17 and 153. Based on the total score obtained for each statement, the respondents were classified into three categories, using the mean and standard deviation check.

Entrepreneurship Orientation Index (EOI) was calculated using following formula:

$$\text{Entrepreneurship Orientation Index (EOI)} = \frac{\text{Total score obtained}}{\text{Maximum possible score}} \times 100$$

Based on the mean and standard deviation entrepreneurship orientation was further categorized as low, medium, and high as detailed below:

Sl. No.	Category	Score
1	Low Entrepreneurship orientation (less than)	$(X - SD)$
2	Medium Entrepreneurship orientation (in between)	$(X \pm SD)$
3	High Entrepreneurship orientation (more than)	$(X + SD)$

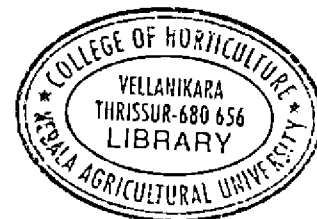
3.5.14 Effectiveness Entrepreneurship Interface of KAU as perceived by the teacher

Effectiveness Entrepreneurship interface of KAU as perceived by the teacher was operationally defined as the opinion of the respondent teachers on how well KAU responds to aspiring agri-entrepreneurs who approach KAU and how well KAU facilitates the transfer of technology with ease.

The variable was measured using a scale developed for the study prepared after culling relevant parameters from literature and subjecting those parameters to detailed discussion with the experts. The 20 items thus delineated were subjected to judges rating and the most relevant 10 statements were finalized for the study.

Thus, the scale to measure Entrepreneurship Interface of KAU as perceived by the teachers consisted of 10 statements (six positive statements and four negative statements) each rated on a nine-point continuum to ensure that the slightest nuance of varied response got its true value. The response options included: never, rarely, seldom, occasionally, sometimes, often, frequently, usually, and always and a score of 1 to 9 assigned to the above options for positive statements and the scoring was reverse in the case of negative statements.

Entrepreneurship Interface Index (EII) for teachers was calculated using following formula:



Entrepreneurship Interface Index Teacher (EIIT)

$$= \frac{\text{Total score obtained}}{\text{Maximum possible score}} \times 100$$

Total score was obtained by adding all the scores for each statement. Thus, the minimum and maximum possible score was 10 and 90^a respectively. The respondents were classified into three as low, medium, and high in keeping with the mean and standard deviation check as detailed below:

Sl. No.	Category	Score
1	Low Entrepreneurship interface (less than)	(X - SD)
2	Medium Entrepreneurship interface (in between)	(X ± SD)
3	High Entrepreneurship interface (more than)	(X + SD)

3.5.15 Entrepreneurship Interface of KAU as perceived by aspiring/practicing entrepreneurs

Entrepreneurship interface of KAU as perceived by the aspiring/practicing entrepreneurs was operationally defined as the opinion of the aspiring/practicing entrepreneurs who had approached KAU for technology transfer on how well KAU responds and how well KAU facilitates the transfer of technology with ease.

The variable was measured using a scale developed for the study prepared after culling relevant parameters from literature and subjecting those parameters to detailed discussion with the experts. The 20 items thus delineated were subjected to judges rating and the most relevant 10 statements were finalized for the study.

Thus, the scale to measure Entrepreneurship Interface of KAU as perceived by aspiring/practicing entrepreneurs consisted of 10 statements (seven positive

statements and three negative statements). The respondents were asked to respond on a nine-point continuum as always, usually, frequently, often, sometimes, occasionally, seldom, rarely, never. The scores assigned were 9, 8, 7, 6, 5, 4, 3, 2, and 1 respectively for positive statements and the scoring was reverse in the case of negative statements. The data were analyzed based on the entrepreneurship interface index.

Entrepreneurship Interface Index (EII) for aspiring/practicing entrepreneurs was calculated using following formula:

Entrepreneurship Interface Index Entrepreneur (EII)

$$= \frac{\text{Total score obtained}}{\text{Maximum possible score}} \times 100$$

Total score was obtained by adding all the scores for each statement. Thus, the minimum and maximum possible score was 10 and 90 respectively. The respondents were classified into three as low, medium, and high in keeping with the mean and standard deviation check as detailed below:

Sl. No.	Category	Score
1	Low Entrepreneurship interface (less than)	(X – SD)
2	Medium Entrepreneurship interface (in between)	(X ± SD)
3	High Entrepreneurship interface (more than)	(X + SD)

3.6 Tools used for data collection

Data collection was done using structured questionnaires. Based on the objectives of the study separate structured questionnaires were prepared for the teachers of Kerala Agricultural University and aspiring/practicing agri-entrepreneurs

who had contacted the KAU Technology Hub for transfer of technology. After extensive discussion with experts from the field and incorporating their suggestions the questionnaire was pretested with non-sample respondents. Pretesting was carried out to know whether the contents and the structure of the questionnaires were satisfactorily, reliable and easily understood by the respondents. Further deletions and additions were made based on the insight gained. The final questionnaire used for the study is given in Appendix-I and II. Secondary data was also used for aspiring/practicing agri-entrepreneurs.

The questionnaire was directly administered to the teachers in line with the sampling process described in 3.5. The respondents were often very reluctant to answer the questionnaire. It was only after much persuasion that the questionnaires filled from the teachers were finally obtained.

For the aspiring agri-entrepreneurs who had contacted the KAU Technology Hub for technology transfer, the questionnaire was sent by post with a reply-paid envelope and stamp. But only few responded. Follow up was done by telephone calls and in person until all the questionnaires were received back.

3.7 Statistical methods used for analysis of data

Data collected was coded, compiled, tabulated and analyzed using descriptive statistics. Percentage analysis was carried out for classification of the respondents. Kendall's co-efficient of concordance was used to determine the degree of agreement.

Results and Discussion

4. RESULTS AND DISCUSSION

In this chapter the results and discussion of the study are arranged under the following headings.

4.1 Profile characteristics of the respondents

4.2 Entrepreneurship Orientation of KAU teachers

4.3 Entrepreneurship Interface of KAU as perceived by the teachers

4.4 Entrepreneurship Interface of KAU as perceived by the aspiring/practicing entrepreneurs

4.5 Perceived contributions of KAU teachers

4.6 Case Studies of Transfer of Technology with special reference to the experiences of aspiring/practicing agri-entrepreneurs in relation to KAU

4.7 Suggestions to foster a better entrepreneur interface for the Kerala Agricultural University.

4.1 Profile characteristics of teachers

The profile characteristics of the teacher respondents included were designation, place of work, age, gender, qualification, service, publications, research contributions, recognitions and extension activities.

4.1.1 Designation

There was a reasonable level of representation from all the three categories of teachers with Assistant Professors having the highest percentage 35.6 per cent, followed by Associate Professors 33.3 per cent and Professors 31.1 per cent as detailed in the table below:

Table 1: Distribution of teacher respondents based on designation

Sl. No.	Category	Frequency	Percentage
1	Assistant Professor	32	35.6
2	Associate Professor	30	33.3
3	Professor	28	31.1
	Total	90	100

It is evident that there was an almost equal distribution of Assistant Professor, Associate Professors and Professors in the sample, thus ensuring that all categories were sufficiently represented.

4.1.2 Place of work

Random sampling resulted in 70 per cent of the teacher respondents being from the college, 15.6 per cent being from the extension centres and 14.4 per cent being from the research stations.

Distribution of teacher respondents based on their designation

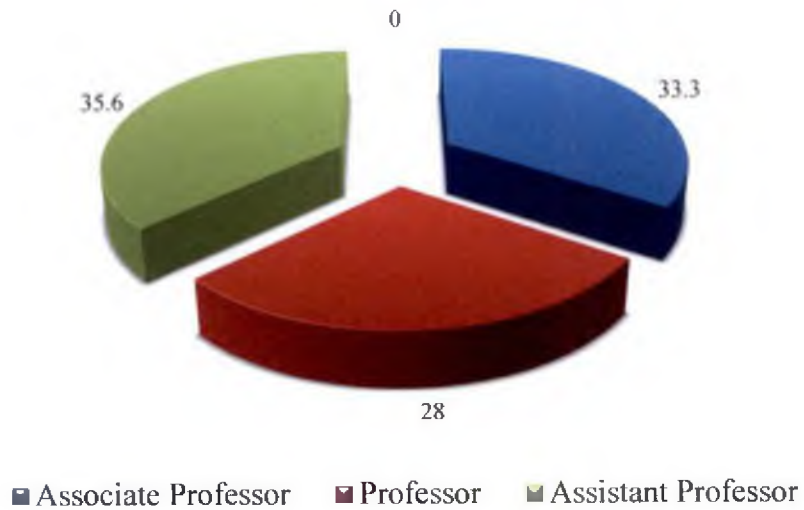


Fig. 1. Distribution of teacher respondents based on their designation

Distribution of teacher respondents based on their place of work

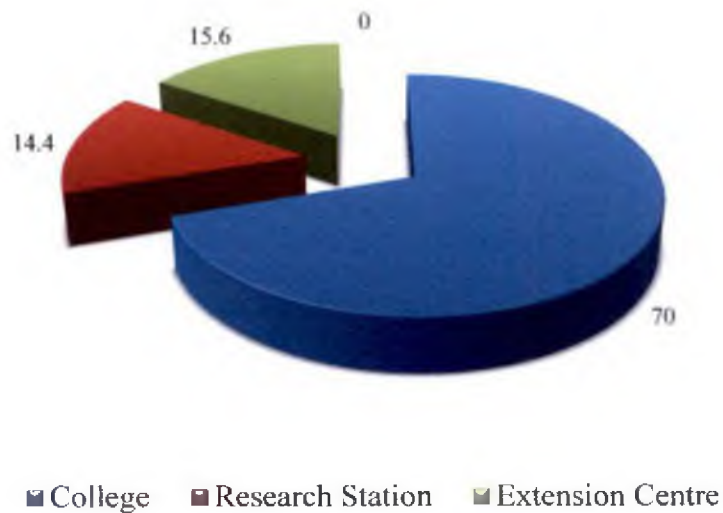


Fig. 2. Distribution of teacher respondents based on their place of work

Table 2: Distribution of the teacher respondents with respects to their place of work

Sl. No.	Category	Frequency	Percentage
1	College	63	70.0
2	Research station	13	14.4
3	Extension centre	14	15.6
	Total	90	100

The place of work for majority of the teacher respondents happened to be in the colleges while there was an almost equal representation of teachers from research stations and extension centres. The reason for there being more teachers from the colleges may be naturally attributed to the fact that population wise, there were more teachers in the colleges.

4.1.3 Age

Majority of the respondents 52.2 per cent were between 36 to 50 years old, 45.6 per cent belonged to 51 years and above age group while only 2.2 per cent were below 35 years of age.

Table 3: Distribution of teacher respondents with respect to age

Sl. No.	Category	Frequency	Percentage
1	Young (35 and below)	2	2.2
2	Middle age (36-50)	47	52.2
3	Old (51 and above)	41	45.6
	Total	90	100

Distribution of teacher respondents with respect to age

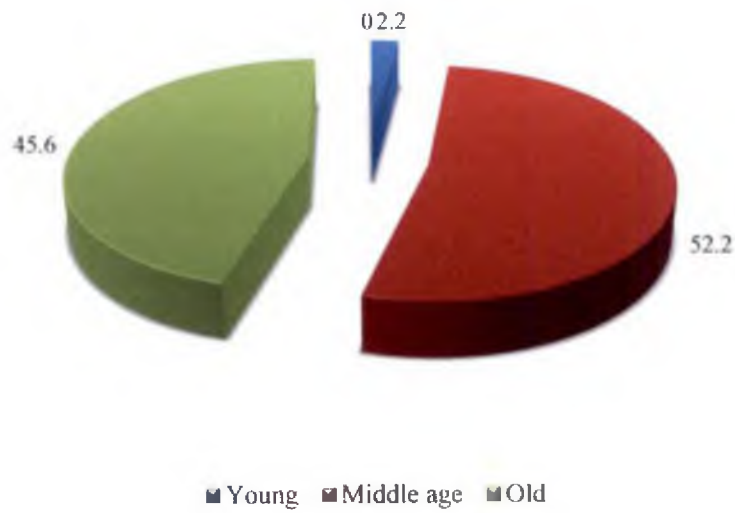


Fig. 3. Distribution of Teacher respondents with respect to age

Distribution of teacher respondents with respect to gender

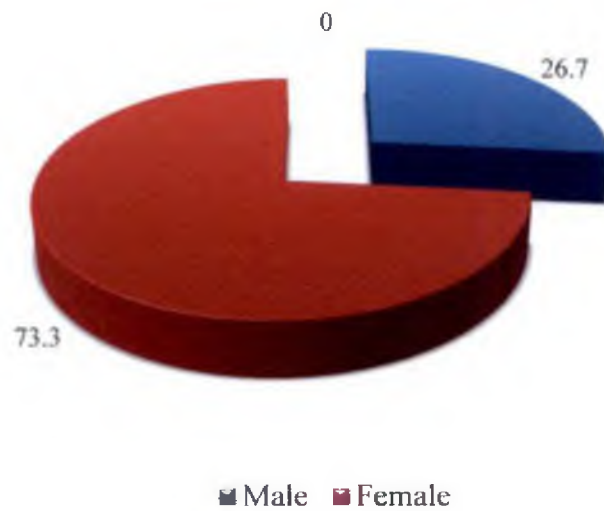


Fig. 4. Distribution of Teacher respondents with respect to gender

The reason for the low percentage in the 35 years and below category may be attributed to the fact that young teachers may have been pursuing higher education; some may have worked outside KAU before joining KAU and most may have joined KAU only after having completed their PhD degree. The findings were similar with the findings of Debberma *et al.*, (2013) where most of the teacher respondents belonged to middle age category.

4.1.4 Gender

Majority of the teacher respondents (73.3 per cent) were female whereas only 26.7 per cent were male.

Table 4: Distribution of teacher respondents with respect to gender

Sl. No.	Category	Frequency	Percentage
1	Male	24	26.7
2	Female	66	73.3
	Total	90	100

This can be attributed to the sex ratio of teachers working in the Kerala Agricultural University at the time of this study as being skewed in favour of the female gender. The findings were consistent with the findings of Bella (2006) where majority of the teacher respondents were also female.

4.1.5 Qualification

Majority (84.4 per cent) of the teacher respondents were PhD holders in their field of specialization. A few (10 per cent) had only MSc/MTech while even a lesser number (5.6 per cent) had post doctoral or other additional diplomas.

Table 5: Distribution of teacher respondents with respect to qualification

Sl. No.	Category	Frequency	Percentage
1	MSc / MTech.	9	10.0
2	PhD	76	84.4
3	Post Doc/others	5	5.6
	Total	90	100

Majority of the teacher respondents were PhD holders, as University Grants Commission (UGC) has specified this higher qualification as a requirement for career advancement. These findings were similar to that of Bella (2006) and Debberma *et al.*, (2013). Only negligible number of respondent teachers had pursued Post Doc/other diplomas. This might be due to the reason that there were hardly any agricultural universities in India offering Postdoctoral degrees and going abroad to pursue post doctorate is costly. The finding was supported by Jyothi (2009). Other reasons for there being only few teachers with Post-Doctoral diplomas might be that it was not a mandatory requirement for promotions and most of the respondents of this study being women, they may have had domestic responsibilities to attend to that would have prevented them from pursuing higher studies after attaining their PhD.

4.1.6 Service details

Majority of the teacher respondents (73.3 per cent) had worked outside before joining KAU, while 42.2 per cent had more than 26 years of service in KAU. Within KAU, 37.8 per cent of the teacher respondents had 1 to 11 years of service in a college of KAU; 45.6 per cent had 1 to 9 years of service at a research station of KAU; 72.2 per cent had not worked in any exclusive extension centre of KAU and majority (71.1 per cent) had never been the head of any office or institution in KAU.

Distribution of teacher respondents with respect to their qualification

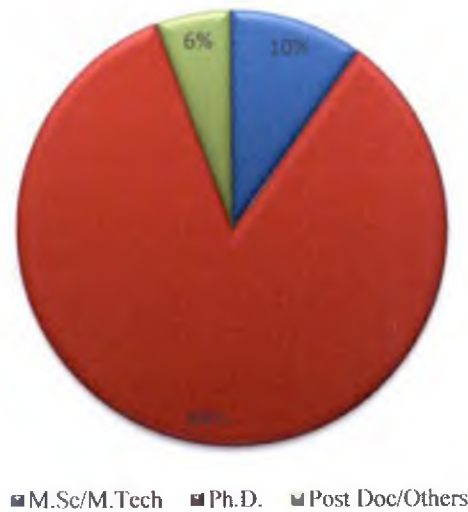


Fig. 5. Distribution of Teacher respondents with respect to their qualification

Table 6: Distribution of teacher respondents with respect to their service details

Sl. No.	Description	Frequency	Percentage
Total service prior to or outside of KAU			
	Not worked outside KAU	24	26.7
	Have worked outside KAU	66	73.3
Total service in KAU			
1	1-12	31	34.4
2	13-25	21	23.4
3	>26	38	42.2
Range = 0.5 - 37, Mean = 19.67			
Years of service in a college of KAU			
1	0	12	13.3
2	1 to 11	34	37.8
3	12 to 23	26	28.9
4	>24	18	20.0
Range = 0 - 34, Mean = 12.88			
Year of service at a research station of KAU			
1	0	31	34.4
2	1 to 9	41	45.6
3	10 to 19	12	13.3
4	>20	6	6.7
Range = 0 - 28, Mean = 5.34			
Years of service at an extension centre of KAU			
1	0	65	72.2
2	1 to 5	19	21.1
3	6 to 10	4	4.4
4	>11	2	2.2

Range = 0 - 17, Mean = 1.18			
Years of service as a head of office or institution in KAU			
1	0	64	71.1
2	1 to 6	20	22.2
3	7 to 12	3	3.3
4	13 to 19	3	3.3
Range = 0 - 19, Mean = 1.22			

Majority of the teacher respondents had worked outside KAU as openings in the university may have been not as forthcoming and they probably could not afford to remain unemployed. Almost half of the respondents had more than 26 years of experience in KAU. This agreed with the finding that majority of the respondents were in older aged category. Those who had 1 to 12 years' experience in KAU may have been, in part, those who had worked outside KAU before joining KAU. Majority had 1 to 9 years of service in a research station of KAU. While majority 72.2 per cent of the teacher respondents has not worked in any extension centres of KAU. The fact that there are only three units and seven KVKs under the Directorate of Extension may be reason sufficient to justify the skew in the sample. Likewise, over seventy per cent had never been the head of any office or institution in KAU, which is understandable as there are only limited posts in that category.

4.1.7 Faculty improvement program participation

Majority of the teacher respondents 56.7 per cent had attended 1 to 5 national seminars / symposia / winter / summer schools during the past five years.

Table 7: Distribution of teacher respondents with respect to their faculty improvement program participation

Sl. No.	Class interval	Frequency	Percentage
Number of national seminars/symposia/winter/summer schools attended			
1	0	15	16.7
2	1 to 5	51	56.7
3	6 to 10	18	20.0
4	11 to 15	6	6.7
Range = 0 to 15, Mean = 4.27			

The motivation to attend such programmes can be attributed to the mandatory UGC requirement for such participation for career advancement promotions. Those who had not attended any national seminar/symposia/winter/summer schools may be those who had already attained their required career advancement.

4.1.8 Publications

More than half of the teacher respondents surveyed 58.9 per cent had published 1 to 10 popular articles; majority 81.1 per cent had published 1 to 26 research articles. However, 60 per cent had not published any research notes during the past five years. Almost half of the teacher respondents 48.9 per cent had not been author of books/technical publications during the past five years. Majority of the teacher respondents 80 per cent had not been editor of books/technical publications during the past five years. More than half of the teacher respondents 55.6 per cent had not contributed one or more chapters of a book/technical publication during the past five years.

Table 8: Distribution of teacher respondents with respect to their publications

Sl. No.	Description	Frequency	Percentage
Number of Popular Articles			
1	0	28	31.1
2	1 to 10	53	58.9
3	11 to 20	6	6.7
4	21 to 30	3	3.3
Range = 0 to 30, Mean = 4			
Number of Research Articles			
1	0	11	12.2
2	1 to 26	73	81.1
3	27 to 52	5	5.6
4	53 to 79	1	1.1
Range = 0 to 80, Mean = 7.74			
Number of Research Notes			
1	0	54	60.0
2	1 to 10	33	36.7
3	11 to 20	1	1.1
4	>21	2	2.2
Range = 0 to 32, Mean = 2.17			
As Author of books/technical publications			
1	0	44	48.9
2	1 to 4	39	43.3
3	5 to 8	5	5.6
4	9 to 13	2	2.2
Range = 0 to 13, Mean = 1.46			
As an Editor of books/technical publications			

1	0	72	80.0
2	1	12	13.3
3	2	5	5.6
4	3	1	1.1
Range = 0 to 3, Mean = 0.28			
As Contributor of one or more chapters of a book/technical publication			
1	0	50	55.6
2	1 to 3	32	35.6
3	4 to 6	7	7.8
4	7 to 11	1	1.1
Range = 0 to 11, Mean = 1.1			

As per UGC norms specified, sufficient number of publications is required for career advancement of the teachers which may be a reason for the above findings.

4.1.9 Research involvement

4.1.9.1 As Principal Investigator

Majority of the teacher respondents 70 per cent had served as Principal Investigators (PI) for 1 to 13 research projects during the past five years. Majority 80.9 per cent of the projects were still ongoing, only 19.1 per cent had been completed.

Table 9 (1): Distribution of teacher respondents with respect to their research involvement as Principal Investigator

Sl. No.	Class interval	Frequency	Percentage
	Ongoing	54	80.9
	Completed	13	19.1
Total			
1	0	23	25.6
2	1 to 13	63	70.0
3	14 to 27	2	2.2
4	28 to 41	2	2.2
Range = 0 to 41, Mean = 3.87			

The reason for low percentage of completed projects may be attributed to the fact that funds for projects approved for the State Plan 2014-15 were released only during 2016-17 and likewise funds for projects approved for the State Plan 2015-16 were released only during 2016-17.

4.1.9. 2. As Co-Principal Investigator

More than half of the teacher respondents 65.6 per cent had served as Co-Principal Investigators (Co PIs) for 1 to 8 research projects during the past five years. Majority of the teacher respondents 77.3 per cent had completed their projects while for 22.7 per cent the projects were still ongoing.

Table 9 (2): Distribution of teacher respondents with respect to their research involvement as Co-Principal Investigator

Sl. No.	Description	Frequency	Percentage
	Ongoing	16	22.7
	Completed	51	77.3
Total			
1	0	23	25.6
2	1 to 8	59	65.6
3	9 to 17	4	4.4
4	18 to 25	4	4.4
Range = 0 to 25, Mean = 3.61			

Co PIs are likely to be junior teachers working under the leadership of a senior PI. Participation of the teachers in more number of research projects is an added advantage both from the experience gaining perspective and as well as from the perspective of being able to climb the career ladder.

4.1.10 Student research guidance

More than half of the teacher respondents 58.9 per cent had guided 1 to 4 MSc students as major advisor during the past five years. Majority of the teacher respondents 65.6 per cent had served as advisory committee member for 1 to 8 MSc students. Majority of the teacher respondents 67.8 per cent had not guided any PhD scholar in the capacity of major advisor. Half of the respondent teachers 50 per cent had not served as advisory committee member for PhD scholars during the past five years.

Table 10: Distribution of teacher respondents with respect to their students' research guidance

Sl. No.	Description	Frequency	Percentage
Number of MSc students guided as major advisor			
1	0	20	22.2
2	1 to 4	53	58.9
3	5 to 8	15	16.7
4	9 to 12	2	2.2
Range = 0 to 13, Mean = 2.6			
Number of MSc students served as advisory committee member			
1	0	17	18.9
2	1 to 8	59	65.6
3	9 to 17	12	13.3
4	18 to 26	2	2.2
Range = 0 to 26, Mean = 4.5			
Number of PhD scholars guided as major advisor			
1	0	61	67.8
2	1	17	18.9
3	2	8	8.9
4	3	4	4.4
Range = 0 to 3, Mean = 0.5			
Number of PhD scholars served as advisory committee member			
1	0	45	50.0
2	1 to 3	34	37.8
3	4 to 6	9	10.0
4	7 to 10	2	2.2
Range = 0 to 10, Mean = 1.3			

Guiding students will help teachers accrue points for their promotions. Those who had not served as advisor or advisory committee members might be those who had been posted in research stations and/or extension centres.

4.1.11 Recognition's received

Majority of the teacher respondents (91.1 per cent) had not received any state level awards, 83.3 per cent had not received any national level awards; 94.4 per cent had not received any international level awards and 98.9 per cent had no patents or GI registrations to their credit. 61.1 per cent had not contributed any recommendation to the KAU Package of Practices.

Table 11: Distribution of teacher respondents with respect to their recognitions received

Sl. No.	Description	Frequency	Percentage
Number of state level awards			
1	0	82	91.1
2	1	7	7.8
3	2	1	1.1
Range = 0 to 2, Mean = 0.11			
Number of national level awards			
1	0	75	83.3
2	1	10	11.1
3	2	5	5.6
Range = 0 to 2, Mean = 0.22			
International level awards			
1	0	85	94.4
2	1	5	5.6

Range = 0 to 1, Mean = 0.05			
Number of Patents or GI registrations			
1	0	89	98.9
2	>1	1	1.1
Range = 0 to 2, Mean = 0.02			
Number of recommendations included in PoP			
1	0	55	61.1
2	1 to 7	32	35.6
3	8 to 14	1	1.1
4	15 to 22	2	2.2
Range = 0 to 22, Mean = 1.29			

This finding tallies with the official data of the university wherein 39 research awards were received by the university teachers/institutions during 2015-2016. This is 9 per cent of the total teacher population. Similarly, the number of patents received and/or the number of GI registrations done during the period of study tallies with the official data of university (KAU Chancellor's Award Application, 2016).

4.1.12 Extension Activity

Half of the teacher respondents 50 per cent had delivered 1 to 8 radio talks or television interviews during the past five years. Majority of the teacher respondents 70 per cent had undertaken 1 to 28 field visits during the last six months. Almost half of the teacher respondents 45.5 per cent had been contacted by 1 to 10 farmers during the past one month.

Table 12: Distribution of teacher respondents with respect to the number of extension activities undertaken by them

Sl. No.	Number of Radio talks or television interviews	Frequency	Percentage
1	0	41	45.6
2	1 to 8	45	50.0
3	9 to 16	3	3.3
4	17 to 25	1	1.1
Range = 0 to 25, Mean = 1.98			
Sl. No.	Number of field visits undertaken by them in the last six months	Frequency	Percentage
1	0	22	24.4
2	1 to 28	63	70.0
3	29 to 56	3	3.3
4	57 to 85	2	2.2
Range = 0 to 85, Mean = 0.84			
Sl. No.	Number of farmers who have contacted them for getting information in the past one month	Frequency	Percentage
1	0	17	18.9
2	1 to 10	41	45.5
3	11 to 20	15	16.7
4	21 and above	17	18.9
Range = 0 to 300, Mean = 0.87			

As is evident from the table above, almost half of the teacher respondents did not deliver any radio talks or present any television interviews during the same period while another half did deliver 1 to 8 radio talks or present any television interviews

during the past 5 years. Majority of the teacher respondents had undertaken 1 to 28 number of field visits in the last six months.

It is encouraging to note that 1 to 10 farmers had contacted 45.5 per cent of the teacher respondents for getting information in the past one month. This data implies that the official estimate of university is far below the reality. The University had given a very modest number that three to four farmers/small entrepreneurs come/call/email each centre of the KAU on a normal working day for consultancy purposes and assuming that there are 375 working days during the period from 1st April, 2015 to 30th June 2016 and given that KAU has six colleges and over 90 research/extension centres, 109125 to 145500 consultations take place annually (KAU Application for Chancellor's Award, 2016). However, the findings of this study imply that the number of consultancies actually taking place may in fact be much higher than what had been estimated.

4.2 Entrepreneurship orientation of KAU Teachers

Table 13 depicts the responses received from the teacher respondents with respect to various parameters of the composite variable – Entrepreneurship Orientation (detailed in item J of Appendix I). From Table 13 it is evident that by their own perception, 50 per cent of the respondent teachers usually kept themselves up-to-date with the latest information about new technology developed (Parameter 1), 47.8 per cent were always eager to learn new things, learn from their previous mistakes and take corrective action (Parameter 2), 20 per cent usually tried to generate new ideas and find relevant information for aspiring entrepreneurs (Parameter 4), 21.1 per cent often were able to create a vision of how the business will grow (Parameter 5), 33.3 per cent were usually ready to work long hours to meet demands of an entrepreneur (Parameter 6), 30 per cent were usually committed to guide and support the entrepreneurs in achieving their start-up goals (Parameter 7),

28.9 per cent usually did not give up easily nor get discouraged by setbacks (Parameter 9), 22.2 per cent were usually able to adopt KAU technology to new and changing situations of the entrepreneur (Parameter 10), 24.4 per cent were frequently able to effectively assist the potential entrepreneurs in transfer of technology (Parameter 11), 18.9 per cent were often able to anticipate future opportunities for entrepreneurs in terms of market demand (Parameter 12), 43.3 per cent were always ready to pass on new technology developed by them to an entrepreneur (Parameter 13), 27.8 per cent usually nurtured a strong desire to solve problems faced by agri-entrepreneurs (Parameter 14), 23.3 per cent usually understood the risks involved for each decision made by the entrepreneur and knew how to analyze and weigh the risks (Parameter 15), 40 per cent always believed that giving training on a particular technology must fit individual learning needs and match the participant's pace of learning (Parameter 16), and 23.3 per cent usually tried to establish an effective partnership with an entrepreneur even after technology has been transferred (Parameter 17).

At the same time, 44.4 per cent of the teacher respondents never believed that KAU would not give them due recognition for trying to promote entrepreneurship (Parameter 3) and 36.7 per cent of them believed that KAU would never give them due credit for technology transferred (Parameter 8).

Table 13: Entrepreneurship Orientation of KAU teachers

Parameter No.	Score	1	2	3	4	5	6	7	8	9
1	<i>f</i>	0	0	0	1	3	14	15	45	12
	%	0	0	0	1.1	3.3	15.6	16.7	50.0	13.3
2	<i>f</i>	0	0	0	0	2	5	9	31	43
	%	0	0	0	0	2.2	5.6	10.0	34.4	47.8
4	<i>f</i>	4	4	2	7	17	14	13	18	11

	%	4.4	4.4	2.2	7.8	18.9	15.6	14.4	20.0	12.2
5	<i>f</i>	10	2	1	6	15	19	14	17	6
	%	11.1	2.2	1.1	6.7	16.7	21.1	15.6	18.9	6.7
6	<i>f</i>	5	3	2	3	8	15	9	30	15
	%	5.6	5.6	2.2	3.3	8.9	16.7	10.0	33.3	16.7
7	<i>f</i>	6	3	2	3	5	9	15	27	20
	%	6.7	3.3	2.2	3.3	5.6	10.0	16.7	30.0	22.2
9	<i>f</i>	9	5	2	2	9	9	15	26	13
	%	10.0	5.6	2.2	2.2	10.0	10.0	16.7	28.9	14.4
10	<i>f</i>	5	3	0	4	12	15	13	20	18
	%	5.6	3.3	0	4.4	13.3	16.7	14.4	22.2	20.0
11	<i>f</i>	5	1	2	1	12	15	22	17	15
	%	5.6	1.1	2.2	1.1	13.3	16.7	24.4	18.9	16.7
12	<i>f</i>	7	3	3	4	13	17	16	15	12
	%	7.8	3.3	3.3	4.4	14.4	18.9	17.8	16.7	13.3
13	<i>f</i>	5	1	0	1	8	12	10	14	39
	%	5.6	1.1	0	1.1	8.9	13.3	11.1	15.6	43.3
14	<i>f</i>	5	1	1	1	6	12	15	25	24
	%	5.6	1.1	1.1	1.1	6.7	13.3	16.7	27.8	26.7
15	<i>f</i>	6	2	2	4	7	18	16	21	14
	%	6.7	2.2	2.2	4.4	7.8	20.0	17.8	23.3	15.6
16	<i>f</i>	5	2	1	0	4	11	9	22	36
	%	5.6	2.2	1.1	0	4.4	12.2	10.0	24.4	40.0
17	<i>f</i>	6	2	2	2	7	14	19	21	17
	%	6.7	2.2	2.2	2.2	7.8	15.6	21.1	23.3	18.9
Parameter No.	Score	9	8	7	6	5	4	3	2	1
3	<i>f</i>	5	3	1	7	13	8	5	8	40

	%	5.6	3.3	1.1	7.8	14.4	8.9	5.6	8.9	44.4
8	<i>f</i>	9	7	4	10	9	6	7	5	33
	%	10.0	7.8	4.4	11.1	10.0	6.7	7.8	5.6	36.7

The findings indicate that the Entrepreneurship Orientation of teachers in KAU is far from sufficient. While almost half of the sample studied usually kept themselves up-to-date with the latest information about new technology developed, were always eager to learn new things and/or learn from their previous mistakes and take corrective action and were always ready to pass on new technology developed by them to entrepreneurs, only 20 to 30 per cent of the teachers had good scores on most of the other parameters of Entrepreneurship Orientation. The findings also indicate that KAU has a long way to go in inculcating the right mind set and attitude in the teachers with respect to entrepreneurship and in giving due credit to the teachers for technology transferred and entrepreneurship promoted. As the management guru Drucker (1974) said we now accept the fact that learning is a lifelong process of keeping abreast of change. And the most pressing task is to teach people how to learn.

Table 14: Mean Score Index of Entrepreneurship Orientation of KAU teachers

Sl. No.	Statement	Mean Score Index
1	I keep myself up-to-date with the latest information about new technology developed	83.46
2	I am always eager to learn new things and learn from my previous mistake and correct it	91.11
3	KAU will not give me due recognition for trying to promote entrepreneurship	75.31

4	I try to generate new ideas for aspiring entrepreneurs	67.41
5	I am able to create a vision of how the business will grow	63.33
6	I am ready to work long hours to meet demands of an entrepreneur	73.09
7	I am committed to guide and support the entrepreneurs in achieving their start-up goals	74.69
8	KAU will not give me due credit for technology transferred	66.30
9	I do not give up easily, or get discouraged by setbacks	68.89
10	I am able to adapt KAU technology to new and changing situations of the entrepreneur	72.22
11	I am able to effectively assist the potential entrepreneurs in transfer of technology	72.47
12	I am able to anticipate future opportunities for entrepreneurs, in terms of market demand	66.67
13	I am ready to pass on new technology developed by me to an entrepreneur	80.37
14	I have strong desire to solve problems faced by agri-entrepreneurs	78.02
15	I understand the risks involved for each decision made by the entrepreneur and know how to analyze and weigh the risks	71.11
16	I believe that giving training on a particular technology must fit individual learning needs and match the participant's pace of learning	80.99
17	I try to establish effective partnership with an entrepreneur even after technology has been transferred	73.09

Mean = 74.03, SD = 7.08

Table 15: Classification of KAU teachers based on Mean Score Index with respect to Entrepreneurship Orientation

Sl. No.	Category	Frequency	Percentage
1	Low (below 55)	9	10.0
2	Medium (between 55-92)	74	82.2
3	High (above 92)	7	7.8

Mean= 74.03, SD=18.48

Majority of the teacher respondents 82.2 per cent were found to have only medium level entrepreneurship orientation while only 7.8 per cent of the teacher respondents had high level of entrepreneurship orientation.

4.3. Entrepreneurship Interface of KAU as perceived by the teachers

Table 16 depicts the responses received from the teacher respondents with respect to their perception of KAUs Entrepreneurship Interface as delineated by the various parameters (detailed in item K of Appendix I). It is evident from the table that only 26.7 per cent perceived that KAU had a fine tuned mechanism for transfer of technology to aspiring entrepreneurs (Parameter 1), 37.8 per cent perceived that the KAU brand was always highly esteemed among agri-entrepreneurs (Parameter 2), 28.9 per cent perceived that entrepreneurs who approached KAU for transfer of technology usually go back fully satisfied (Parameter 4), 20 per cent perceived that KAU often reinvented itself to meet the growing demand of a new generation of agri-entrepreneurs (Parameter 6), 24.4 per cent opined that KAU must always offer its technology free of cost to the farming community (Parameter 7) and 20 per cent opined that that KAU usually helps agri-entrepreneurs in starting their business (Parameter 8).

On the other hand, 26.7 per cent of the teacher respondents opined that there were sometimes many barriers to effective transfer of technology in KAU (Parameter 3), 26.7 per cent opined that administrative barriers occasionally prevented effective and timely transfer of technology in KAU (Parameter 5), 16.7 per cent opined that the process of transfer of technology in KAU was usually bogged down by red tape (Parameter 9) and 17.8 per cent opined that agri-entrepreneurs will sometimes find out ways and means even without KAUs help (Parameter 10).

Table 16: Entrepreneurship interface of KAU as perceived by the teachers

Parameter No.	Score	1	2	3	4	5	6	7	8	9
1	<i>f</i>	1	3	5	5	17	10	14	24	9
	%	1.1	3.3	5.6	5.6	18.9	11.1	15.6	26.7	12.2
2	<i>f</i>	2	0	1	2	9	12	12	18	34
	%	2.2	0	1.1	2.2	10.0	13.3	13.3	20.0	37.8
4	<i>f</i>	2	3	2	3	13	18	13	26	10
	%	2.2	3.3	2.2	3.3	14.4	20.0	14.4	28.9	11.1
6	<i>f</i>	3	4	3	4	13	18	19	16	10
	%	3.3	4.4	3.3	4.4	14.4	20.0	21.1	17.8	11.1
7	<i>f</i>	7	2	1	10	11	12	11	14	22
	%	7.8	2.2	1.1	11.1	12.2	13.3	12.2	15.6	24.4
8	<i>f</i>	1	5	5	5	15	17	11	18	13
	%	1.1	5.6	5.6	5.6	16.7	18.9	12.2	20.0	14.4
Parameter No.	Score	9	8	7	6	5	4	3	2	1
3	<i>f</i>	7	16	11	22	24	2	1	3	4
	%	7.8	17.8	12.2	24.4	26.7	2.2	1.1	3.3	4.4
5	<i>f</i>	3	13	13	24	13	2	3	9	10
	%	3.3	14.4	14.4	26.7	14.4	2.2	3.3	10.0	11.1
9	<i>f</i>	7	10	6	9	13	7	12	15	11

	%	7.8	11.1	6.7	10.0	14.4	7.8	13.3	16.7	12.2
10	<i>f</i>	7	14	12	8	16	11	8	10	4
	%	7.8	15.6	13.3	8.9	17.8	12.2	8.9	11.1	4.4

That only 26.7 per cent perceived that KAU had a fine tuned mechanism for transfer of technology to aspiring entrepreneurs, that only 37.8 per cent perceived that the KAU brand was always highly esteemed among agri-entrepreneurs, that only 28.9 per cent perceived that entrepreneurs who approached KAU for transfer of technology usually go back fully satisfied, that only 20 per cent perceived that KAU often reinvented itself to meet the growing demand of a new generation of agri-entrepreneurs and that only 20 per cent were of the opinion that KAU usually helps agri-entrepreneurs in starting their business all point to the fact that KAU has a long way to go in making itself an entrepreneur friendly institution. This is further reinforced by the finding that 26.7 per cent of the teacher respondents opined that there were sometimes many barriers to effective transfer of technology in KAU and that administrative barriers occasionally prevented effective and timely transfer of technology in KAU. A significant percentage of the teacher respondents are of the opinion that KAU must always offer its technology free of cost to the farming community and this aligns with the findings of the case studies discussed later in this study.

Table 17: Mean Score Index of Entrepreneurship Interface of KAU as perceived by KAU teachers

Sl. No.	Statement	Mean Score Index
1	KAU has a fine-tuned mechanism for transfer of technology to aspiring entrepreneurs	71.11
2	KAU is a brand that is highly esteemed among agri-	81.98

	entrepreneurs	
3	There are many barriers to effective transfer of technology in KAU	44.32
4	Entrepreneurs who approach KAU for transfer of technology go back fully satisfied	72.59
5	Administrative barriers prevent effective and timely transfer of technology in KAU	52.35
6	KAU is reinventing itself to meet the growing demand of a new generation of agri-entrepreneurs	69.14
7	KAU must offer its technology free of cost to the farming community	70.12
8	KAU helps agri-entrepreneurs in starting their business	69.62
9	The process of transfer of technology in KAU is bogged down by red tape	60.67
10	Agri entrepreneurs will find out ways and means even without KAUs help	51.97

Mean = 64.38, SD = 11.64

Table 18: Classification based on the Mean Score Index of Entrepreneurship Interface of KAU as perceived by KAU teachers

Sl. No.	Category	Frequency	Percentage
1	Low (below 51)	12	13.3
2	Medium (between 51-77)	64	71.1
3	High (above 77)	14	15.6

Mean= 64.20, SD=13.83

Majority 71.1 per cent of the teacher respondents of KAU perceived the Entrepreneurship interface of KAU to be only at a medium level, 15.6 per cent rated

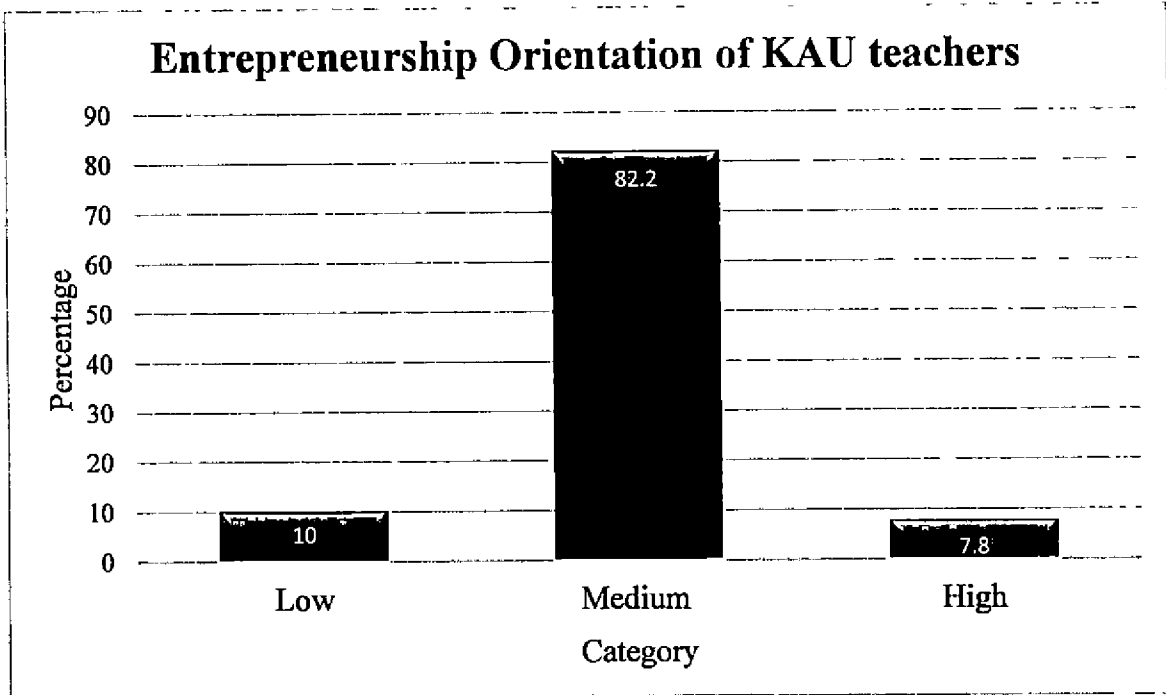


Fig.6: Distribution of Entrepreneurship Orientation of KAU teachers

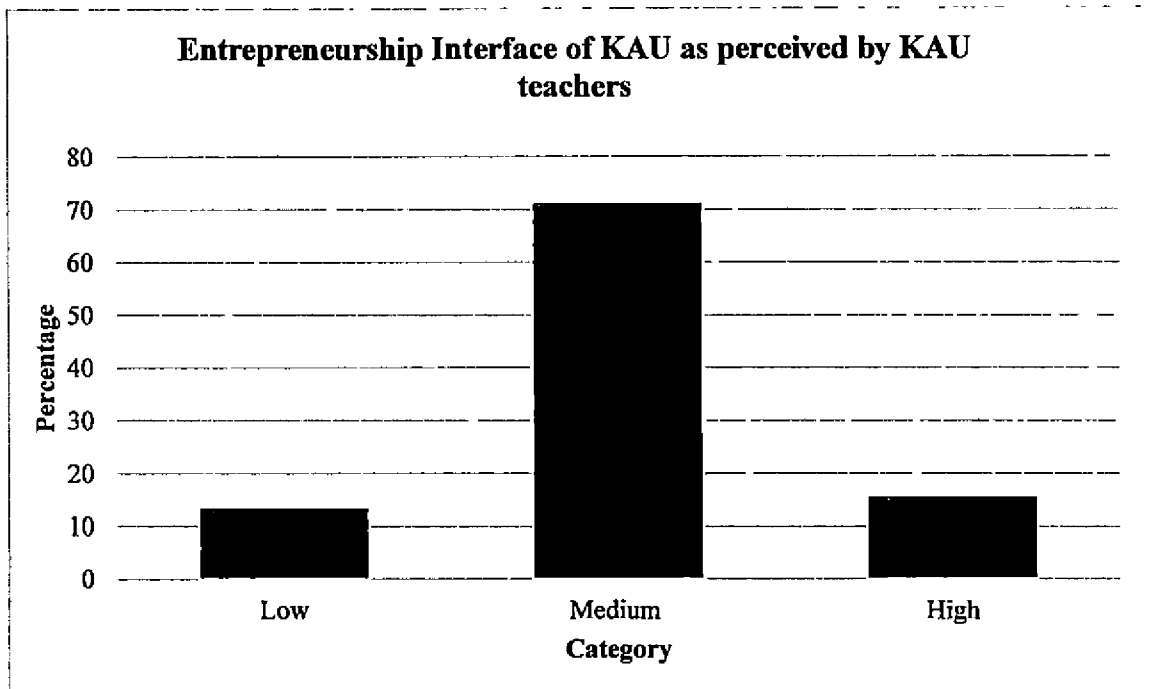


Fig: 7. Distribution of Entrepreneurship Interface as perceived by KAU teachers

KAUs Entrepreneurship Interface as high and an almost equal percentage 13.3 per cent rated KAUs Entrepreneurship Interface as low.

4.4 Entrepreneurship Interface of KAU as perceived by aspiring/practicing entrepreneurs

Table 19 depicts the responses received from aspiring/practicing entrepreneurs with respect to their perception of KAUs Entrepreneurship Interface as delineated by the various parameters (detailed in item A of Appendix II). It is encouraging to note that 90 per cent of the entrepreneurs reported that response at the first point of contact was quick (Parameter 1), 30 per cent said that subsequent follow up by KAU intermediaries was good (Parameter 2), but 26.7 per cent stated that procedures involved in transfer of technology were never simple (Parameter 3) and 40 per cent were of the opinion that the transfer of technology package was never complete and easy in terms of reproducibility (Parameter 4). While 36.7 per cent of the aspiring/practicing entrepreneurs perceived the attitude of KAU intermediaries as always favourable (Parameter 5), 56.7 per cent felt that protection of entrepreneur interest in memorandum of understanding was never ensured (Parameter 6) and 20 per cent stated that KAU provided hand holding services only sometimes (Parameter 7).

Majority (36.7 per cent) of the aspiring/practicing entrepreneurs always rated KAU as not an entrepreneur friendly institution (Parameter 8), 26.7 per cent opined that KAU technology has to be further fine-tuned for commercialization (Parameter 9) and 50 per cent were of the opinion that KAU scientists were always reluctant to pass on useful information (Parameter 10).

Table 19: Distribution of the teacher respondents of entrepreneurship interface of KAU as perceived by aspiring/practicing entrepreneurs

Parameter No.	Score	1	2	3	4	5	6	7	8	9
1	<i>f</i>	0	0	0	0	0	0	0	3	27
	%	0	0	0	0	0	0	0	10.0	90.0
2	<i>f</i>	6	1	2	1	1	2	0	9	8
	%	20.0	3.3	6.7	3.3	3.3	6.7	0	30.0	26.7
3	<i>f</i>	8	2	2	0	2	1	3	6	6
	%	26.7	6.7	6.7	0	6.7	3.3	10.0	20.0	20.0
4	<i>f</i>	12	2	3	1	0	0	2	5	5
	%	40.0	6.7	10.0	3.3	0	0	6.7	16.7	16.7
5	<i>f</i>	7	2	4	0	1	2	1	2	11
	%	23.3	6.7	13.3	0	3.3	6.7	3.3	6.7	36.7
6	<i>f</i>	17	3	3	0	2	1	0	1	3
	%	56.7	10.0	10.0	0	6.7	3.3	0	3.3	10.0
7	<i>f</i>	5	3	4	3	6	2	1	4	2
	%	16.7	10.0	13.3	10.0	20.0	6.7	3.3	13.3	6.7
Parameter No.	Score	9	8	7	6	5	4	3	2	1
8	<i>f</i>	7	1	2	0	0	0	3	6	11
	%	23.3	3.3	6.7	0	0	0	10.0	20.0	36.7
9	<i>f</i>	5	8	5	1	2	1	0	5	3
	%	16.7	26.7	16.7	3.3	6.7	3.3	0	16.7	10.0
10	<i>f</i>	4	1	0	0	5	1	2	2	15
	%	13.3	3.3	0	0	16.7	3.3	6.7	6.7	50.0

Table 20: Entrepreneurship Interface of KAU as perceived by aspiring/practicing entrepreneurs

Sl. No.	Statement	Mean Score Index
1	Response at the first point of contact was quick	98.89
2	Subsequent follow up by KAU intermediaries was good	66.30
3	Procedures involved in ToT were simple	58.15
4	The ToT package was complete and easy in terms of reproducibility	47.41
5	Attitude of KAU intermediaries was favourable	60.00
6	Protection of entrepreneur interests in MoU was ensured	30.74
7	Hand holding services were provided	49.63
8	KAU is not an entrepreneur friendly institution	67.78
9	KAU technology has to be further fine-tuned for commercialization	45.56
10	KAU scientists are reluctant to pass on useful information	74.81

Mean = 59.92, SD = 18.75

Table 21: Entrepreneurship interface of KAU as perceived by aspiring/practicing entrepreneurs

Sl. No.	Category	Frequency	Percentage
1	Low (below 55)	15	50.0
2	Medium (between 56 - 63)	2	6.7
3	High (above 63)	13	43.3

Mean= 59.92, SD=3.32

While 50 per cent of the aspiring/practicing entrepreneurs rated KAUs Entrepreneurship Interface as low an almost equal percentage (43.3%) rated KAUs Entrepreneurship Interface as high.

Table 22: Relationship between entrepreneurship orientation of KAU teachers and independent variables

Sl. No.	Factors	Correlation coefficient
1	Years of service as a head of office/institution in KAU	0.334***
2	Number of Popular Articles	0.177*
3	Number of Research Notes	0.201**

*Correlation is significant at the 0.10 level (2-tailed)

**Correlation is significant at the 0.05 level (2-tailed)

***Correlation is significant at the 0.01 level (2-tailed)

Years of service as head of office had a positive and significant relationship to entrepreneurship orientation of teachers at 1 per cent level. Teacher respondents who had published more popular articles had a positive and significant relationship with entrepreneurship orientation of teachers at 5 per cent level. Teacher respondents who had published more research notes were found to be significantly and positively correlated to entrepreneurship orientation at 10 per cent level.

Table 23: Relationship between entrepreneurship interface of KAU as perceived by the teachers and independent variables

Sl. No.	Factors	Correlation coefficient
1	Total number of research projects as PI	0.244***

***Correlation is significant at the 0.01 level (2-tailed)

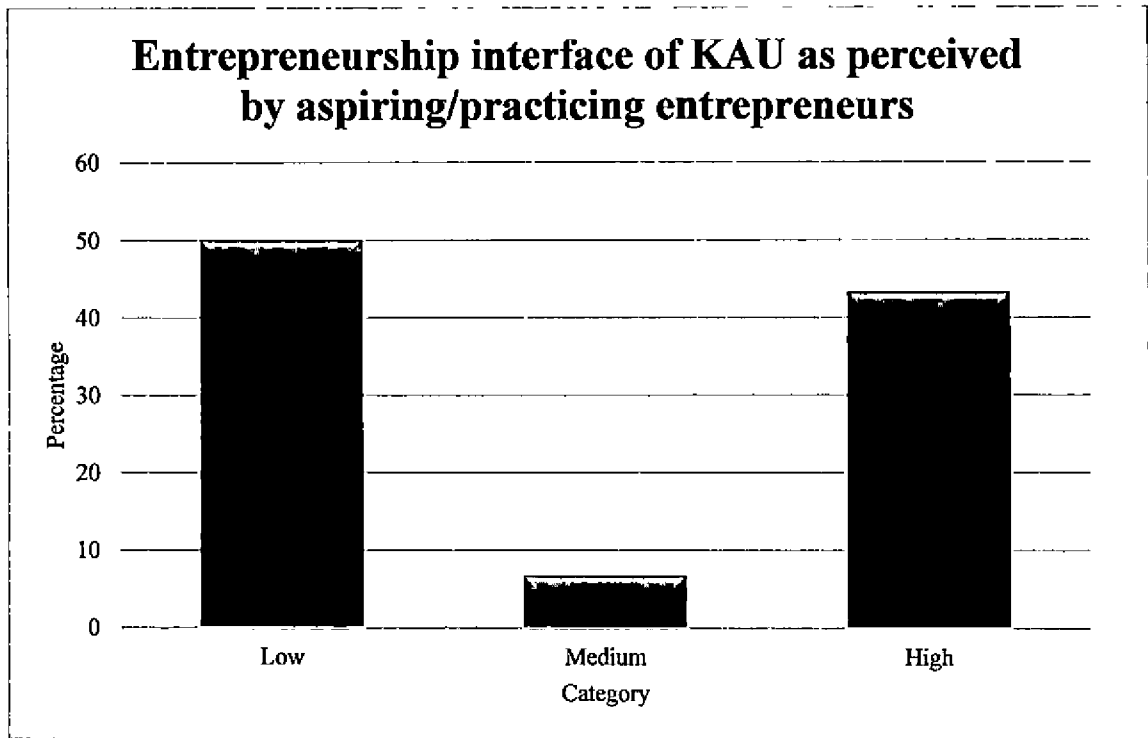


Fig. 8: Entrepreneurship interface of KAU as perceived by aspiring/practicing entrepreneurs

While 50 per cent of the aspiring/practicing entrepreneurs rated KAUs Entrepreneurship Interface as low an almost equal percentage (43.3%) rated KAUs Entrepreneurship Interface as high.

Table 22: Relationship between entrepreneurship orientation of KAU teachers and independent variables

Sl. No.	Factors	Correlation coefficient
1	Years of service as a head of office/institution in KAU	0.334***
2	Number of Popular Articles	0.177*
3	Number of Research Notes	0.201**

*Correlation is significant at the 0.10 level (2-tailed)

**Correlation is significant at the 0.05 level (2-tailed)

***Correlation is significant at the 0.01 level (2-tailed)

Years of service as head of office had a positive and significant relationship to entrepreneurship orientation of teachers at 1 per cent level. Teacher respondents who had published more popular articles had a positive and significant relationship with entrepreneurship orientation of teachers at 5 per cent level. Teacher respondents who had published more research notes were found to be significantly and positively correlated to entrepreneurship orientation at 10 per cent level.

Table 23: Relationship between entrepreneurship interface of KAU as perceived by the teachers and independent variables

Sl. No.	Factors	Correlation coefficient
1	Total number of research projects as PI	0.244***

***Correlation is significant at the 0.01 level (2-tailed)

Total number of research projects as Principal Investigator had a positive and significant relationship with Entrepreneurship Interface of KAU as perceived by the teachers at one per cent level.

4.5 Perceived contributions of KAU teachers

The purpose of this inquiry was to find out what the teachers of KAU perceived as their most significant contribution during their service in KAU. The idea was to find out if entrepreneurship found a valid place in the perceived contribution of the teachers. The respondent teachers were asked to list what they considered to be their three most significant contributions. Some of the responses received are listed below:

- Developed *Psuedomonas fluorescens* that is now commercially distributed by KAU
- Developed a fungal bacterial co-culture system
- Developed the KAU pheromone trap against fruit flies
- Standardized *Beauveria bassiana* bio-control agent against pest
- Spearheaded a palynological investigation of Indian honey bee apiaries in South India which revealed that the Indian bee depends on 69 plants for foraging of which coconut and mimosa are the major contributor of pollen and nectar
- Isolated seven *Hirsutella* from the dead coconut Eriophid mite, tested their pathogenicity conducted their morphological and molecular characterization
- Observed significant morphometric variations between the midland and upland stingless bees of South India and the association of this their honey quality parameters
- Contributed three recommendations for nematode management in brinjal and banana that have now been incorporated in the KAU Package of Practices
- Biocide molecule yielding weed plants such as *Quisqualis indica*, *Simarouba glauca* and *Mikaniamicrantha* were identified

- Imparted training on various subjects of Home Science, thus equipping them to become good entrepreneurs
- Contributed towards the overall development of the Cardamom Research Station, Pampadumpara
- Refinement and standardization for white pepper and virgin coconut oil protocols
- Improvements in post-harvest management of papaya
- Standardization of commercial production technology for *Aloe vera*
- Standardization of mini set method of rapid multiplication in *Kasthuri* turmeric
- Imparted knowledge in various fields of horticulture to students, farmers and entrepreneurs for the past 28 years
- Released six new varieties in different crops for commercial cultivation
- Teaching the advances in modern biology to UG, PG, PhD students
- Contributed a few chapters to a book
- Enabled farmers to identify deficiency systems in orchids
- Studied the physiology of heat tolerance in rice and identified donor parents for drought and heat tolerance in rice
- Identified microsatellite markers associated with root traits and water use efficiency in rice
- Improved upon the technology for cashew apple processing
- Developed the technology for seed extraction in cucurbitaceous vegetables
- Served as Principal Investigator for projects worth 105 lakhs
- Documented the characterization of organic matter in different soil types of Kerala
- Evaluated acidity parameters in wet land rice soils of Kerala in relation to nutrient availability
- Developed Biochar – a new method for solid waste management and soil health management

- Standardization of technology for bottle mushroom cultivation and wine production from mushrooms
- Extension activity: handled many farmers training classes on plant propagation, banana cultivation and commercial floriculture
- Co-authored a chapter for a national level reference text book on fruit breeding
- Developed two hypo-virulent strains of *Rhizoctonia* capable of protecting rice plants against sheath blight disease
- Developed two *Trichoderma* spp: with excellent bioremediation capacity for removal of metal ions from wetlands of Kuttanad
- Developed an Integrated Disease Management (IDM) package for management of Fusarium wilt of cowpea
- Popularized cool season vegetable cultivation in Kollam district
- Optimized the Osmo-dehydration of Nendran banana
- Initiated works on soil enzymology
- Formulated a multi micro nutrient mixture for the southern region of Kerala
- Developed mobile soil test lab facility, issued 5000 soil health cards and extended soil test service to more than 30,000 farmers
- Standardized the protocol for *in vitro* embryo reserve deflasking and hardening of hybrids in orchids
- Releasing five novel orchid hybrids and registered several novel hybrid combinations of orchids with the Royal Horticultural Society, England
- Suggested three situation specific fertilizer recommendations for vegetable cowpea, bhindi and sweet potato in the reclaimed alluvial soils of Kuttanad that have now been included in the KAU Package of Practices.
- Led projects on the use of biofertilizers in vegetables in a watershed of Kottayam district that made a very good impact on the fertilizer use pattern of the farmers of the area and was widely acclaimed by the media

- Received the 'Dr. Harbhajan Singh Award 1999' initiated by the Indian Society of Vegetables Science for the best research paper
- Recommended three cow pea varieties and two non-season bound horsegram varieties for cultivation in Kerala
- Guided student research that led to the realization that heterosis breeding is possible with bhindi varieties
- Developed the irrigation design and infrastructure for Instructional Farm, Vellayani
- Undertook several interventions to improve RARS, Ambalavayal
- Reported for the first time, three species of oyster mushroom and one species of milky mushroom
- Released Bheema - a robust, high yielding, high quality milky mushroom
- Standardized double sucker planting technique in banana
- Standardized sulphur requirement for rice based cropping system
- Actively involved in several farmer-extension-scientist interactions
- Identified two new larval parasitoids affecting rice case worm in India
- Standardized the process of developing sex pheromones for rice case worm
- Handled eight courses for BTech Food Engineering and Agricultural Engineering course, four courses for MTech Agricultural Processing and Food Development, four courses for PhD Agricultural Engineering Programme
- Developed five technologies that have now been incorporated in the KAU Package of Practices and transferred the technology to three processing industries
- Created infrastructure through externally aided projects worth nearly five crores
- Technology on four farm implements were transferred to four industries
- Authored a text book which has been published by the Kerala Bhasha Institute
- Developed three technologies on farm implements that have been included in the KAU Package of Practices and patent applications have been filed for six farm machines
- Developed seed extractor for ashgourd and cucumber

- Improved post-harvest management of vanilla
- Improved farmer developed crude micro-sprinkler
- Moulded 14 batches of B.Tech Agricultural Engineering students
- Developed soil and water conservation measures suitable for rubber plantation
- Involvement in development of equipment for threshing, cleaning and grading of pepper
- Standardized vermi-composting technologies suitable for Kerala conditions
- Developed low cost system for vermi-wash collection
- Standardized enriched manure production technologies
- Served as Course Director for the Diploma Course on Organic Agriculture
- Pollination studies in cucumber and bitter gourd revealed that Indian bees contributed for 25% enhancement in yield, compared to open pollination
- Popularized scientific meliponiculture and apiculture in the state
- Contributed to improving the university's revenue while working at the Instructional Farms at Padannakkad and Vellayani
- Developed a technology and awaiting patent
- Established a bio-control lab
- Promoted organic ways of pest management
- Made significant contribution in crop improvement of spices and medicinal plants
- Pioneered research efforts on *in vitro* production of secondary metabolites from medicinal plants
- Imparted technical knowhow to farmers/students on various aspects of horticultural crops for the past 27 years
- Contributed to the initial stages of establishment of Farm Machinery Facilitation Centre and Agro Machinery Service Centre at ARS, Mannuthy
- Contributed to the setting up of the Agricultural Engineering Research and Training Centre at the College of Horticulture, Vellanikkara
- Studies on impact of silicon on rice crop

- Developed and released the first pineapple hybrid from KAU
- Identified the cheapest source of deosgenin, steroid drug precursor from a local plant
- Documented the ethno botanical uses of more than 600 threatened plants used by the Malayalam tribe of Kerala
- Developed a manually operated banana peeler cum slicer for Nendran variety
- Developed a continuous cocoa pod breaker cum strainer
- Developed a black pepper decorticator for the production of white pepper
- Developed micro nutrient mixture formulations for foliar application in rice and banana
- Developed micro nutrient recommendations for soil applications in various crops for the central zone of Kerala
- Served as a consultant for farmer's field problems
- Maintaining 60 varieties released from Pattambi and from other stations of KAU for conservation and maintenance of rice germplasm
- Ensured quality of seed by serving as the Principal Investigator of the Seed Testing Laboratory at Pattambi
- Conservation of mango and vegetables germplasm
- Development of tissue culture lab and production of tissue culture plants
- Marker assisted selection of Bacterial Leaf Blight resistant rice genotypes
- Development of new rice type with branching tillers and multiple panicles/tiller
- Created 2000 work days for an SHG, thus providing employment to 10 poor women
- Produced and sold nearly 50000 grafts/seedlings of fruit plants
- Molecular characterization of blast and bacterial blight pathogen population prevailing in the state has been done and identified suitable effective genes that can combat these pathogens which can lead to development of resistant varieties to these two diseases

- About 22 recommendations for rice disease management have been included in KAU Package of Practices
- Established a rice knowledge centre and museum at RARS, Pattambi
- Published a practical manual for Agronomy entitled 'Principles of Agronomy'
- Authored several technical bulletins/leaflets in Malayalam for farmers
- Constructed a sub-surface dyke under SIDA assisted ground water project at AMPRS, Odakkali during 1988 which is still functioning successfully
- Developed and popularized 'KAU Micro-sprinkler' which is low cost, farmer friendly and clog-free
- Established a Nodal Water Technology Centre at KAU campus during 2016 with demonstration units and research facilities
- Taught 22 batches of students on almost all aspects of Soil and Water Engineering
- Guided many student projects with much satisfaction
- Facilitated the formation and registration of a society for mushroom growers of Thrissur district
- Transfer of technology to the farmers – organic farming techniques
- Establishment of KVK, Malappuram in 2004 and converting it into one of the best performing KVKs in the zone
- Instrumental in promoting of a successful women group for paddy mechanization that become a model for the entire district
- Standardized tissue culture protocols for black pepper and orchids
- Established Centre for Intellectual Property protection in KAU and further strengthened its activity
- Developed two rice varieties through participatory Plant Breeding and released them for cultivation
- Contributed to the development of seven other rice varieties released from KAU
- Took up activities for GI registration of products of Kerala, seven of such products were registered under the leadership of KAU

- Recommendations on Indigofera have been incorporated in the KAU Package of Practices
- Involved as Co PI in the preparation and demonstration of soil fertilizer map and distribution of soil fertility cards to farmers of 42 panchayats in Palakkad district
- Research Published in 14 NAAS rated Journal papers, and was Co PI in the release of a new variety
- Authored a book on 'Important Medicinal Plants of Kerala'
- Associated with development of three rice varieties
- Developed advanced cultivars in black gram
- Research under taken in hybrid rice technology
- Teaching Plant Breeding and Genetics
- Working as UG Associate Academic Officer, CoH, Vellanikkara
- Improvement of areas and production and productivity of Cashew and Coconut
- Improvement of livelihood of farm labourers, farmers and tribal community
- Ensured quality education to post graduate and PhD students
- Research in the field of precision farming, focusing on fertigation and plastic mulching in open field cultivation
- Research in the hydrology of Bharathapuzha river basin using SWAT model
- Standardized methods to enhance flowering in bush jasmine especially during cooler months
- Standardized the technology for chocolate soda and vinegar production from Cashew apple
- Standardized the production technologies for growing orchids
- Teaching – wrote three text books and one practical manual for the students
- Research – introduced high yielding hybrid cultivation and promoted this as a commercial venture
- Extension – facilitated successful women run fodder banks
- Developed acid tolerant *Azospirillum* and PSB

- Standardized liquid formulation for *Azospirillum* and PSB
- Identified a consortium of microbial inoculants for *ex vitro* establishment of micro propagated vanilla and ginger
- Evaluated different measures for the management of wild animals in field crops and satisfied farmers are now adopting these effective practices
- Experiments for the management of pest problems in poly house conditions
- Served as a resource person for several training programmes organized by Department of Agriculture
- Associated with the development of mechanical waste weed harvester for Kuttanad
- Conducted several training programmes for farmers on mechanization, micro-irrigation and water harvesting
- Developed a FA-FA kit (Family Farming Kit) for growing vegetables in a protected environment and popularized this among the farmers
- Developed 'Veggie Wash' to reduce pesticide residue problems
- Developed molecular markers for tracking and breeding of 15 important genes
- Generated revenue for the university by conducting innovative billeting programmes for bank managers
- Best paper on biodiversity studies at the international ECOCASD conference
- Served as Academic Officer for UG and PG students
- Prepared three teaching manuals for BSc (Ag.) Students
- As Academic Council member representing teachers was instrumental in bringing about many educational reforms
- The fruit of my research has found a place in KAU Package of Practices and KAU *ad hoc* Package of Practices for organic farming

The mandate of KAU is to provide excellence in agricultural education, research and extension for sustainable agricultural development and livelihood security of the farming community. In this context, the contributions of the teachers

listed above do stand justified in many ways. While some teachers have focused on academics, others have focused on research and yet others on outreach activities. Some have focused on institutional building. KAU's most significant contribution must be measured from multiple perspectives. One significant contribution is the human resources that KAU has produced every year since its inception – who now occupy vital positions in the development departments, research and policy making institutions in India and abroad. KAU's contribution in terms of bio-diversity conservation and varietal improvement are also very significant. In financial terms, it has been estimated that the contribution from KAU varieties and technology has been estimated at ₹.5456 Cr. per annum (KAU, Chancellor's Awards Application, 2016). All that being duly acknowledged, the emphasis on entrepreneurial facilitation is one area where KAU has to make a lot of improvement. Even re-designating the Directorate of Extension as the Directorate of Extension & Entrepreneurship may go a long way in bringing emphasis on one aspect of KAU that is missing in its very mandate. If KAU is to remain relevant, it must take stock of its human resource planning. KAU must be in a position to deliver in terms of producing not merely extension workers and researchers, but also service providers, agro technicians, traders, exporters and consultants. This calls for a new emphasis on inculcating the attitude, cementing the determination and equipping the students and teachers with the skills that are required for entrepreneurship to blossom.

4.6 Case Studies of Transfer of Technology with special reference to the experiences of aspiring/practicing agri-entrepreneurs in relation to KAU

The second objective of this study was to document the experiences of aspiring/practicing agri-entrepreneurs in relation to KAU.

Since the inception of the KAU Technology Hub at CTI, Mannuthy in 2014 and till September 2016 – the time of collecting data for this study, 133 agri-

entrepreneurs had contacted the KAU Technology Hub for obtaining specific KAU technology. Of the 50 KAU technologies that had been documented and made available for transfer, five technologies were randomly selected for detailed case study. These were Veggie Wash, Red Banana Cool, Njavara based health drink, Osmo-dehydrated products and the induction of flowering and improvement of yield in adult mango trees. In the discussion below, Red Banana Cool and Njavara based health drink have been discussed together as a single case study their storyline followed a similar pattern.

Case study 1: Veggie Wash – A case wherein the credibility of KAU was at stake

With the increasing awareness of the dangers of pesticide residue in foods and the possible adverse consequences of such residue on health, there was a felt need for development of a low cost, easy to use, household product capable of cleaning the fruits and vegetables from pesticide residues, before consumption.

KAU officially proposed and propagated 'Veggie Wash' as a product to clean the vegetables and fruits from the risk of external pesticides. 20 ml of Veggie Wash is to be diluted in 2 L of water and the vegetables or fruits are to be soaked in this diluted solution for 15 minutes. Thereafter, the vegetables are to be washed rigorously in water (KAU, 2014).

Data at the KAU Technology Hub reveal that 50 aspiring agri-entrepreneurs had contacted the hub for getting the Veggie Wash technology for starting an enterprise. The KAU Technology Hub registers the client and responds by sending a detailed email about the technology to the client and simultaneously marking a copy of the email to the Principal Investigator (PI) for necessary follow up. This email concludes by giving the contact details of the Principal Investigator and requests the client to get in touch with the Principal Investigator first before remitting the transfer

of technology fee and signing the Memorandum of Understanding (MoU) at the KAU headquarters, Vellanikkara. Once this is done, the client is invited by the Principal Investigator and on mutually convenient dates training as well as the technical know-how for the particular technology is transferred.

Initially the rate for the transfer of technology with respect to Veggie Wash was fixed at ₹. 25,000/- plus service tax at prevailing rates. Later, the University hiked the fee for transfer of technology of Veggie Wash to ₹.1,00,000/. Inclusive of taxes, the aspiring entrepreneur now has to shell out total of ₹. 1,14,000/- in order to obtain the Veggie Wash technology (KAU, 2016).

Tinturaj (2015) - an MBA student who got in touch with KAU at the Young Entrepreneurs Summit was one of the first entrepreneurs to effectively market Veggie Wash in the brand name 'Chillies' (through e-mail).

Hongtai Group Company Ltd. (2015) a Chinese company was one of the clients that had expressed interest to collaborate with KAU on Veggie Wash technology (through e-mail).

There have however been complaints that information regarding the 'Veggie Wash' technology has been openly published in newspapers and thus the agri-entrepreneurs who paid the hefty transfer of technology fee felt betrayed. The agri-entrepreneurs who had obtained the Veggie Wash technology from KAU formed an association and demanded that damage be avoided by preventing the publication of the details of the technology in other newspapers. The Principal Investigator however claims that the Government of Kerala advertisement regarding 'Veggie Wash' did not in any way reveal the trade secret of the technology that KAU was promoting. Nevertheless, in the context of the confusion that prevailed, the Director of Research, KAU directed a halt to further transfer of technology with respect to Veggie Wash until the

problems including issues raised in marketing of the product, exemption from VAT, etc. were resolved.

Despite all this, it is encouraging to note that the Associate Director of Research (AR & T) who is the custodian of all such transfer of technology MoUs, has informed that by the time of this study, forty-nine agri-entrepreneurs had paid the required transfer of technology fee, signed the MoU and obtained the Veggie Wash technology from KAU.

Some of the agri-entrepreneurs were of the view that neither KAU nor the Government of Kerala had taken any concrete steps to promote Veggie Wash and that there was a lobby that seemed bent upon undermining the credibility of Veggie Wash.

In 2016 the Report of the Multi-centre study to evaluate the performance of Veggie Wash developed by KAU for decontamination/removal of pesticides from vegetables undertaken by the ICAR All India Network Project on Pesticide Residues claimed that the performance of Veggie Wash was found to be the same as that of washing of with ordinary water/lukewarm water (40-50 °C).

Sreekumar (2016) has raised questions as to: (1) Whether the Veggie Wash research proposal was presented in the Faculty Research Council (FRC) and/or the Zonal Research and Extension Advisory Council (ZREAC) till date? (2) If there are strictures from the ICAR, why was KAU still permitting the sale of Veggie Wash? (3) Pesticides with different formulations and properties (contact/systemic) may have been used for vegetable cultivation and their degradation pattern differed and in that context, was Veggie Wash equally effective for all? He also accused KAU for unleashing panic in the society about pesticide residues in vegetables because the Maximum Residue Levels (MRL) values of some the vegetables reported had not

been previously fixed in the first place, and therefore to claim that the levels found were above the MRL was not in good taste for the scientific temper (through e-mail).

According to Mathew (2015) the Association of Indian Pesticide Industry has even challenged the efficacy of Veggie Wash in the court of law (through e-mail).

However, Koshy (2016) who serves as General Manager for a company that exports cut vegetables to the European Union (EU), the United States of America (USA) and other foreign countries, claims to be using Veggie Wash for cleaning all raw vegetables at their processing units and has so far reported that the end products have with stood all rigorous lab tests, thanks to Veggie Wash from KAU (through e-mail).

Pesticides with different formulations and properties (contact, systemic) may have been used for vegetable cultivation and their degradation pattern would accordingly have differed. Was Veggie Wash equally effective for all pesticide formulations? Mass Media in Kerala has been leading a campaign to enlighten the public on pesticide residue in vegetables. Is the demand for Veggie Wash simply an off-shoot of that new-found health conscious awareness or is it due to the effectiveness of the formulation itself? The case study has thus brought to the forefront several questions that still remain unanswered.

Case study 2: Red Banana Cool and Njavara based health drink – A case wherein bureaucratic delays seem to have affected the process of transfer of technology.

Red Banana, known as *Cheng Kathali* in Malayalam, is geographically distributed in the southern districts of Kerala. It is in high demand because of its health benefits, special aroma and flavour. KAU had developed technology for

extracting the clear juice of red banana juice by enzyme clarification process while retaining its health benefits, special aroma and flavor. The product was named Red Banana Cool and shot into popularity after the KAU Technology Meet held as part of the South Indian Agricultural Fair – Agrifesta 2014 at the KAU main campus, Vellanikkara. This juice can be consumed as such, mixed with other juices and/or can be used for preparation of other fruit drinks. The Ready-to-Serve (RTS) beverage, prepared from red banana juice, has both domestic and export potential. The demand for Red Banana in foreign countries is due to its characteristic flavour – the so called ‘raspberry-banana flavour’ and health benefits. It is a good source of potassium, low in calorie and a rich source of vitamins. It can be promoted as a health drink with cooling effects and nutritional benefits. If properly marketed, it has the potential to compete with synthetic soft drinks industry.

Njavara is a medicinal rice strain grown in some tracts of Kerala. It has medicinal and nutraceutical properties relevant to ailments affecting the human circulatory, respiratory and digestive systems. The medicinal properties appear to be attributable to the sulphur containing amino acid, Methionine, which is involved in the metabolic pathway of the biosynthesis of Thiamine (Vitamin B1). Njavara is also richer than pulses in free amino acid content, entitling it to be called a proteinaceous cereal. Ayurveda recommends regular consumption of Njavara gruel prepared in cow milk with sugar as a health tonic, effective in overcoming general fatigue and enhancing longevity. Allopathy also recommends the use of rice as a safe food for new born babies and as a supplementary diet for the underweight. It was in this context that the scientists of KAU researched and developed the Njavara based health drink powder which has now been granted registration by Food Safety Standard Authority of India (FSSAI).

The health drinks market in India is around ₹. 1,400/- crore and in terms of volume about 65,000 tonnes per annum. Glaxo Smith Kline (GSK) with four brands –

Horlicks, Boost, Viva and Maltova – is the leader in the Indian health drink market. Complan, Glucon D from Heinz India and Cadbury India's Bournvita are also popular brands. While the health drinks industry in India often focuses on the age group of 5 to 18, Njavara based health drink caters to the health and nutritional requirements of the entire population irrespective of age. Thus, the competitive advantage of Njavara based health drink in the market cannot be downplayed.

The dates on which requests for transfer of technology were received at the KAU Technology Hub and the promptness with which the KAU Technology hub has responded to the client and alerted the concerned PIs is evident in the table given below:

Table No 24: Response Time at KAU Technology Hub

Sl. No.	Aspiring Entrepreneur	Date of receipt of request for transfer of technology	Date on which the KAU Technology Hub has responded to the client & PIs
1	Prakash Babu	9 th November, 2015	11 th November, 2015
2	Biju Krishnan Kutty	16 th December, 2015	16 th December, 2015
3	Nithin Chandran	6 th January, 2016	7 th January, 2016
4	AO, Krishi Bhavan, Thrithala	5 th February, 2016	8 th February, 2016

It is evident from the above table that there has been no delay at the first point of contact and this finding agrees with the findings reported in Table 19 depicting the responses received from aspiring/practicing entrepreneurs with respect to their perception of KAUs Entrepreneurship Interface. Ninety per cent of the entrepreneurs reported that response at the first point of contact was quick.

However, a month later, Nithin Chandran (listed in Table 24) reverted saying that he had contacted all the three PIs but had been asked to return to the KAU Technology hub at Mannuthy. The KAU Technology Hub immediately contacted the concerned PIs over telephone and in response, Chandran received an email on the very next day from the PI for Red Banana Cool indicating that she was willing to initiate steps for the technology transfer and sign the MoU at the earliest. However, nothing seems to have gone forward at that time. On 14th June 2016, the KAU Technology Hub once again took the initiative of transmitting draft MoUs and cost calculations for whetting by the concerned PIs and Co-PIs. On 16th June 2016, the PI for Red Banana Cool reverted for clarifications. Thus, on 24th June 2016, the KAU Technology Hub put up a note to the Director of Extension seeking sanction for the proposed rates for the transfer of technology for Red Banana Cool and Njavara based health drink and for the draft MoU to be transmitted to the Registrar, KAU for further whetting by the legal section. The file was forwarded to the Hon'ble Vice Chancellor on 7th July 2016 and on 13th July 2016, the Hon'ble Vice Chancellor had noted on the file requesting the Director of Extension to speak to him about the matter. On 25th August 2016, the Hon'ble Vice Chancellor directed that a committee be constituted to examine similar cases for the transfer of technology on payment basis. The Hon'ble Vice Chancellor in his note had also specified that the said committee should consist of the Director of Research, the Director of Extension, the Associate Director of Research (AR&T), the Associate Director of Extension (Central Zone) and the Professor and Head of the concerned department. Direction was given to the office staff to find out a mutually convenient date and time to convene the meeting and finally direction was given to convene the meeting on 3rd October 2016. Minutes of the meeting were approved by the Director of Extension on 18th October 2016 and formal orders were sought for. As on date of this report, one full year has transpired since the entrepreneur first contacted the KAU Technology Hub for the technology, but the same has not materialized. It is evident from the timeline detailed in this case

study that bureaucratic delays seem to have affected the process of transfer of technology.

Case Study 3: Induction of flowering and improvement of yield in adult mango trees – A case where transfer of technology took place through training

Scientists of the Kerala Agricultural University had developed the technology for induction of flowering and improvement of yield in adult mango trees. This involved drenching the soil at about 60 cm away from the tree trunk in the month of September with Paclobutrazol @ 5.0 g/tree diluted in 10 L of water. Necessary precautions and directions in this regard have also been incorporated in the KAU Package of Practices Recommendations: Crops (15th edition). Paclobutrazol is a growth regulator which helps in greater flower bud induction, improved yield and better fruit quality. Instead of selling this technology to agri-entrepreneurs by way of a Memorandum of Understanding (MoU), KAU instead opted for conducting course fee based training programmes at the Communication Centre, Mannuthy through the Central Training Institute, Mannuthy. During the period from September 2015 to September 2016 five batches of such training programmes were conducted thus imparting the technology to 70 participants. This definitely seemed to be a better, faster and more effective method of technology transfer especially when compared to the previous cases where procedural and bureaucratic bottlenecks seem to have strangled the whole process of effective and timely transfer of technology.

Case 4: Osmo Dehydrated products – A case of discrepancy in the rates for transfer of technology

Rates for the transfer of technology decided by KAU were found to be varied for basically the same technology or process as is evident in the following table.

Table No. 25: Discrepancy in Technology Transfer rates

Or. No. R8/61087/15 dated 17.10.15	Or. No. R8/61087/15 dated 03.09.15	Or. No. R8/61087/15 dated 03.09.15
Osmo-convective or Osmo vac dried intermediate moisture foods	Osmo dehydrated ripe flakes	Osmo dehydrated products of jack, pineapple and mango
₹.10,000/- per product	₹. 20,000/-	₹.16,000/- per product

Such discrepancy is confusing for the client as well as the intermediary staff who have to receive the fee. Three different rates for basically the same process or technology are not justifiable and must be rationalized.

4.7: Suggestions to foster a better entrepreneur interface for the Kerala Agricultural University and the integration of teaching and research in technology facilitation for entrepreneurship.

The third objective of this study was to suggest reforms to foster a better entrepreneur interface for the Kerala Agricultural University and integration of teaching and research for technology facilitation of entrepreneurship. That being so, emphasis has been given to maximize the number of suggestions listed herein.

The case studies reported above highlight the importance of credibility, the problems that accrue from bureaucratic delays, the confusion created by different rates for basically the same process/technology and all this was contrasted with the ease with which technology was alternatively transferred through training, by charging a training fee but not a transfer of technology fee. While research is the mandate of the Directorate of Research, transfer of technology is the mandate of the Directorate of Extension. As of now, rates for transfer of technology are being fixed by the Directorate of Research while the Directorate of Extension is mandated with

transfer of technology. The MoU has to be further examined by the legal section and then signed by the Registrar. At a time when there is a lot of emphasis on the Ease of Doing Business parameters, KAU will surely have to do a lot of hard thinking and action to demystify and simplify the whole process of technology transfer by institutionalizing a single window system for procedures. Doing so will kick-start an entrepreneurial culture within the university.

It is necessary for the students to be exposed to the challenging prospect for employment. It is also necessary to reduce entrepreneurial risks among the teachers. An employee must find the freedom and encouragement to take a break and pursue his or her entrepreneurial instincts by leveraging the knowledge gained during the work years. He or she should be encouraged to take a risk, and on failure should be allowed to join back into the system.

In the process of creating entrepreneurship programmes, KAU must become more entrepreneurial itself. The colleges and research stations of the University should be natural incubators of creativity. While it is often assumed that Indians in general and Keralites in particular do not have entrepreneurial passion running in their blood, this notion has to be challenged. A study by Kauffman Foundation indicates that 33.2 % of all companies founded in the US had an Indian co-founder. The most talented immigrant community among Indians is considered to be Keralites. But unfortunately, the best youth of Kerala have been leaving the State in pursuit of better career options, and many of them have become successful entrepreneurs outside the State. KAU needs to provide an ecosystem where the best of the students revert to challenging and satisfying career options within the University so as to maximize his/her potential. This would mean ensuring recruitment processes every year to prevent brain drain.

Technology Business incubators must be established at the KAU Headquarters and at the College of Agriculture, Vellayani. The incubation policy should cover incubation amenities for all students and alumni irrespective of their streams of specialization.

All colleges in the university should provide core infrastructure like 5000 sq. ft. floor area exclusively for entrepreneurship activity.

Small student teams of two or three can be assigned to specific farmers from the first year of study onwards so that they familiarize with the real-life farming situation. Third year students can be required to take up a matter-of-fact problem in real life, and resolve it as a part of the academic curricula. Post graduate students should be assigned with research projects that address the real needs of the farmers.

The Centre for e-governance and/or the Centre for e-learning functioning at KAU, may be asked to come up with an electronic platform that could function as a virtual incubator to startups in agriculture and allied subjects that connects the researcher, mentor, entrepreneurs and all other stakeholders to serve as an incubator without walls.

KAU should also consider establishing FABLABS or fabrication labs in order to promote hardware fabrication and creation of hardware prototypes. This should include design studios staffed with professionally qualified hands.

Students Startups or Alumni Startups (within 3 years of graduation), which have made a significant impact and which had an early stage connection with the university incubator should be given suitable appreciation/reference/awards for their achievements.

KAU should have exclusive packages to train faculty for promotion of innovation.

Entrepreneurship/Innovation Clubs should be established at all colleges and yearly competitions organized. The best ideas should be awarded. KAU can consider celebrating an 'Entrepreneurship Day' on 12th September every year – that being Kerala Entrepreneurship Day.

KAU can also consider cross fertilization of ideas by encouraging agricultural students to network with engineering students for the project works such as in the use of drones in pesticide application and crop mapping.

The possibility of starting a certificate course in Fundamentals of Technology Entrepreneurship can be considered. This may be offered to students to be done over and above their regular course in line with the Central Governments Student READY scheme (ICAR, 2016).

In concluding this chapter, it seems evident from all that has been stated above that a lot can be done and a lot must be done. Constituting a special task force at the highest level of the university to fast forward and monitor progress on these matters may be a reflection of the universities determination to make change happen.

Summary and Conclusion

5. SUMMARY AND CONCLUSION

The study entitled “Effectiveness of Kerala Agricultural University in technology facilitation for entrepreneurship” was undertaken with the following objectives.

1. To study the entrepreneurship orientation of teachers in the Kerala Agricultural University (KAU)
2. To document the experiences of aspiring/practicing agri-entrepreneurs in relation to KAU
3. To suggest reforms to foster a better entrepreneur interface for the Kerala Agricultural University and integration of teaching and research for technology facilitation of entrepreneurship

Methodology

The study was conducted in the Kerala Agricultural University in the year 2015-2016. *Ex-post facto* research design was adopted. At the time of the study there were 421 teachers on the rolls and 90 of them were randomly selected for the study. Out of the 133 agri-entrepreneurs who had contacted the KAU Technology Hub, 30 aspiring/practicing agri-entrepreneurs were randomly selected for the study. A pre-tested structured questionnaire was administered to the teacher respondents and a mailed questionnaire was used for the agri-entrepreneurs. Secondary data available at the KAU Technology Hub was also utilized. The data was analyzed using appropriate statistical tools.

Major findings of the study are given below:

- Of the teacher respondents, 35 per cent were Assistant Professors, more than half were middle aged, 73.3 percent were female and worked outside KAU before joining KAU, 84.4 percent were PhD holders.
- 42.2 per cent had served KAU for more than 26 years, 37.8 per cent had served in the college for up to 11 years, 45.6 per cent had served at research stations for up to 9 years, majority of them had not worked at any exclusive extension centres nor served as head of any office/institution in KAU.
- More than half had attended 1 to 5 national seminars / symposia / winter / summer school and published 1 to 10 popular articles. Majority (81.1%) had published up to 26 research articles, 60 per cent had not published any research notes, 48.9 per cent had not authored any books/technical publication. Majority (80 %) had not been editor of books/technical publications and more than half (55.6%) had not contributed one or more chapters of a book/technical publication.
- Majority (70 %) had served as Principal Investigator (PI) for up to 13 research projects and 65.6 per cent had served as Co-PI for up to 8 research projects.
- More than half (58.9%) of the teacher respondents had guided up to four students as major advisor, 65.6 per cent had guided up to eight students as advisory committee member, 67.8 per cent had not guided any PhD scholars as major advisor and 50 per cent had not guided PhD scholar as advisory committee members.
- In the past five years, 91.1 per cent, 83.3 per cent and 94.4 per cent had not received any state, national, international level awards respectively. 98.9 per

cent had no patents or GI registrations to their credit and 61.1 per cent had not contributed any recommendations to the KAU Package of Practices (Crops).

- Half (50 %) of the teacher respondents studied had delivered up to eight radio talks or television interviews during the past five years. Majority (70%) had taken up to 28 field visits during the last six months and almost half (45.5 %) had been contacted by up to 10 farmers during the past one month.

- With respect to the Entrepreneurship Orientation of KAU teacher's half (50 %) of the teacher respondents usually kept themselves up-to-date with the latest information about new technology developed, almost an equal number (47.8 %) were always eager to learn new things, learn from their previous mistakes and take corrective action. Twenty per cent usually tried to generate new ideas and find relevant information for aspiring entrepreneurs, 21.1 per cent were often able to create a vision of how the business will grow. Around thirty percent of the teacher respondents were usually ready to work long hours to meet demands of an entrepreneur, committed to guide and support the entrepreneurs in achieving their start-up goals and did not give up easily nor get discouraged by setbacks. Twenty two percent of the teachers claimed to be able to adapt KAU technology to new and changing situations of the entrepreneur. Twenty four percent claimed to effectively assist the potential entrepreneurs in transfer of technology frequently, 18.9 per cent were often able to anticipate future opportunities for entrepreneurs in terms of market demand, 43.3 per cent were always ready to pass on new technology developed by them to an entrepreneur, 27.8 per cent usually nurtured a strong desire to solve problems faced by agri-entrepreneurs, and almost a similar percentage (23.3 %) usually understood the risks involved for each decision made by the entrepreneur and knew how to analyze and weigh the risks. Forty per cent always believed that giving training on a particular technology must fit

individual learning needs and match the participant's pace of learning while 23.3 per cent usually tried to establish an effective partnership with the entrepreneur even after technology had been transferred.

- It is disheartening to note that 44.4 percent of the teacher respondents always believed that KAU would not give them due recognition for trying to promote entrepreneurship and an almost similar number (36.7 %) always believed that KAU would not give them due credit for the technology transferred. Thus, Entrepreneurship Orientation of KAU teachers were found to be at medium level and KAU has a long way to go in creating the right mind set and attitude in teachers. That being so, only 26.7 per cent of the teacher respondents perceived that KAU had to fine tune its mechanism for transfer of technology to aspiring entrepreneurs, 37.8 percent perceived that the KAU brand was always highly esteemed among agri-entrepreneurs. Teacher respondents were of the opinion that only 28.9 per cent of the entrepreneurs who approached KAU for transfer of technology went back fully satisfied. Only 20 per cent of the teacher respondents perceived that KAU often reinvented itself to meet the growing demand of a new generation of agri-entrepreneurs, one fourth (24.4 %) opined that KAU must always offer its technology free of cost to the farming community and only one fifth of the teacher respondents (20 %) opined that that KAU helped agri-entrepreneurs in starting their business.

- One-fourth (26.7 %) of the teacher respondents opined that there were sometimes many barriers to effective transfer of technology in KAU, and that administrative barriers occasionally prevented effective and timely transfer of technology in KAU. Sixteen to eighteen per cent of the teachers opined that the process of transfer of technology in KAU was bogged down by red tape and that agri-entrepreneurs will sometimes find out ways and means even without

KAUs help. Thus, 71.1 per cent of the teacher respondents perceived the Entrepreneurship Interface of KAU to be at the medium level.

- Despite this, it was encouraging to note that 90 per cent of the aspiring agri entrepreneurs reported that response at the first point of contact was quick. Thirty per cent said that subsequent follow up by KAU intermediaries was good. Forty per cent of the entrepreneurs believed the transfer of technology package was never complete and easy in terms of reproducibility, and 26.7 per cent stated that procedures involved in transfer of technology were never simple. While 36.7 per cent of the aspiring/practicing, entrepreneurs perceived the attitude of KAU intermediaries as always favourable, 56.7 per cent felt that protection of the entrepreneur's interest in the Memorandum of Understanding (MoU) was never ensured and 20 per cent stated that KAU provided hand holding services only sometimes.
- KAU was rated as 'always' not an entrepreneur friendly institution by 36.7 per cent of the aspiring/practicing entrepreneurs, 26.7 per cent opined that KAU technology had to be further fine-tuned for commercialization and 50 per cent were of the opinion that KAU scientists were always reluctant to pass on useful information. Thus, the Entrepreneurship Interface of KAU as perceived by aspiring/practicing entrepreneurs found to be low level.
- Correlation of the profile characteristics of the teachers with entrepreneurship orientation of teachers showed that years of service as a head of office/institution in KAU, number of popular articles and research notes published had a positive and significant relationship with entrepreneurship orientation.

- Correlation of the profile characteristics of the teachers with entrepreneurship interface of KAU as perceived by the teachers showed that the total number of research projects as Principal Investigator had a positive and significant relationship to the perception of KAUs' Entrepreneurship Interface.

Documenting the experiences of aspiring/practicing agri-entrepreneur in relation to KAU.

- Five technologies, viz., Veggie Wash, Red Banana Cool, Njavara based health drink, Osmo-dehydrated Products and induction of flowering and improvement of yield in adult mango trees were selected for detailed case study. Each case study brought to light a different aspect of KAUs technology transfer process that required focused and immediate attention of the highest authorities in KAU.
- The case study on Veggie Wash highlighted the need to rigorously follow set down procedures in research and the need to safeguard the credibility of the university.
- The case study on Red Banana Cool, Njavara based health drink and Osmo-dehydrated Products highlighted how delay in administrative process had entangled the transfer of technology process and there was a need to rationalize the rates for transfer of technology.
- The case study on induction of flowering and improvement of yield in adult mango trees brought to light that adopting the training pathway for transfer of technology presented a far more viable means of hassle free technology transfer.

Suggestions to foster a better entrepreneur interface for the Kerala Agricultural University and the integration of teaching and research in technology facilitation for entrepreneurship

The third objective of this study was to suggest reforms to foster a better entrepreneur interface for the Kerala Agricultural University and integration of teaching and research for technology facilitation of entrepreneurship. That being so, emphasis has been given to maximize the number of suggestions listed in the Results and Discussion chapter.

The term 'Intrapreneurs' has now come to refer to employees of an organization who display entrepreneurial qualities, including taking calculated risks to effect positive changes in an organization. Building an 'intrapreneurial' culture in organizations will go a long way towards meeting their expectations. Certain factors certainly contribute to 'intrapreneurship'. Rigid hierarchies and reporting lines will need to dissolve into an interconnected, collaborative, matrixed network that operates seamlessly. Leaders should encourage employees to 'fail fast', and not penalize them for failures arising from experimentation and calculated risk taking. By encouraging experimentation as well as by incubating innovation, an organization will be creating a millennial-friendly environment. Talent acquisition processes and learning agility are necessary to succeed in today's business environment. Organizations with a larger purpose beyond just financial growth tend to perform better than their counterparts. Being purpose-driven also brings in a sense of focus even in the face of disruptive change. Effecting changes in workplace culture is not without its challenges. Organizations today are increasingly multigenerational. Managing the expectations of millennials alongside that of Gen-Xers and in some cases, Baby Boomers in

leadership roles becomes a major challenge. Each generation brings in a very different approach to work. Another challenge is cascading the organization's purpose and values to the last mile. Balancing the need for processes and standardization while maintaining the flexibility and agility of a start-up, is yet another challenge. With their need for autonomy, flexibility and adaptability, millennials will surely reshape the work environment in the years ahead (Piramal, The Hindu, 11 Jan. 2017).

This study has documented the effectiveness of Kerala Agricultural University in technology facilitation for entrepreneurship. Entrepreneurship Orientation of KAU teachers is far from sufficient. Entrepreneurial facilitation is one area where KAU should make a lot of improvement. It still has a long way to go in inculcating the right mind set and attitude in the teachers to become an entrepreneur friendly institution. While the first point of contact to KAU was, quick and follow up made by KAU was good, administrative red tape has prevented the effective transfer of technology.

To better understand how important, it is for KAU to focus on entrepreneurship development, it seems appropriate to place the whole issue in the national context. India continues to harbor the third largest start-up base, marginally behind the U.K., according to a Nasscom-Zinnov start-up report. The report, titled 'Indian Start-up Ecosystem Maturing – 2016,' says that the ecosystem is poised to grow by an impressive 2.2X to reach more than 10,500 start-ups by the year 2020 despite the popular belief that the Indian start-up ecosystem is slowing down. There is an increased interest from student entrepreneurs this year, according to the report. A remarkable growth of 25 per cent has been witnessed in 2016 with over 350 ventures founded by young students. The median age of start-up founders has reduced marginally from 32 in 2015 to 31 years in 2016. Technology start-ups are creating a new identity for India and its technological prowess (The Hindu, 27 Oct. 2016).

India is in for a heavy growth cocktail. When the country opened-up in 1991, many thought that India would buckle down and its entrepreneurs would disappear. India has been very resilient. The Indian business has coped well with the competition from foreign industries. If heightened competition had generally resulted in compromising business ethics, let it be made known loud and clear that morality in business is still very highly respected. The younger generation in the business community today has had to straightaway hit the ground running. World players will be here. India is connected to the world market financially and economically. We must seize every opportunity to grow and produce innovative products.

Demographic indicators show that for the next 40 years, India would have a youthful, dynamic and productive workforce when the rest of the world, including China, is aging. It is further estimated that the average age in India by the year 2020 will be 29 years as against 40 years in the USA, 46 years in Europe and 47 years in Japan. In fact, in 20 years the labour force in the industrialized world will decline by 4 %, in China by 5 %, while in India it will increase by 32 %. The task before us is enormous. To employ all its youth, India will have to create 1 million new jobs every month for the next 20 years, and this can be made possible only by startups through entrepreneurship. This demographic dividend will end sooner in Kerala due to its aging population and lower population growth and therefore, for Kerala in general and KAU in specific, the relevance of this research report is of paramount importance.

Future line of work:

- This study focused only agri-entrepreneurs who had got in touch with the KAU Technology Hub. Further studies may be taken up with respect to the Agri Business Incubator at KCAET, Tavanur.
- A profile study of Entrepreneur friendly teachers in KAU may be undertaken to determine the qualities that contribute to entrepreneurship facilitation. A case in mind is that of Dr. P. Rajendran, presently the Associate Director of Research, Regional Agricultural Research Station, Ambalavayal. While he was heading the Agricultural Research Station, Anakayam he has proved that it is possible to take risks while operating within the government system to transform unproductive farms into master pieces of agricultural technology. He is now in the process of replicating that success at his present posting in Ambalavayal.
- A detailed study of technology transfer modalities may be undertaken to find out the specific delay points and factors that need to be addressed.
- A study that exclusively focuses on entrepreneurship orientation of KAU students can be undertaken.

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* Original not seen

Appendix

APPENDIX – I



KERALA AGRICULTURAL UNIVERSITY COLLEGE OF HORTICULTURE Department of Agricultural Extension

Sir/Madam,

Kum. Learou L.D. (2014-11-212) is a post graduate student of this department and she is undertaking her study on the **Effectiveness of KAU in technology facilitation for entrepreneurship**. In this connection, I am attaching herewith a questionnaire and I kindly request you to take a few minutes to fill it up. Taking into consideration your busy schedule we have tried to make the questionnaire as short as possible. Kindly note that the information provided by you will be used only for the purpose of this research and hence kindly provide honest/candid answers.

Thanking you,

Yours faithfully,

Dr. Alexander George
Professor and Head
CTI, Mannuthy

Entrepreneurship Orientation of KAU Scientists – Questionnaire

A. Scientist Profile

1. Name:
2. Designation:
3. Department/College/Research Station/Unit:
4. Age: (completed years of age):
5. Gender: Male/Female
6. Qualification (tick above all that are applicable): M.Sc/PhD/Post Doc

B. Service Details

To be given in number of completed years for each case

1. Total service prior to/outside KAU:
2. Total service in KAU:
3. Years of service in a College of KAU:
4. Years of service in a Research Station of KAU:
5. Year of service at an Extension Centre of KAU:
6. Years of service as a head of office/institution in KAU:

C. Faculty Improvement:

1. Number of National Seminars/Symposia/Winter/Summer Schools attended during the past 5 years:

D. Publications

Only data for the past 5 years need to be provided

- 1 Number of Popular Articles:

- 2 Number of Research Articles:
- 3 Number of Research Notes:
- 4 As Author of books/technical publications:
- 5 As an Editor of books/technical publications:
- 6 As Contributor of one or more chapters of a book/technical publication:

E. Research

(Only data for the past 5 years need to be provided):

- 1 Total number of research projects for which you were the PI:
 - 1.1 How many of those projects are still ongoing as on date:
 - 1.2 How many of those projects are completed as on date:
2. Total number of Research projects for which you were associated as Co PI:
 - 2.1 How many of those projects are still ongoing as on date:
 - 2.2 How many of those projects are completed as on date:

F. Student Research Guidance

(Only data for the past 5 years need to be provided)

Capacity >	As Major Advisor	As Advisory Committee Member
Number of M.Sc. Students		
Number of PhD Scholar		

G. Recognition's Received

(Only data for the past 5 years need to be provided)

1. Number of State Level Awards:
2. Number of National Level Awards:

3. Number of International Level Awards:
4. Patents or GI registrations:
5. Number of recommendations proposed by you that have been included in the KAU Package of Practices:

H. Extension Activity

1. Number of Radio talks or television interviews done by you during the past 5 years:
2. Number of field visits you have undertaken in the last 6 months
3. Number of farmers who have contacted you for getting information in the past one month:

I. Most Significant Contributions

1. List what you consider the three most significant contributions that you have made during your service in KAU in the space provided below. It may be in the field of teaching/Research/Extension or other area

	is bogged down by red tape								
10	Agri entrepreneurs will find out ways and means even without KAUs help								

**EFFECTIVENESS OF KERALA AGRICULTURAL
UNIVERSITY IN TECHNOLOGY FACILITATION
FOR ENTREPRENEURSHIP**

By

L. D. LEAROU

(2014-11-212)

ABSTRACT OF THE THESIS

**Submitted in partial fulfilment of the
requirement for the degree of**

MASTER OF SCIENCE IN AGRICULTURE

Faculty of Agriculture

Kerala Agricultural University



DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF HORTICULTURE

VELLANIKKARA, THRISSUR – 680656

KERALA, INDIA

2016

ABSTRACT

Kerala Agricultural University (KAU) has in the past been adjudged the best in the nation in academics' performance. Undoubtedly KAU has a pool of very good teachers, but how did this translate into technology facilitation for entrepreneurship? How oriented were KAU teachers in converting research output into entrepreneur usable technology? Were teachers keeping the technology to themselves for fear that once released they would never get due credit for the effort they had put in? Were intellectual property rights at stake? Was innovation duly rewarded? Where did KAU stand on ease-of-doing business parameters? What were the issues that needed to be addressed to make KAU gain the status of being an entrepreneur friendly destination? Could technology transfer procedures be simplified? Was there a mechanism for aspiring entrepreneurs to redress their grievances? These were the questions that this study sought to address.

The study attempted to decipher the level of entrepreneurship orientation among KAU teachers. The study documented the experiences of aspiring/practicing agri-entrepreneurs in relation to KAU with respect to transfer of technology. The study provided insight on how KAU can reinvent itself to remain relevant in the changing agribusiness scenario and made suggestions for improving the entrepreneur interface of Kerala Agricultural University. The random sample included 90 teachers and 30 aspiring/practicing agri-entrepreneurs who had contacted the KAU Technology Hub.

The study documented the profile characteristics of the teacher respondents with respect to designation, place of work, age, gender, qualification, service details, faculty improvement, publications, research involvement, recognitions received and extension activity.

Entrepreneurship Orientation of KAU teachers: While teachers had a positive attitude towards entrepreneurship, 44.4 per cent believed that KAU would never give

them due recognition for trying to promote entrepreneurship and 36.7 per cent believed that KAU will never give them credit for technology transferred.

Entrepreneurship Interface of KAU as perceived by the teacher respondents: 26.7 per cent opined that there were sometimes many barriers to effective transfer of technology in KAU and that administrative barriers often prevented effective and timely transfer of technology in KAU.

Entrepreneurship Interface of KAU as perceived by aspiring/practicing entrepreneurs: 90 per cent expressed that response at first point of contact was always quick but 56.7 per cent stated that protection of entrepreneur interest in the MoU was not really ensured.

Based on mean score index the Entrepreneurship Orientation of KAU teachers and the Entrepreneurship Interface of KAU as perceived by the teachers was found to be at a medium level while the Entrepreneurship Interface of KAU as perceived by aspiring/practicing entrepreneurs was found to be at a low level.

Years of service as head of office/institution in KAU, number of popular articles and research notes published had a positive and significant relationship with Entrepreneurship Orientation. Total number of research projects as Principal Investigator had a positive and significant relationship with the perception of KAUs' Entrepreneurship Interface as perceived by the teachers.

Five technologies, viz., Veggie Wash, Red Banana Cool, Njavara based health drink, Osmo-dehydrated Products and induction of flowering and improvement of yield in adult mango trees were randomly selected for case study. Each case study brought to light a different aspect of KAU technology transfer process that required focused and immediate attention of the highest authorities in KAU.

Suggestions have been put forth to foster a better entrepreneur interface for the Kerala Agricultural University and four areas were delineated for future research.

