OCCASIONAL PAPER

19

S.P. Subash, Manju Gerard, K. Srinivas
and R. Kalpana Sastry

DEVELOPING INTELLECTUAL PROPERTY AND TECHNOLOGY MANAGEMENT PROFESSIONALS IN NARES: THE CASE OF NAARM

September 2017

भाकृअनुप - राष्ट्रीय कृषि अनुसंधान प्रबंध अकादमी
राजेन्द्रनगर, हैदराबाद-५०००३०, तेलंगाणा, भारत
ICAR-National Academy of Agricultural Research Management
(ISO 9001:2008 Certified)
Rajendranagar, Hyderabad-500030, Telangana, India
https://naarm.org.in

Citation

S.P. Subash, Manju Gerard, K Srinivas and R Kalpana Sastry (2017), *Developing Intellectual Property and Technology Management Professionals in NARES: The case of NAARM*. Occasional paper 19, ICAR-National Academy of Agricultural Research Management, Hyderabad

Published By
Director, ICAR-NAARM, Hyderabad

Printed at
Printing Press, ICAR-NAARM

Preface

In 2006, ICAR took the stewardship of technology commercialization through promulgation of Intellectual Property and Technology commercialization policy. Realizing the importance of education of IP to all stakeholders from farmers to innovators to industry players, ICAR-NAARM initiated sensitization workshops & seminars. Subsequently, ICAR established the Zonal Technology Management Units & Business Planning and Development units across the ICAR institutes.

Concurrently, Academy started its initiatives with the aim to develop professionals for Knowledge Process Outsourcing industry in agricultural domain. NAARM started one-year full time diploma in IP& TM. On the huge demand of working professionals, the course is offered in distance education mode along with University of Hyderabad.

Considering the efforts of ICAR-NAARM in this area in the past decade and to identify the future steps required for capacity building, this study was carried out to assess the impact of all the programs in IP&TM from 20016 to 2011.

The authors place on record the support of all the faculty and staff of the Academy whose continuous encouragement has helped the program to reach to the present state. All the support from Centre for Distance and Virtual Learning, University of Hyderabad is duly acknowledged. To end with, we express our sincere gratitude to the Director, NAARM for taking this initiative and providing all support and guiding us time to time in carrying out this study.

Authors

Acronyms

DST	Department of Science & Technology
DCR	Directorate of Cashew Research
EPO	European Patent Office
GoI	Government of India
ICAR	Indian Council of Agricultural Research
IPE	Institute of Public Enterprise
ITMC	Institute Technology Management Committee
ITMUs	Institute Technology Management Units
IP	Intellectual property
IPRs	Intellectual Property Rights
KIRAN	Knowledge Involvement in Research Advancement through Nurturing
KPO	Knowledge Process Outsourcing
LUVAS	Lala Lajpat Rai University of Veterinary and Animal Sciences
LPO	Legal Process Outsourcing
NAARM	National Academy of Agricultural Research Management
NAIP	National Agricultural Innovation Project
NARES	National Agricultural Research and Education System
NIVEDI	National Institute of Veterinary Epidemiology and Disease Informatics
PGDTMA	Post Graduate Diploma in Intellectual Property and Technology Management
PPVFRA	Protection of Plant Varieties & Farmers Right Act
QRT	Quinquennial Review Team
SAUs	State Agricultural Universities
SMD	Subject Matter Division
TIFAC	Technology Information, Forecasting and Assessment Council
TRIPS	Trade-Related Intellectual Property Rights
USPTO	United States Patent & Trademark Office
UoH	University of Hyderabad
WIPO	World Intellectual Property Organization
WTO	World Trade Organization
ZTM&BPD	Zonal Technology Management and Business Planning and Development

List of Tables

List of Figures

Contents

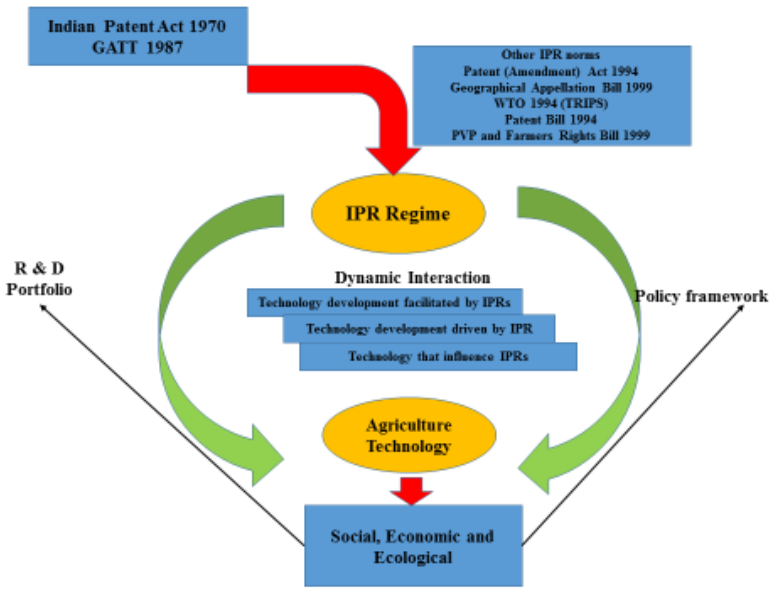
Chapter 1. Background

1.1 Introduction

Intellectual property (IP) regime in India dates back to colonial era, but in the post-independence period it started with Patents Act 1970 (Graff 2007). IP regime started in agriculture with the signing of Trade-Related Intellectual Property Rights (TRIPS) agreement under World Trade Organization (WTO) in 1995. By 2000, India amended various laws to comply with the minimum requirement of the agreement (Rao and Kalpana Sastry 2004). With the signing of TRIPS agreement, India became obligated to modify its laws to bring plant varieties under IP by *sui generies* system. Accordingly, in Indian law, the Protection of Plant Varieties & Farmers Right Act of 2001 covers IPRs related to innovation on crops and planting (PPVFRA Act, 2001).

Promoting creativity and innovation through IP policies and commercialization through licensing are two main components of the development agenda of several global floras, including World Intellectual Property Organization (WIPO's) development agenda. In 2007, WIPO formally adopted the Development Agenda with forty-five recommendations. This agenda encompasses recommendation on transfer of technology, protection of genetic resource and traditional knowledge, and preservation of public domain. This put forth emphasis on shift of the approach of all-purpose IP law to custom/tailor made approach. To help WIPO to build a positive approachable policy and research agenda for IP law, Yu (2012) put forward the need of intellectual property training and education for development. He had also listed pros and cons of various method of delivery of training and educational program such as a face-to-face teaching, distance, town hall meetings, professional development, academic exchange and published information. The dynamics of interwoven relation between agriculture and IPR, can be better understood by observing the technology development facilitated by IPRs, technology development driven by IPRs and technologies that influence IPRs as shown in Figure 1.

Figure 1. IPR Regime and technological processes in agriculture



Source: Ravishankar and Archak (2000)

It is widely acknowledged that's several incidences such as United States Patent & Trademark Office (USPTO) grant on wound healing property of turmeric and basmati rice in the late 1990s, patents grant on neem based bio pesticide by European Patent Office (EPO) triggered a lot of public awareness and turmoil in the Indian landscape (Kalpana Sastry, 2009). This also led to more awareness in the policy makers, judiciary, R & D researchers and public at a large that there is a need to develop IP advocacy and understand the nuisances of the global and national laws in the context of research programmes (Tulsi and Rao 2008). The fact that that India was a signatory on biodiversity convention 1992, also brought forth the development of National Biodiversity Act (NBA 2002[1]). In this regard first efforts was to make laws in place, followed by research organisation started policies in place (Kalpana Sastry, 2009).

The IPRs, technology development and transfer would have multiple impacts on the farmers, researchers and organizations involved in the agribusiness where multiple sectors and networks work together. The IPR regime can be successful only with strong legislation and implementation of laws. In view of strengthening the IPR regime The Government of India has recently announced the "National Intellectual Property Rights (IPR) policy (GoI, 2016a) with the mission to stimulate a dynamic, vibrant and balanced IPR system in India to foster creativity and innovation thus promoting entrepreneurship. The focus areas are access to health care, food security and environment protection among other sectors of vital social, economic and technological importance. The present IPR policy document advocates promotion of a holistic and conducive ecosystem for catalyzing the intellectual property for economic, socio-cultural development and protecting public interest. The policy document put forth seven objectives namely (i) IPR awareness: outreach and promotion, (ii) generation of IPRs (iii) legal and legislative framework, (iv) administrative management, (v) commercialization of IPR, (vi) enforcement and adjudication and (vii) human capital development.

1.2 Efforts by Public Sector Organizations on IPR awareness

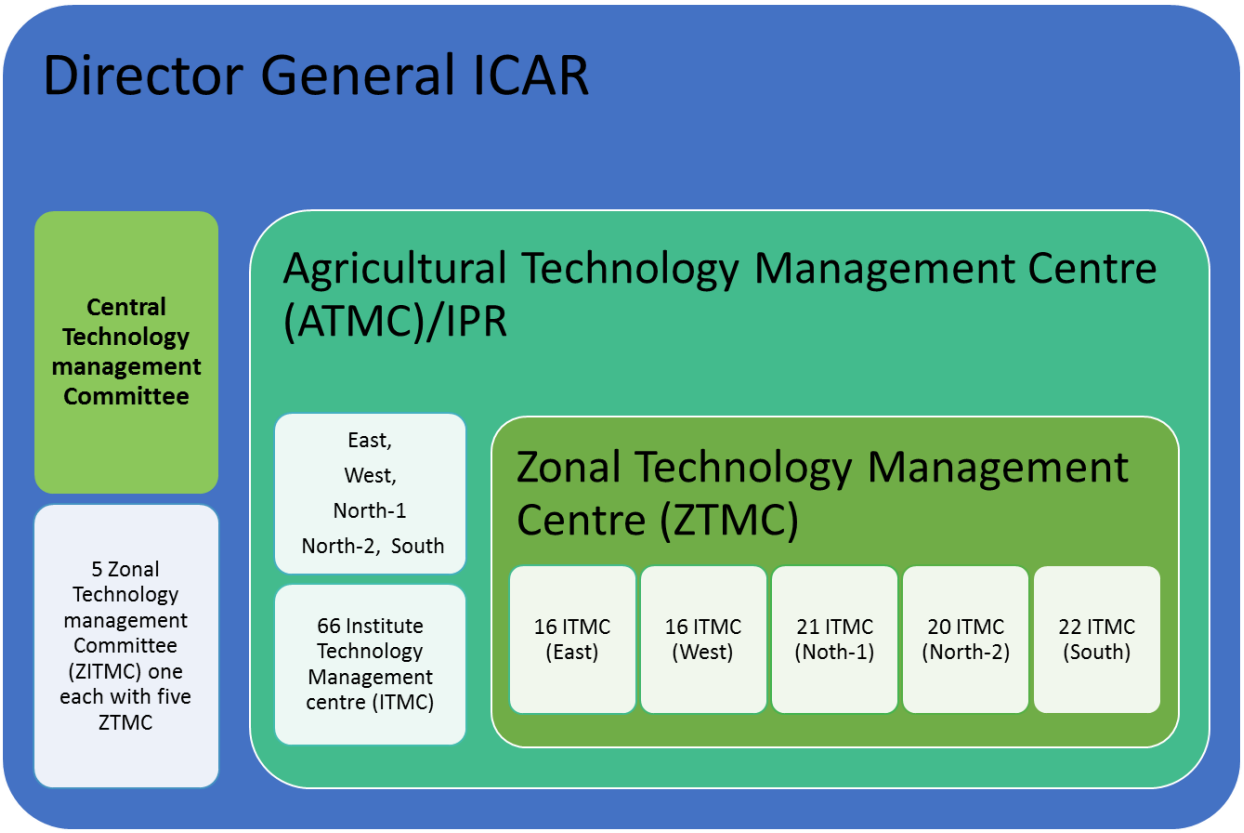
Since the implications of the technology and IPRs could be in social, economic and ecological system where the involvement of public sector is important to enhance the creation of a better environment for improving the agricultural innovation in the country. In addition, for implementation of several kinds of techniques/methods, farming equipment etc., by public and private players, there is a need for advertisement with the society. Thus, education and training in the area of IPR and technology management plays an important role. In this direction the Women Scientists Scholarship Scheme (WOS-C) of Technology Information, Forecasting and Assessment Council (TIFAC) (as a part of umbrella scheme– Knowledge Involvement in Research Advancement through Nurturing (KIRAN) of Department of Science & Technology (DST), GoI) is a progressive step. The scheme train the women having qualifications in science/engineering/medicine or allied areas in the area of IPR and their management for a period of one year. Besides patent filing and prosecution work, the women are trained to generate technology scan-cum-patent analysis reports on wide range of topics. Such services are not only in demand from an Indian clientele but in countries also, through Knowledge Process Outsourcing (KPOs) and Legal Process Outsourcing (LPOs). Looking at the demand for IP fabric of the nation, the scheme is looked as thread bearer and trainees as thread.

[1] http://nbaindia.org/content/25/19/1/act.html

1.3 Mainstreaming IP & TM into NARES

Indian Council of Agricultural Research (ICAR) had taken the stewardship of technology commercialization through the promulgation of IP and technology commercialization policy in 2006 (ICAR, 2006). Since 2007, the institutionalization of the policy was initiated through development of set of operational guidelines (ICAR, 2014a; ICAR, 2014b) and also through establishment of a governance mechanism in a three tier mode across all the 100 institutes of all ICAR (Samuel et al., 2014). Accordingly, Institute Technology Management Units (ITMUs) have been established in its 95 institutes as a single-window mechanism to highlight the intellectual assets of the institute and pursue matters related to IP management and transfer/commercialization. In addition, five Zonal Technology Management and Business Planning and Development (ZTM&BPD) Units were created as the middle-tier, in synergy with the ITMUs, in their respective zones (Figure 2).

Figure 2. Three –Tier Mechanism for IP management in ICAR systems



Source: Kalpana Sastry (2009)

The institutionalization of IP management in the ICAR institutes has been able to create the desired awareness of IP issues and a minimum level of in-house expertise. This needs to be nurtured with the aim to generate an environment in which researchers come forward with ideas and create an effective innovation system. Under the World Bank National Agricultural Innovation Project (NAIP) grant, efforts were made to bring incubation systems, which are driven by IP. Ten Agri-Incubation centers[2,] have been established in the

[2] The ZTM&BPD Units were established in five ICAR Institutes namely - National Institute for Research on Jute and Allied Fibers Technology, Kolkata (East); Central Institute for Research on Cotton Technology, Mumbai (West); Indian Agricultural Research Institute, New Delhi (North-I); Indian Veterinary Research Institute, Izatnagar (North-II); and Central Institute of Fisheries

XI Plan Scheme, with support from NAIP. These Agri-Incubators have been instrumental in formulating business policy, plan and developing models for technology commercialization not only for the institutes where they are located, but also for the identified institutes in the respective zone.

Based on the experiences gained in the XI Plan Scheme, along with support from NAIP, the XII Plan Scheme proposed some changes and additional scaling up. The major change was reorganization of the institutes associated with the ZTM&BPD Units. Earlier, the institutes were associated based on geographic location, later it changed to subject specific association of the institutes with the ZTM-BPD Units; in congruence with the Subject Matter Division (SMD) in ICAR Headquarter.

These efforts by ICAR have been successful in creating an institutional mechanism for commercialization of agriculture research products/technologies generated from public research institutions. The ZTM & BPD Units were supported to provide the physical infrastructure necessary for technology incubation and to launch new business, including offices and lab space, and shared resources such as specialized equipment and technical support services. This lead to a growing demand of professionals to manage the IP enabled ecosystem. There was a dire need of capacity building in terms of human resource by engaging/contracting professional help and providing required trainings to the existing inter-disciplinary professionals in the area of technology management and enterprise creation.

1.4. Efforts by ICAR-NAARM

Education and knowledge of IP to all stakeholders from farmers to innovators to industry players is key for becoming the beneficiaries of IP regime as well as for competing with global players. Coincident with the developments at global national level, academy started sensitisation of IPR. ICAR-NAARM entrusted with the responsibility of building capacity and competencies of human resources in NARES in the specific area of IP & TM. The chapter 12 of the IP & TM policy document of ICAR also emphasised on role of NAARM in sensitisation and training of professionals in NARES on IP & TM (ICAR 2006). The time line of evolution of IP and TM at NAARM as shown in figure 3.

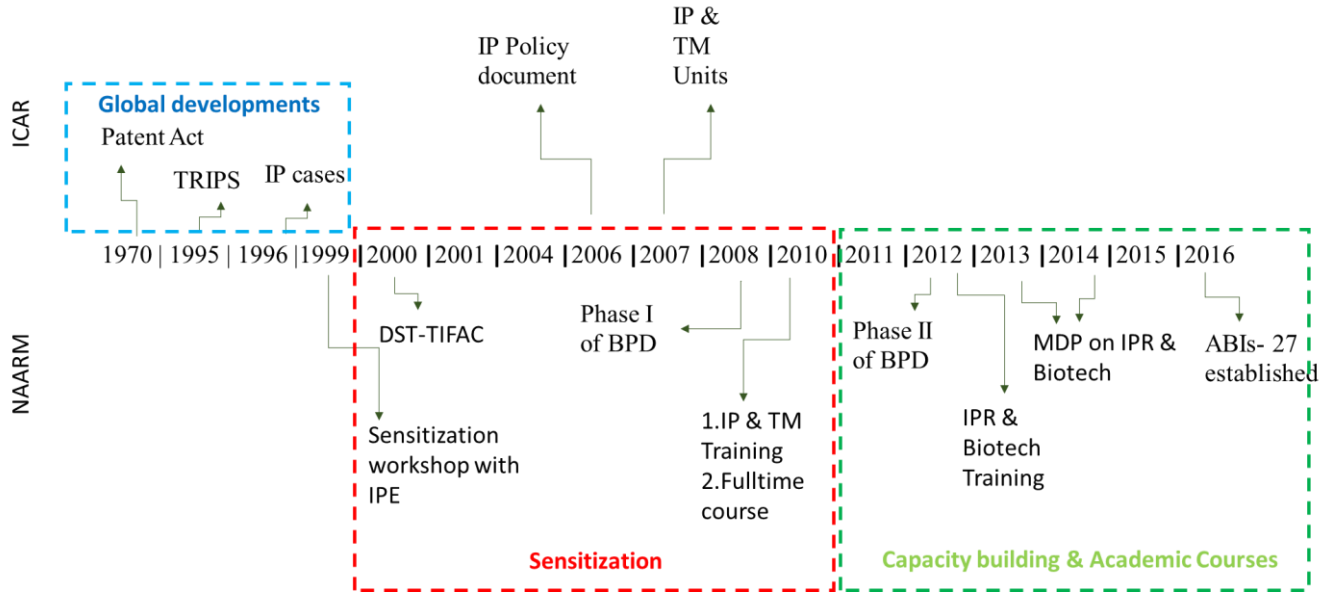
The first phase (2000-2010) was sensitization, in which various workshops were conducted to sensitise the about IPR in the NARES. It started with awareness and sensitisation workshop in partnership with Institute of Public Enterprise (IPE), followed by one-day awareness programme with DST-TIFAC. In 2006, ICAR came up the of IP and technology commercialization policy. After the implementation of the IP policy, the academy with ICAR HQ took the responsibility of organising sensitization workshops. By 2007, IP & TM units named as ZTMUs. In 2008, BPD-I started and from the sensitisation phase academy started training, workshop and academic course. The grant from NATP for BPD provided opportunity for conducting training and establishing BPDs across various ICAR and SAUs. The fifth QRT of the academy recommended starting of academic courses in IP & TM using the expertise gained through research and training. In 2010, a full time diploma in IP & TM started as a one-year residential programme. The focus was to develop professionals for KPO industry in agricultural domain. The academic initiative undertaken with a detailed

Technology, Kochi (South); and in five State Agricultural Universities, namely, Anand Agricultural University, Anand; Birsa Agricultural University, Ranchi; Chaudhary Charan Singh Haryana Agricultural University, Hisar; Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur; and Tamil Nadu Agricultural University, Coimbatore.

stakeholder's consultation. Prospective clientele such as industry, policy and statutory bodies, law firms consulted for designing the curriculum of the course. The course designed to be, offered as a 12-month diploma course through a national level selection process following an exam, group discussion and personnel interview mode of selection. Sixteen students were selected and admitted in the first batch.

After offering the diploma programme in IP & TM for one year, there was a demand from working professionals for offering the IP & TM courses in a distance education mode. In 2011, NAARM together with University of Hyderabad (UoH) started offering Post Graduate Diploma in Technology Management (PGDTMA). The vision 2050, document of NAARM also envisaged Intellectual Property Management as a key area of the academy. The allocation of HRD fund for attending the course and a credit of two points awarded for the diploma degree brought recognition and acceptance of the course in the NARES system. Simultaneously under the Learning and Capacity Building project of NAIP several in-house training programmes were developed for mid-level and senior level scientist and academicians in the NARES, SAARC and ASEAN countries. Various other training programmes such as 'Intellectual property rights and biotechnology' was organised by the academy. This programme, later launched as Management Development Programme (MDP) on IPR and Biotechnology in 2013 and 2014.

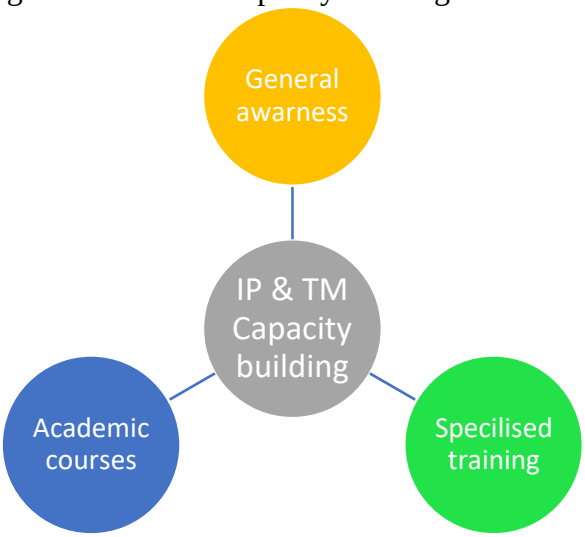
Figure 3. Evolution of IP & TM at ICAR-NAARM



Source: Based on data collected by authors

The efforts of developing IP & TM as a part of capacity development focuses primarily on three areas; General awareness, specialised training programmes and academic programmes, as shown in Figure 4.

Figure 4. IP & TM capacity building dimensions



Source: Drawn by authors

Chapter 2. The Study

NAARM as part of the training and capacity building programme had offered a full time programme in IP and TM (2010-11), and various training programmes (one or two per year) on IP and TM (2010–2016), and a distance education programme (PGD TMA) offered together with University of Hyderabad since 2011[3].

The aim of the IP & TM training and course offered by NAARM was to educate the stakeholders in the agricultural ecosystem in India. The specific objective of IP & TM trainings were to develop the skills of the mid-level and senior professionals in the NARES. The full time course developed for professionals in the agricultural ecosystem. The professionals aimed to be intersect between law and science. There was a demand from the working professionals to avail a course in distant mode. Therefore, a distance education programme was designed for them, to develop their skills in the emerging area of IP & TM. The course was specially designed to cater the needs for building a strong IP portfolio along with efficient technology management, diffusion and commercialization skills among the scientists, teachers, students and professionals engaged in agriculture and related industries. Considering the efforts of NAARM in this area in the past decade, a study carried out to assess the impact of all the programs from 2006 to 2011. The results from the study is discussed in chapter 3.

2.1 Objective

The key objectives of the study are

1. To understand the effectiveness of various capacity building programmes on IP & TM initiated by NAARM
2. To assess the outcome of these initiatives in professional accomplishments
3. To identify the future steps to be taken for capacity building in the area of IP & TM with the focus to enhance the entrepreneurship and innovation for employment and livelihood.

2.2 Purpose

Since 2010, ICAR-NAARM has trained 333 individuals across India from various organisations and institutions. The number of participants attending each programme is given in Table 1. The specific objective of the assessment is to understand the impact of this training programme, on their knowledge, skill and influence on their career growth. This would give insights in understanding how the course is helping the participants and for re-designing the existing course or designing similar courses.

Table 1. Number of respondents in each category

Courses/Training	Participants	Total mailed	Responded	Percent
PGD TMA	191	145	29	20.00
IP & TM full time	16	16	6	37.50
IP & TM Training	126	50	8	16.00
Total	333	211	43	12.91

[3] At:http://www.naarm.ernet.in/images/stories/docs/PGDTMA/naarm_Brochure-PGD-TMA-2015.pdf (Accessed on 22-03-2017)

2.3 Sample size

Though the overall sample response rate is low, it satisfies the minimum requirement set forward by Nutly (2008). The minimum sample size for online base surveys under 'Liberal condition' (10% error and 80% confidence interval) is 8% for 300 students (Table 1). Though the sample size requirement is satisfied, the samples were not, selected at random. This could lead to response bias. So the study could not be generalise (low external validity). However, the results could be interpreted, for understanding what happened to the participants who had attended the courses and training and how it influenced their career pathway.

2.4 Methodology

2.4.1 Data collection

As the study subjects distributed sparsely across India, the data was collected using web based questionnaire. A questionnaire developed in google form, mailed to the participants of the IP & TM programmes/courses (Table 2). The word and PDF format of the questionnaire was provided to the respondents. Two reminders were send in a week's interval to fill the questionnaire.

Table 2. Web based questionnaire

S. No.	Course/Training	Google Form link
1.	PGDTMA	http://goo.gl/forms/FA6cjizizqBZFjvn1
2.	IP & TM full time course	http://goo.gl/forms/Ty8sAuOiKtiDaalG3
3.	IP & TM Training	http://goo.gl/forms/fPJKC0yjghCDeZht1

2.4.2 Data Analysis

The study used a mixed approach to analyse the data. The quantitative data collected for basic information and scales were summarised using tabular analysis, percentage and graphs. The qualitative data was analysed using content analysis based on the statement made by the respondents (Flick 2014[4]). The unit of analysis was 'Paragraph' (statement in a line or more), given as a response to the open-ended questionnaire. The qualitative data was quantified and visualised using word cloud (https://worditout.com/) and Microsoft Power BI (https://powerbi.microsoft.com/en-us/). World cloud is an image composed of words in the response of open-ended questionnaire. The size of each word indicates the frequency or importance of word. It gives insights into the qualitative data. Using Microsoft Power BI we had drawn Sankey diagram. It's a specific type of flow diagram, which is used to visualise the impact pathway.

[4] See Flick, U (2014). An Introduction to qualitative research. Sage Publications Ltd. for detailed methodology.

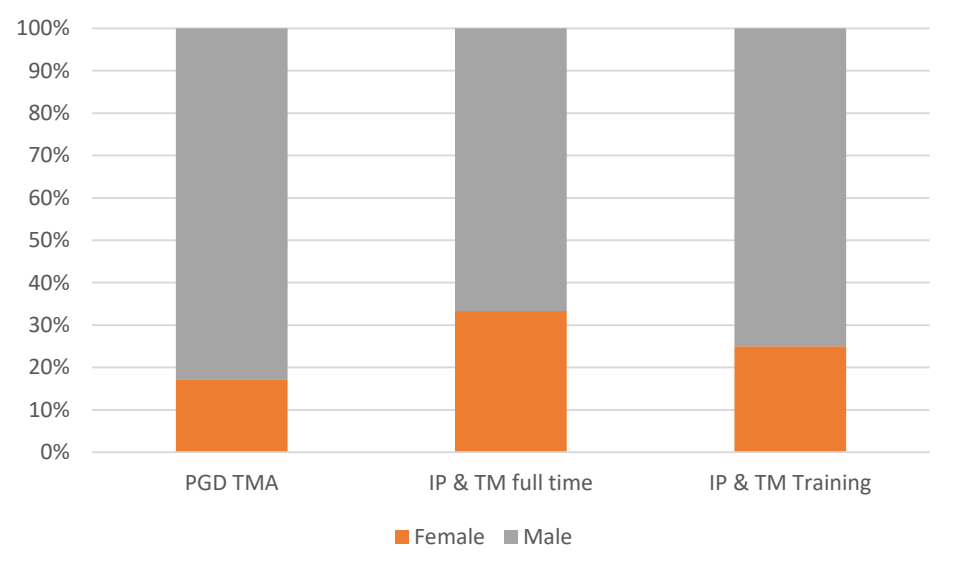
Chapter 3. Results and Discussion

The results are summarised in three categorises; Training programmes on IP & TM (IP & TM training), IP & TM course, and Post Graduate Diploma in Intellectual Property and Technology Management (PGD TMA).

3.1 Basic profile

The individual profile of the respondents are provided in this session. The gender composition of the respondents' shows that, roughly one third of the respondents in case of IP &TM fulltime and training were females (**Error! Reference source not found.**), while in case of PGDTMA it was 17.24%. The gender ratio is on par with desired ratio in such courses.

Figure 5. Gender composition of surveyed respondents



Source: Based on data collected by authors

The average age and experience of respondents are tabulated in Table 3. The average age of respondents are lesser in IP & TM full time and PGDTMA as the participants are mostly early level carrier aspirants. In case of training, the participants are mostly mid-level and senior professionals with an average age of 45 years.

Table 3. Age and experience of the surveyed respondents

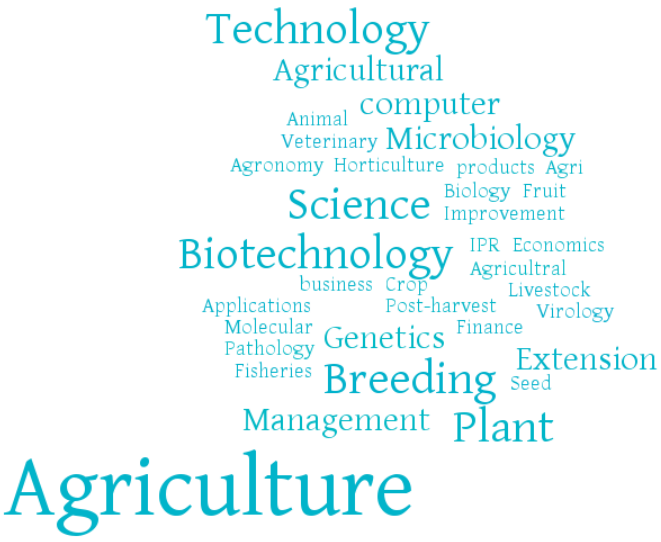
	PGD TMA		**IP & TM full time**		**IP & TM Training**	
	Age	Experience	Age	Experience	Age	Experience
Observation	29	29	6	6	8	8
Mean	39.72	12.95	37.00	12.00	45.63	18.75
Std. Dev.	10.48	10.79	10.10	8.32	4.72	5.50
Min	25	0	30	6	42	13
Max	68	47	50	25	54	28

Source: Based on data collected from online survey by authors

3.2 Discipline and focus area

The respondents are from varied disciplines. A word cloud was drawn to understand the disciplines (Figure 6). The participants were mostly from agriculture with diverse discipline such as biotechnology, plant breeding and extension.

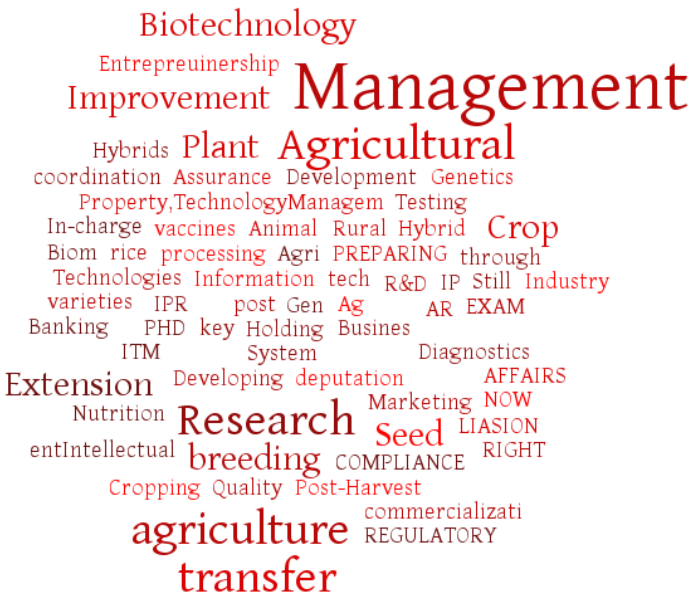
Figure 6. Disciplines of PGD TMA respondents



Source: Based on data collected by authors

In case of IP & TM training respondents, three are from the discipline of biotechnology, one from horticulture and two from veterinary sciences. Though the participants are science background, they mostly are, focused in Management (Figure 7).

Figure 7. PGD TMA respondents focus area



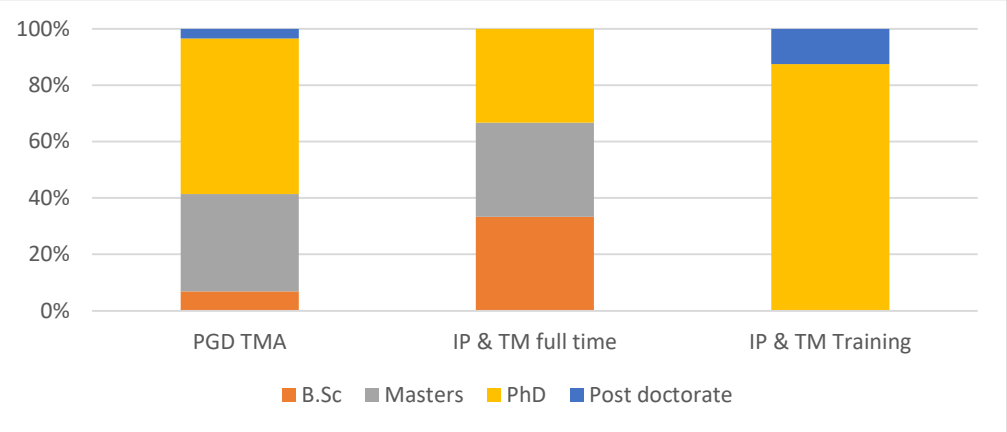
Source: Based on data collected by authors

In case of IP & TM full time course four out of six respondents are working in Intellectual property as the area of current focus, the other two are in veterinary science and seed production respectively. In case of IP & TM training respondents, five are engaged in biotechnology and genetics as area of current focus, and two are in field of veterinary sciences.

3.3 Qualification

The graphical representation of qualification of respondents are shown in Figure 8. Most of the PGD TMA respondents were Master's and PhD graduates. In case of IP & TM full time course, the students were, equally distributed among Bachelors, Master's degree and PhD. While the IP & TM trainees were only PhD and Post Doctorates as the clienteles are mostly Scientists and Professors from NARES.

Figure 8. Qualification of the respondents

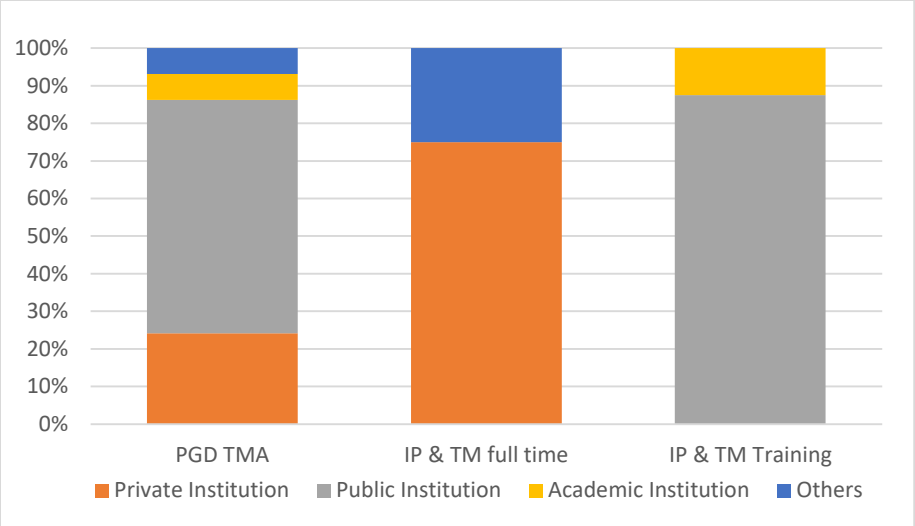


Source: Based on data collected by authors

3.4 Organisation

The organisations with whom the respondents are affiliated is shown in Figure 9. Roughly, 20% of the respondents in PGD TMA are associated with private institution, while 60% of them are with public institutions. About 75% of the IP & TM full time respondents are associated with the private sectors, while 87% of the IP & TM trainees are from public sector and the rest from academic institutions. The database available with the academy on the 16 full time graduates shows that, about 15 of them are how working with private Agri-input Companies, Knowledge Processing Organisation (KPOs), Farm Machinery Company, Start-up and in Professional law-firms. In the due course of seven years, they were moving in different positions across different companies.

Figure 9. Percentage of respondents in different organisations/Institutions



Source: Drawn by authors based on data from online survey

3.5 Driving force for the programme

The respondents were asked to state the reasons or motivations behind joining the course or programme. It was an open-ended question and the respondents gave answers in a sentence to a paragraph (no word limit was provided). The statements were then visualised using word cloud to understand the key factors (Figure 10). The key words emerged were course, knowledge and interest. To understand this factor and attributing them further, qualitative analysis using content analysis was carried out.

Figure 10. Motivation for joining the programme by PGD TMA respondents

Source: Based on data collected by authors

The factors motivating the participation among the participants to join the course was analysed using content analysis as shown in Table 4. The key factors emerged are self-driven interest, knowledge seeking, features of the course, referred by others, career growth & potential.

Table 4. Factors determining participation

S.No.	Factors	Quotes
1	Self-driven interest	"Personal interest to learn about agri business". "Interested to learn the special concepts of the management given by this course & is conducted by NAARM & UoH collaboration". "Interest in IPR & other related aspects". "Interest towards Patent Systems & NAARM (ICAR)" . "Interested in Learning about IP". "I'm always interested in agricultural sector and want to pursue a career in this sector". "During service period served from grass root level to State level always ahead. I had to perform over the vast field of agriculture by management broadly in research, extension, NRM and statistics as a member of selection Board of Public Service Commission, even as a Member of IMC of some 2 ICAR Institutes. Still I am to impart guidance. From the Nomenclature of PGD_TMA, I thought it has research management mechanism to learn what new may be. As such on the principle of learn till death, I undertook the PGDTMA".
2	Knowledge seeking	"Enhance knowledge in the area". "To advance my knowledge in the field of IP & TM". "Update my knowledge" "Enhancing knowledge and skills". "Interest in exploring management of technologies". "To update the knowledge on IP". "To learn more about technology management".
3	Features of the course	"Course design and structure", "Course structure", "Course Contents and Faculty", "Uniqueness of the course offering Technology management in Agriculture, Reputation of the institute (NAARM) offering the course, Credentials of the faculty and the course Director.
4	Referred by others	"Friend Suggested". "My senior who is working as assistant professor in TNAU guided me to join for this course".
5	Career growth & future potential	"Certification for Job". "Post-retirement benefits". "To Learn IPR and Update My Skills for Career Enhancement". "My career would be as plant breeder, I would have to come across Plant Breeder Right's and related IPR issues". "I was pursuing technology transfer activities at IVRI as officer, incharge, ITMU". "Interest in transfer and commercialization of technologies". "Emerging area in Plant Variety Protection and Farmer's Rights Act".

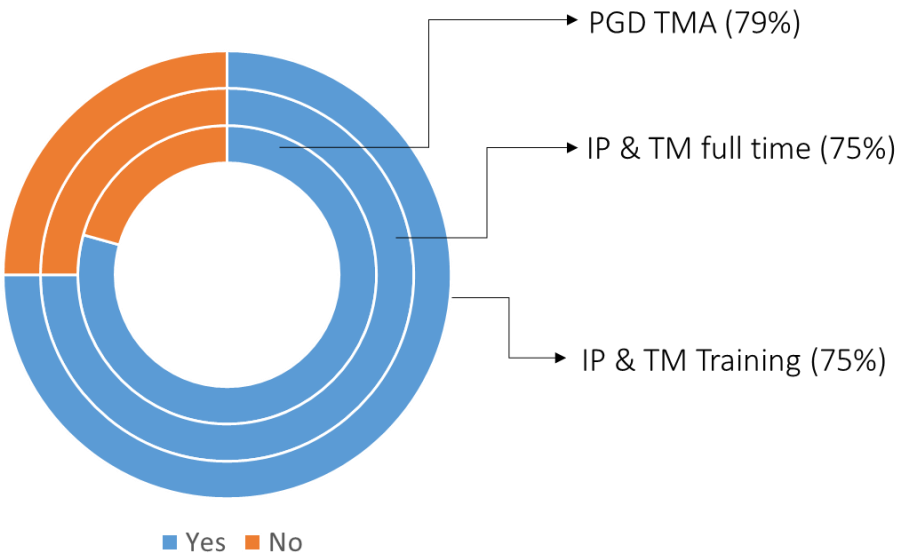
Note: The identity of the respondents by name is avoided to keep confidentiality. The quotes are separated by double quotes (" ").

Source: Based on survey data collected by authors

3.6 Level of awareness and knowledge

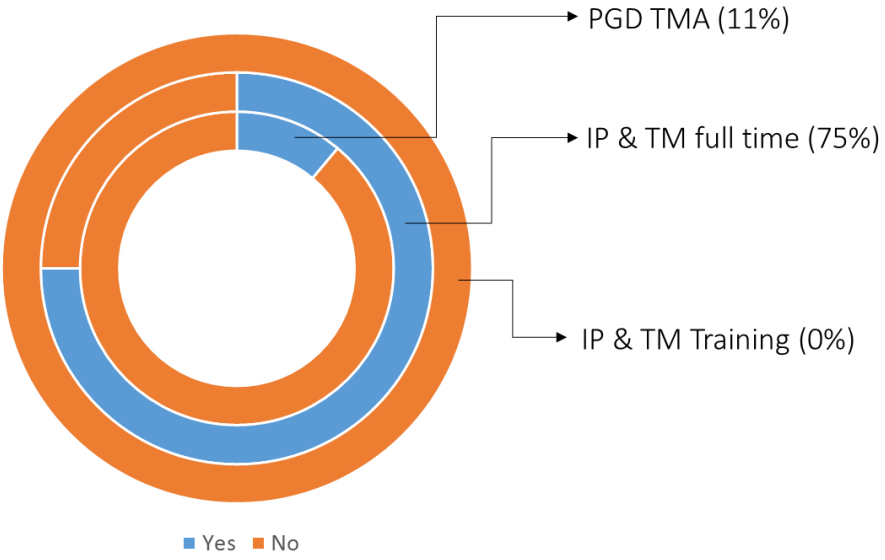
About 75% of the respondents in all the three programmes had attended some course in IP before joining the course or programme at NAARM (Figure 11). Only IP & TM full time respondents (75%) have attended IP programmes after the course/programme at NAARM (Figure 12).

Figure 11. Courses before NAARM



Source: Based on survey data collected by authors

Figure 12. Courses after the course/training at NAARM



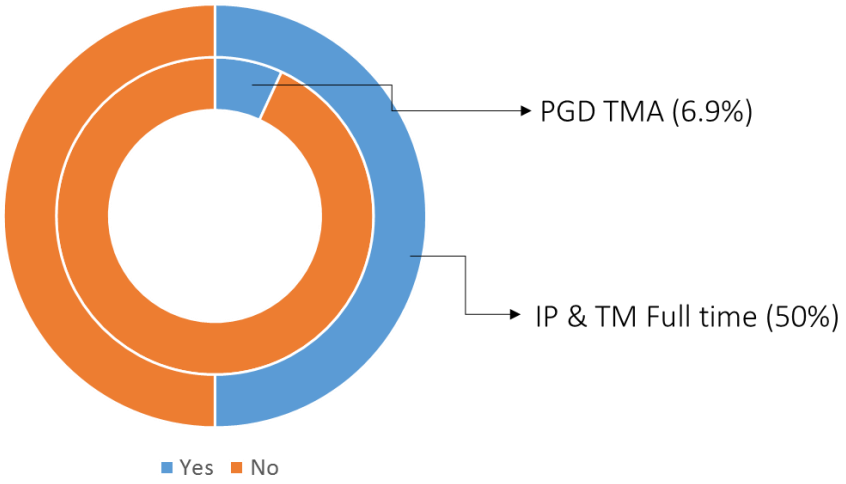
Source: Based on survey data collected by authors

3.7 Utilization of knowledge

Two members of the PGD TMA programme, are registered with Syngenta India Limited, Indian Patent Office as Patent agent and patent facilitator. About 50% of the IP & TM full time respondents are registered as patent agents. All the respondents of IP & TM full time

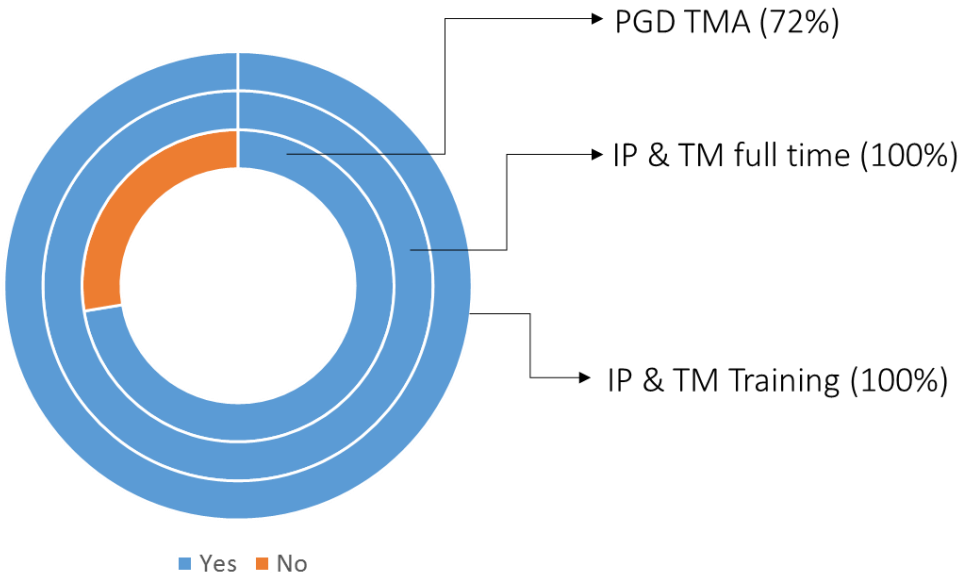
course and IP & TM training programme stated that they had utilised the knowledge gained in the programme in their profession (Figure 13). In case of PGD TMA, 72% of them stated that they had used the knowledge gained in their profession (Figure 14).

Figure 13. Registered agent with any statutory body or Official Body



Source: Based on data collected by authors

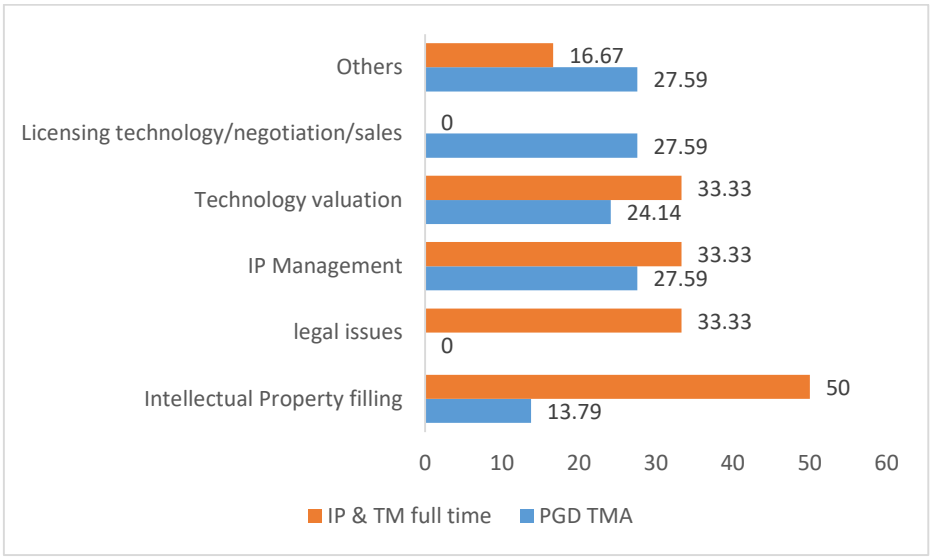
Figure 14. Utilisation of knowledge gained through the course in profession



Source: Based on data collected by authors

Figure 15 shows the way in which PGD TMA and full time course participants had utilised their knowledge. . Most of the IP & TM full time participants are handling the legal divisions and are utilising the knowledge they had gained for IP filing, legal issues, IP management and technology valuation. The PGD TMA respondents are involved mostly in licensing technologies, IP Management and technology evaluation.

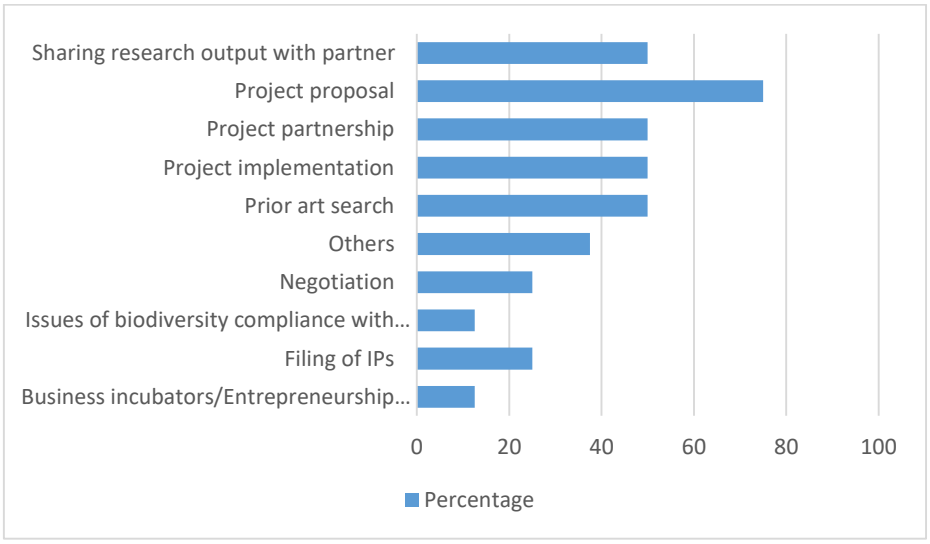
Figure 15. Utilisation of knowledge gained through the course in profession by PGD TMA and full time respondents



Source: Based on data collected by authors

About 78% of the IP & TM training respondents utilised the knowledge gained for developing new project proposals and issues related to projects as shown in Figure 16.

Figure 16. Utilisation of knowledge gained through the course in profession by IP & TM training respondents

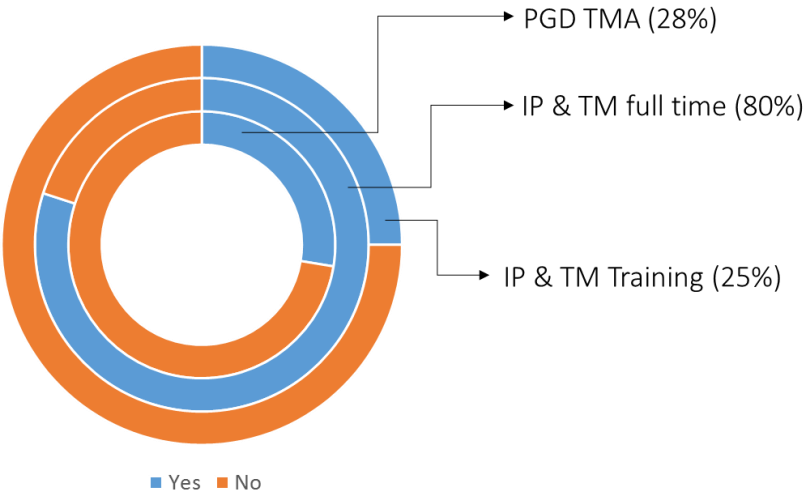


Source: Based on data collected by authors

The respondents also stated that they are currently part of the IP Management team of the organisation (Figure 17). About 28 % of the respondents of PGD TMA programmes are now with the IP Management team of their organisation. Out of the total five are In-charge or member of ITMU cell in their respective institutes. Most of the full time respondents (80%) are working in the legal or IP cell of the organisation. Two of the respondents of IP &TM

training were instrumental in filing two patents for ICAR-NIVEDI, and 11 patents for NRDC/ LUVAS, Hisar, Haryana.

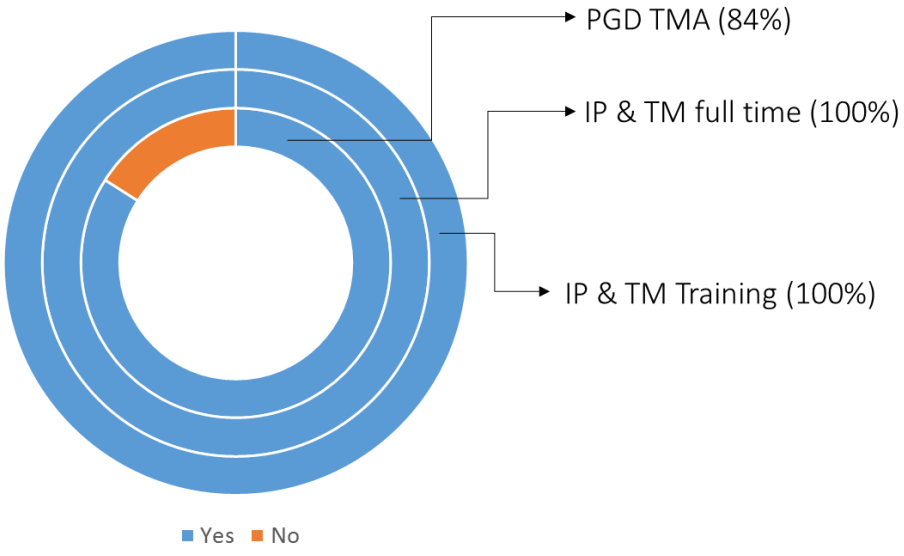
Figure 17. IP Management team of the Organisation



Source: Based on data collected by authors

The respondents in all the programmes, had stated that the courses and trainings had made them IP savvy (Figure 18). The respondent rate was 100% for full time and training and 84% for PGD TMA.

Figure 18. IP & TM course at NAARM made IP savvy



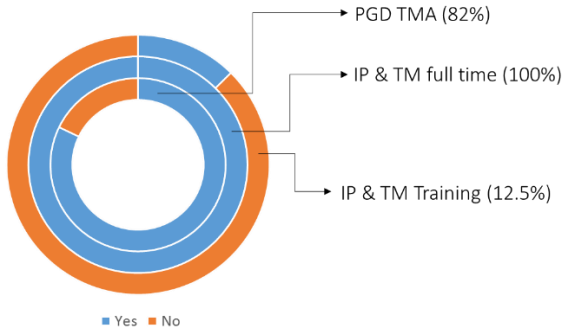
Source: Based on data collected by authors

3.8 Impact of IP & TM course and training

The respondents were asked to attribute the impact of the course in form of utility in handling the IP & TM portfolio (Figure 19), career progression (Figure 20) and ways of career progression (Figure 21). About 82% of the PGD TMA and 100% of full time respondents

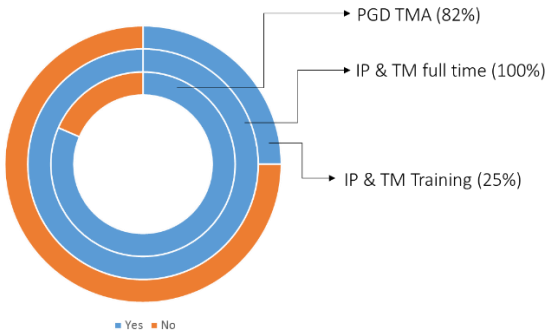
stated that the course was useful in handling the IP & TM in the organisation. The attribution was lower among the training respondents (13%). Similar trend was also, noticed in response for the question on whether it had helped them in getting career progression. Though 25% of the training respondents stated it helped in the career progression.

Figure 19. Utility of the course in handling IP & TM in organisation



Source: Based on data collected by authors

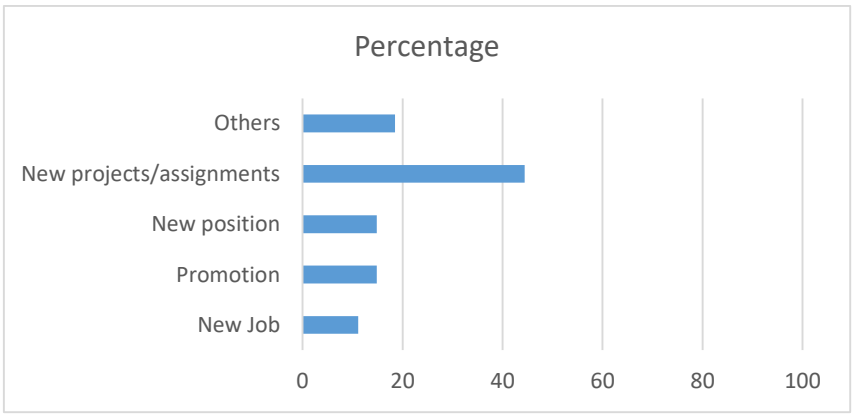
Figure 20. Impact of the course on career progression



Source: Based on data collected by authors

To understand further, how it hand holded in career progression, the PGD TMA respondents were asked to state the ways of career progression. About 45% of the stated that the course had resulted in getting new projects.

Figure 21. Ways of career progression



Source: Based on data collected by authors

Note: Data collected only from PGD TMA participants. The responses are not mutually exclusive.

3.9 Outcomes

In the previous session (3.8), impact was analysed using direct quantitative responses. The pre-defined outcomes were measured among the respondents. An open-ended question was asked to narrate their story about what happened to their professional life because of the participation the course. The story narrated in a paragraph or a line was used as a unit for content analysis and outcomes were derived (Table 5). The analysis shows six major

outcomes such career, knowledge, employment, projects, promotion and skill development in IP & TM.

3.10 Impact pathway

The results and discussion so far has looked into each dimensions of the participants, the background of the respondents, the factors/purpose, which motivated their participation in the programme, the course they offered and the outcome. Connecting these dimensions, an impact pathway as a Sankey graph (using Power BI) was drawn. Sankey graphs illustrate the flow. The diagram shows the flow from background to outcome. The major background of the participants are researchers, education (academicians), managers and people with law degrees. The reasons for opting the course among researchers varies from career prospects, features of the course, self-interest and seeking knowledge. The grey path in the diagram shows the impact pathway. The results shows that the background, motivation and the course affecting the outcomes. Corroborating the results with the objective and aim of the programme the analysis shows that the desired targeted participants and outcomes were achieved. The results also shows that the PGDTMA had a wider background, covering audience with wider motivation and outcomes.

Table 5. Outcomes of the IP & TM programme participation

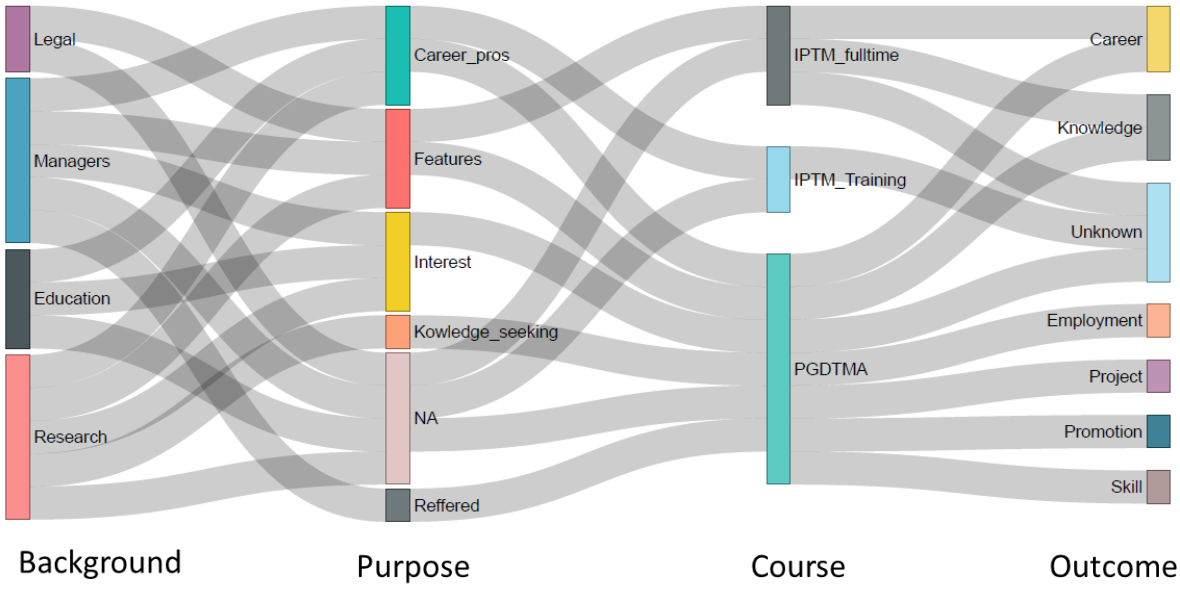
S. No.	Outcomes	Quotes
1	Career	"the knowledge and exposure i gained during the course acted as launch pad for my IPR career so far". "attending this course helped me to take some important career decisions. basically i am not interested in banking career and this course gave me an inspiration to study further and increase my knowledge base. right now i am focusing on pursuing a career which i like to do". "It was at a point of time when I was planning for some difference in career that I got to know about PGDTMA programme at NAARM from a newspaper advertisement. I was successful in course completion with distinction. My project work helped to interact with NAARM faculty and my interest for the subject pulled me to join a project at NAARM under […]. I was given opportunity to explore the IP and TM fields through many seminars and workshops and publications. Even though I left a senior position of Academic Head in an Educational Institution, I take pride in being associated with NAARM for the learning I got in a short period of 3+ years which I couldn't really do in my 15 years of service. This experience is currently giving me numerous opportunities for senior positions in many organizations which I am yet to choose now". "1. Became a member of Institute Technology Management Committee (ITMC) of Directorate of Cashew Research (DCR), Puttur, Karnataka and offering guidance at regular intervals in IP management, Commercialization of technologies, Variety Registration etc., 2. Protection of Plant Varieties and Farmers' Rights Authority (PPVand FRA) sanctioned the project on "Development of DUS testing criteria and Establishment of National Genebank for Cocoa' (file No. PPV&FRA/REG/Cocoa/2015-16 dtd.31.03.2016), 3. Initiated works on registration for germplasm and varieties of Cocoa'. "I am an Agrico, who has decided to make IP as career and chosen a full time course in Intellectual Property(IP) at NAARM. It was an extremely challenging beginning of career as IP is dominated by Lawyers. One point of time, I was doubtful about my decision. But, I tried hard and receive supports from good office contacts and technical understanding, these sets things in motion and I received an opportunity to work. "In 6 years of career, I got opportunities to work with National, International and Multinational institutions in the agricultural related IP Matters such as Plant Variety Protection and Biological resources management. Based on thrust of gaining IP skills, I had completed many additional courses from WIPO and UPOV from time to time. I have been granted two times fellowship from the Dutch Ministry for course on PVP & PGR Management at Wageningen university, Netherlands. I have qualified Trade Mark Agent examination". "Presently, I am working with an MNC on IP and other related issues in Agricultural. I believe that one should have passion and knowledge to contribute significantly in a respective filed."
2	Knowledge	"Yes, I have now broad level of knowledge in all spheres of IP and good knowledge of Technology Management" "It have provided basic and advance information, knowledge and understanding to handle IP matters. Although, the matter/issue was totally new but conceptual understanding acquired through the course was useful in dealing." "I gained knowledge IPR and on Agriculture which I am interested …"
3	Employment	"After taking the course, I could emphasize on the importance of IP Management and Patents. Before this course, I was not clear about patents and their importance. By having this course in my CV, my chances of employment are increasing in comparison with previous experience." "After completing IP and TM from NAARM in March 2010, I started as technology manager at IIT - Delhi Technology office. This gave me a real time experience with handling process of technology commercialization. Then I went on to become a IP consultant for Amity University and Galgotias university in January 2011. This gave me a rare opportunity of handling patent drafting, filing and providing research indicators for an educational institution. I worked on it for a year. Now, a major gap in my experience was drafting of US patents. For gaining this experience I joined a KPO that was solely dedicated to patent drafting for US clients in December 2011. I worked there till August 2013 and drafted almost 100 biomedical cases for USA and EU filing only. From September 2013 I have been working on establishing and running my start-up venture called Novocus Legal LLP. Since October 2015, we have reached a stage

		where we focus on litigation support including Evidence of Use claim charts for US lawyers and for preparing technology intelligence reports for corporate organizations." "Being the student of PGD - IPTMA course at NAARM helped me to land my first job at NIF-Ahmedabad as RA-IPR. And my first job facilitated my switch to second job in my hometown. Currently I am facilitating IPR application filing and prosecution for clients as Legal Executive at my organization handling a team of three colleagues.
4	Project	"Immediately after completing my course at NAARM, I have been assigned a project "Intellectual property management and Transfer/Commercialization of Agricultural Technology Scheme (IPMT-CATS) as a PI. Under this project till now we have licensed two varieties and applied for Trademark for registering our institute logo"
5	Promotion	"The knowledge of this course helped me to get a new position from research to technology valuation, technology management & market study for the technology / product, to improve marketing & communication skills etc. Now I am heading the entire India for Canter novel technologies & products. India as agri based country in need of these new & useful technologies now & future." "I have been promoted to the position of Project Officer this April 2016 with added responsibility of tech transfer. Earlier I was working as Senior project Executive". "I hope shortly able to hold the key post". "Even though I was passionate with IP & technology management, since we were the 1st to develop usable technologies at IVRI and also filed the 1st patent application in the year 2001. I became more passionate when I was included as Member of Institute technology management Committee (ITMC) and faculty of IP and Technology management course for the students of IVRI deemed University. these activities gave me opportunities to go under the PGD_TMA course at NAARM. Even though I was applying my skills and knowledge of IP and Technology management before I joined PGD-TMA. this programme helped me further to develop more confidence in this filed as I was continuously involved in the practice of IP and Technology management in this Institute. This also helped me to become head, Division of Biological Products and also to get grant from some externally funded agencies like DBT & ICAR". "The PGDTMA gave edge in heading ITMU. Through this unit, I am getting opportunity to involve in technology transfer and commercialization. This also gave opportunity to set up Agribusiness Incubator unit at my institute".
6	Skill	"I completed PhD in Agriculture with specialization in Plant Breeding & Genetics. This course explore me emerging IP & TM area after PVP&FR Act 2001 which now have important role in Modern Seed Industry. Earlier, Plant Breeder were dependent on IP Officer who take care all process since registration to varietal release. But Now after this course, I can handle this s process by own and can play dual role, Crop Varietal development & Crop Varietal release". "After done this course, I am able to suggest our clients to know how of technology management in agri business." "I was looking after the PME cell at my previous institute. The IP & TM course has further helped me to give a holistic approach to IP issues and its management. The course has helped me in taking the right decisions in my job". "I want to be skilled in latest concepts of agri.technology mgmt".

Note: There are couple of outcomes narrates across the code classes made. The identity of the respondents by name is avoided to keep confidentiality. The quotes are separated by double quotes (" ").

Source: Analysed by authors based on survey data.

Figure 22. Sankey graph showing the impact pathway of IP & TM programmes offered by ICAR-NAARM



Chapter 4. Conclusion and way forward

The study was carried out as a mid-course analysis to understand whether the objectives of the IP & TM course and programmes has been achieved or not. Our analysis shows a positive indication. The academy had evolved from the mandates of sensitization, building awareness to offering diploma courses and training programmes. It is evident that the training had led to development of large human resources in the NARES, which is in alignment with the ICAR IP policy 2006 (Chapter 12). However, the impact attributed by trainees for the training programmes was low, compared to other pro/grammes. In order to develop higher-level professionals in the evolving domain of IP & TM, this activity needs to be continued. The full time programme of the academy has developed 16 hard-core IP professionals. However, based on the public demand from the working professionals in the industry, the distance-learning programme was offered (PGD TMA). The six years of the programme had led to creating an ecosystem of professionals, who are skilled and were able to gain careers, projects and promotions. It also helped students and early career professionals to remould their career in the area of IP & TM. In the emerging era of digital platforms for distance learning programmes, the IP & TM programme could be offered on Massive open online courses (MOOCs) platform to enhance its reach.

References:

Graff, G.D. (2007), Echoes of Bayh-Dole? A Survey of IP and Technology Transfer Policies in Emerging and Developing Economies. ipHandbook of best practices. Available online on http://www.iphandbook.org/handbook/ch03/p03/. Accessed on 24-07-2016.

GoI, (2016), *National Intellectual Property Rights Policy*. Department of Industrial Policy and Promotion. Ministry of Commerce and Industry, Government of India.

ICAR, (2006), *ICAR Guidelines for Intellectual Property Management and Technology Transfer/Commercialization*. Indian Council of Agricultural Research, New Delhi.

ICAR, (2014a), *ICAR Rules and Guidelines for Professional Service Functions.* Indian Council of Agricultural Research, New Delhi.

ICAR, (2014b), *ICAR Guidelines for Internal Evaluation and Forwarding Research Papers to Scientific Journals and Data Management in ICAR Institutes*. Indian Council of Agricultural Research, New Delhi.

Kalpana Sastry, R (2009). Intellectual Property Management Regime in the Indian national Agricultural Research Systems. In: CAS-IP NPI. 2009. Institutionalization of Intellectual Property Management: Case Studies from four Agricultural Research Institutions in developing Countries. CAS-IP, Rome, Italy.

PPVFRA Act (2001). Protection of Plant Varieties & Farmers' Rights Act. Avaiable online on http://lawmin.nic.in/ld/P-CT/2001/The%20Protection%20of%20Plant%20Varieties%20and%20Farmers%E2%80%99%20Rights%20Act,%202001.pdf. Accessed on 24-07-2016.

Ravishankar and Archak (2000) Intellectual Property Rights and Agricultural Technology: Interplay and Implications for India. Economic and Political Weekly. Vol. 35, No. 27, pp. 2446-2452.

Rao, N.H., and Kalpana Sastry, R, (2004), "Towards a policy for management of intellectual property in public agricultural research system in India", *Journal of Intellectual Property Rights*, Vol. 9, pp.242-259.

Samuel, M.P., Sastry, Kalpana. R., Venkattakumar, R, (2014), "Status and prospects of IP regime in India: Implication for Agricultural Education". *Journal of Intellectual Property Rights*, Vol. 19, pp. 189-201.

Tulsi, K.G. and Rao, B.S. (2008), A Detailed Study of Patent System for Protection of Inventions. Indian Journal of Pharma Science. Vol. 70, No. 5, pp. 547-554.

Nutly, D.D., (2008), The adequacy of response rates to online and paper surveys: what can be done? *Assessment & Evaluation in Higher Education*, Vol. 33, No. 3, pp. 301–314

Yu, P.K. (2012), Intellectual property training and education for social justice. Available online on http://www.peteryu.com/mtima.pdf. Accessed on 24-07-2016.