Project Completion Report

Intellectual Property Rights Policy and Innovation in Higher Education Institutions (HEIs) in India

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Preface

Intellectual Property (IP) is considered engine of growth as it fosters innovation and helps in economic progress of an organization as well as country. Higher Educatin Institutions (HEIs) which consists of universities and research institutions are source of Intellectual Capital for performing research and create innovations. In order to harness the potential of to generate and leverage IP, it is important that a favorable ecosystem is provided to the actors involved in HEI innovation chain. IP Policy of HEI creates favourable ecosystem for IP to survive from lab, to till it reaches market. It facilitates for fruitful collaborations for joint research and development with other entities. Though India has largest network of HEIs, no notable innovations are carried out by HEIs, which is evident from number of patents and other forms of IP rights applied and granted. The impetus on publications and subsequent focus on career growth at HEIs lead to India lagging behind. In India, attempts made to strengthen the industry linkage to universities and research institutes did not show significant benefit to the HEI researchers and research output; though the model has shown triggering effect on many countries' innovation output. Studies on these are need of the hour, as economists around the world recognized patents as indirect indicators of economic development of a country which also decides the Foreign Direct Investments (FDIs) and international trade. HEIs innovations are strength of a nation in promoting competition and sustainable economic growth in developed countries. It is inevitable need for our country to establish IP system and policies to leverage HEIs' innovation potential contributing to the national economy. Indian S&T ecosystem lacks right program and funding schemes at right places of S&T framework demand.

This study would help to assess and to know the functioning of IP polcies and practices of HEIs for making innovations. Knowing the status of innovation strength and current correlation between innovation practices, collaboration and innovation ouput would help designing of policy instruments, programs and schemes designed and implemented at supply and demand sides.

Acknowledgement

Executive Summary

Innovation is heart of promoting competition and economy of a country. Along with industries, Higher Education Institutions (HEIs) —public and private universities and research institutions (RIs) play a crucial role in generation of new ideas, knowledge, and innovation. The knowledge generated and disseminated by HEIs are utilized by industries to innovate their processes and products for improved productivity which leads to promotion of national economy. While teaching and research are primary and secondary missions of HEIs respectively; the third mission —contribution of HEIs' potential to the national economy from their innovative and commercially viable research and development are not given much importance due to lack of supportive policies & requisite budget allocations. The increased need for global competitiveness made commercialization of HEI generated research inevitable and eventually paved way for development of R&D, IPR and national innovation policies to support such activities at HEIs.

In this aspect, western countries, among them, USA and European countries are pioneers in identifying the potential of research and development (R&D) and strength of Intellectual Property (IP) generation by HEIs; prioritized it by formulating national IPR, R&D and HEI IP policies suitable for their third mission/social mission envisaged. Strengthening of the IP system to protect the IP, formulation of supporting IP policies for the promotion of IP awareness, and enforcing the IPR are important aspects to make HEIs contribute to the national economy efficiently. National IPR policies identify the strengths and weaknesses of the National Innovation System (NIS) and provide the needed technological framework balancing competition and societal benefits.

In India, the first National Intellectual Property Rights Policy was launched on May 12, 2016, by the Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, Government of India. It aims to address some of the drawbacks of the IP system and laid objectives to foster innovation and protection of IPR in India. The policy emphasized for promotion of awareness, capacity building, generation, and commercialization of IP at HEIs. This study aims to understand the status of procedures and facilitations made by HEIs following broad objectives of National IPR policy.

This study explores institutional research and innovation practices and IP policy of different HEI typologies —Central and State government universities, Private Deemed, Institutions of National Importance (INI), and Research Institutions (RIs) in India and finds correlation between their collaborations and IP generation and innovation. It further explores for bariers towards IP generation, commercialization and technology transfer from the perspective of IP management of

HEIs. It also studies the strategies and focus of top management in the promotion of IP and innovation at HEIs.

The study was designed in a qualitative approach at the institutional level with a structured questionnaire tool. IP cell/Technology Transfer Office (TTO) managers, registrars, R&D dean/directors of respective HEIs are participants in this questionnaire-based survey. The purposive sampling technique was used to choose the sample of HEIs from the University Grants Commission (UGC) approved list. Sampling of HEIs for data collection was done in two phases. First, the top 100 National Institutional Ranking Framework (NIRF) ranked HEIs were selected to deploy the questionnaire. In the second phase, other UGC-approved central and state universities, Private Deemed universities, and Institutions of National Importance (INI) and research institutions (RIs), were chosen to deploy the questionnaire. The questionnaire consists of open-ended, dichotomous, multiple-choice, and Likert-scale questions framed as per the study objectives specified. The questionnaire made using Google forms were sent through e-mail along with Participant Information Sheet (PIS) to the participants of sampled HEIs.

Analysis of survey was made based on 71 responses received in the survey. It was found that research and innovation practices, support systems, and IP policies of HEIs are evolving.

Among all types of HEIs studied, INI are embraced with successful research and innovation practices, and supportsystems towards the IP generation and commercialization goals envisaged; However, this observation is restricted only to a few INI which are more than 25 years old and IP policies implemented much earlier than others. Most of the INI IP polcies were implemented during 2000-2020. Despite of having government funded IP cells, IP policies implementated and support systems provided in INI which are less than 25 years old, they did not support for fruitful collaborations with industries leading to joint patent applications and IP commercializations. Newly established INI lack IP cells and policies, and committees for policy implementation. Innovation practices, IP ownership and revenue sharing terms of implemented IP policies in these INI are not motivating institutional researchers during collaborated R&D projects (Industrial Consultancy and sponsored). They do not have specific budget allocations to IP cells for filing and maintenance of IP. Among INI, age of the institution and age of the IP policy implementation have significant positive correlation with successful innovation output; Older the institution and established IP cell, and earlier the implementation of IP policy, better the innovation output. Positive correlation between collaborations and research and innovations is seen only in few older INI, but collaborations did not promote innonvation output in other less older INI. There is no

clear evidence supporting promotion of innovations with geographical location and size of the collaborated industry. No specific budget allocation for IP cells, lack of incentives and funding are seen as major barriers for IP generation and commercialization. Among all types of HEIs, INI's top management have more vested focus on commercialization of IP and promoting collaborations to enable it.

Next to INI, Private Deemed universities are more inclined towards promoting innovations towards their social mission. Unlike INI, despite of lacking government funded IP cells, they have research and innovation practices, IP policies and support systems established commensurate with their research and IP generation, but annual budget allocation to IP cell and its activities are meagre. Unlike INI, there is no observable correlation between age of the institution, IP cell and IP policy implementation towards successful generation and commercialization of IP. Institutional practices of private deemed universities towards innovation varies significantly with INI. Screening of research results for protection of IP is occasionally done by IP cell coordinator before publishing it. Most of their IP cells have approximate annual budget less than 10 lacs.

Research Institutions (RIs) are embraced with successful research and innovation practices, and supportsystems towards the IP generation and commercialization goals envisaged; However, this observation is restricted only to a few INI which are more than 25 years old and IP policies implemented much earlier than others. Most of the INI IP polcies were implemented during 2000-2020. Despite of having government funded IP cells, IP policies implementated and support systems provided in INI which are less than 25 years old, they did not support for fruitful collaborations with industries leading to joint patent applications and IP commercializations. Newly established INI lack IP cells and policies, and committees for policy implementation. Innovation practices, IP ownership and revenue sharing terms of implemented IP policies in these INI are not motivating institutional researchers during collaborated R&D projects (Industrial Consultancy and sponsored). They do not have specific budget allocations to IP cells for filing and maintenance of IP. Among INI, age of the institution and age of the IP policy implementation have significant positive correlation with successful innovation output; Older the institution and established IP cell, and earlier the implementation of IP policy, better the innovation output. Positive correlation between collaborations and research and innovations is seen only in few older INI, but collaborations did not promote innonvation output in other less older INI. There is no clear evidence supporting promotion of innovations with geographical location and size of the collaborated industry. No specific budget allocation for IP cells, lack of incentives and funding are seen as major barriers for IP generation and commercialization. Among all types of HEIs, INI's

top management have more vested focus on commercialization of IP and promoting collaborations to enable it.

Central universities mission, objective of research and innovation practices, and supportsystems are not inclined towards the IP generation and commercialization goals. Most of their IP polcies were implemented during 2014-2018. They mostly have self sustained IP cells, and IP committees are not constituted or still under process. Innovation practices, IP ownership and revenue sharing terms of implemented IP policies in theseHEIs are not motivating institutional researchers during They do not have specific budget allocations to IP cells for filing and maintenance of IP. There is no clear evidence supporting promotion of innovations with geographical location and size of the collaborated industry. No specific budget allocation for IP cells, lack of incentives and funding are seen as major barriers for IP generation and commercialization. Central university top management have no vested focus on promotion of IPR and collaborations.

State universities research and innovation practices, and supportsystems towards the IP generation and commercialization goals envisaged are little among all HEIs; Most of the State universities IP polcies were implemented during 2005-2018. Despite of having government funded IP cells, IP policies implementated and support systems provided, they did not support for fruitful collaborations with industries leading to joint patent applications. They do not have specific budget allocations to IP cells for filing and maintenance of IP. Age of the institution and age of the IP policy implementation have no correlation with successful innovation output as most of their policies are only about 10 years old. Not all their IP cells are funded by government. Not all have a committee constituted for reviewing IP policy and promoting their IP. Their IP policy is not available on website and no periodical updates on IP related data. They do not have sufficient prefabricating support systems for making prototypes. IP policy and institution support systems did not promote fruitful collaborations with industries. No specific budget allocation for IP cells, no formal/informal practices for screening and processing of potential innovations, lack of incentives and funding are seen as major barriers for IP generation and commercialization. The mission and objective of research in State and Central universities are not focused on protection and exploitation of research output.

Overall, though there is an indication that Indian HEIs are transforming towards the third mission goal by absorbing the national policy objectives and protecting their IP with formulated institutional IP policies, inadequacy and inefficiency of intellectual capital of HEI and innovation schemes launched by government are becoming barriers hindering the IP generating and

commercializing enablers in HEI ecosystem. Despite having a significant positive change in the innovation practices of HEIs during the decade of innovation, there is no proportionate change in the HEIs' innovation output due to lack of supporting organization culture. Though IP policies formulated, implemented and committees constituted, they did not add significance to institutional R&D support systems for fruitful collaborations leading to IP generation, commercialization, and technology transfer. As most of the institutional research and IP policies formulated are mere emulations of best performing HEIs' which are not tailor-made as per the innovation strengths and needs of the HEIs, it could not create efficient innovation linkages. It further lead to the creation of a non-competitive environment in the HEI ecosystem. The non-competitive environment could not facilitate motivating incentives for researchers and stakeholders. Adding to this, organization structure, complementary business assets and management focus are not on compliance with the mission and goals of their stated IP policy of HEI. Researchers' unawareness on IPR added to the little budget allocation to IP cells and HEIs' organizational policies of researchers career advancement which gave emphasis to research publications with impact factors created a demotivated environment for researcher to choose the path of protecting their IP and commercializing it. NIRF ranking methodology provided scores for IP filings and grants; though it promoted patent filings number in most of the HEIs, quality of patents has reduced which caused IP commercialization impossible. Lack of full time IP professionals and limited/no specific budget for IP cells made them to file limited patent filings though many potential ideas are disclosed to IP cells and no fulltime staff in IP cell is a reason for non-maintenance of records of working, non working, lapsed and invalidated patents at their HEIs. Except few INIs, role of technology transfer offices in funneling the viable IPR to create market value in HEIs is scanty. As NIRF ranking is making a positive change in the focus of top management for facilitating innovation needs, it should take measures to promote quality of innovation output by adding and emphasizing IPR indicators strategically to enhance quality of generated IPR.

Policy implications

Key findings

1. Mission and objective of the university research and IP policies are determined for creating products/processes not as a valued public good nor for societal benefits, but for mere meeting of patentability criteria. HEIs strategies to seek for IPR protections is for keeping consistency in annual rankings by maintaining the pace of predetermined number of annual filings with meagre budget allocations for its maintenance and for IP cell. Top management focus of research output is not channelled towards wide dissemination of knowledge/technology or for employment generation. Though IP policies formulated and committees established, they are of little use in creating and leveraging intellectual property and incentivizing the researcher.
2. Lack of mission and objective oriented research lead to the poor facilitation of organization and human capital; it caused least utilization of IPR, which is main impediment for potential ideas to conceive from lab to market through incubation.
3. Very few early established INI are successful in generating and commercializing IP; however, from idea to market, role of industrial collaboration did not benefit any type of HEIs' researchers sufficely to promote innovation further.
4. Performance based restructuring of HEIs categorization is needed to implement new schemes and to reconciliate existing schemes for strengthening human capital and structural capital of HEIs to channelise its S&T output towards innovation. As few INIs transformed into entrepreneurial and self reliant for R&D funds from their technology commercialization, focusing dedicated S&T schemes and funds towards top performing private deemed, state and central universities would promote more quality IP generation.
5. To enhance quality of HEI patents, step by step change in ranking methodology of NIRF in the metric of 'Research Productivity, Impact and IPR' (RPII) would certainly make HEI management's perspective missioned towards facilitation for IPR generation and incentives for inventors; which would further improve the quality of IP generated and working of the patents.
6. To catalyse and utilize Private Deemed universities innovation strength, whose mission and objectives, policies and practices are better equipped towards IP generation and commercialization (next to top performing INIs), catalysing their innovation strength by introducing special schemes to enable venture capital/special purpose vehicles for start-ups and researcher spin-offs would create channels for commercialization of generated IP. To enable this, instead of balanced or unbalanced funding strategies of government for different statutory

establishments of HEI structures, a ‘great push strategy’ is needed for supplying entrepreneurial-oriented human capital and financial resources in the HEIs ecosystem of evolving INIs and Private Deemed universities.

7. State and Central universities’ intellectual capital and support systems are not entrepreneurial oriented and not tapped accordingly towards social mission. Redesigning of research mission, objectives and IP policies in support of ‘inventor ownership of IP’ in state and central universities; delivering funds and customized programs accordingly would reinvigorate innate potential of knowledge and technology generation by them.
8. University Industry collaboration to promote innovation is not seemed to be a viable strategy to promote innovation in Indian national innovation system where trade, industrial and competitive policies and legislations are barriers for this to happen. Categorising HEIs as basic and applied oriented, based on their research and academic excellence and promoting University-University collaborations with policies and schemes supporting these structures through venture capital and spin-offs would enhance current lack of competitive environment for research and innovations to flourish in the HEI innovation ecosystem. Licensing of generated IP to start-ups and spin-offs would help.

Suggestions and recommendations

Issue 1: Addressing the shortcomings of HEI’s IP policy formulated

Shortcomings: Clarity on mission and objective of university research, transfer of reasonable power and authority to IP management wing of the university, first priority to inventor to exploit the IPR, creating opportunity to student and researcher to be heard off in the IP committee constitution, understanding HEI’s location specific regional strengths and needs.

Recommendation 1 It is an inevitable need for stirring and catalyzing the HEIs’ innate innovation potential towards regional and national economy goals envisaged. For this, HEIs’ top management Chancellors, Vice-Chancellors and Directors should design and articulate their mission and objective of university research and re-formulate their IP policies and reasonable authority and power handed over to IP management entity established. IP policy of HEIs should be revived with clear ownership specifications during different conditions; with mandatory first right of refusal to inventor to proceed for commercialization; and not withstanding to any clause in presence of consultancy or funder’s agreement— first and equal preference to inventor to exploit the IPR— during collaboration; committee constitution of atleast one member representing wide range of stake holders (students, staff, institute directors, external promoters, governing board members and

industry heads) of university innovation. Most HEIs excluded students, teaching and research staff and top management of industry in the constitution of IP committee. Lack of participation of students and researchers in the committee created vacuum in promoting awareness. Policy should also emphasise the innovation demand specific to geographical location of HEIs and should build structural and organizational capital accordingly. Overall, inventor first approach should be manifested in the policies of HEI innovation ecosystem.

Issue 2: Lacking of entrepreneurial oriented human and organizational capital at HEIs

Shortcomings: Under utilization of trained IPR personnel in various capacity building schemes implemented, Lack of programs for facilitating fulltime IP professionals in HEIs, Lack of complementary business assets established in HEI innovation ecosystem.

Recommendation 2 A great push in fund allocation for customised programs and schemes should be designed. Programs must be tailor made for different statutory establishments of HEIs—Institutions of National Importance, Central, State and Private Deemed universites and Research Institutions—by taking their geographical locations and innovation performance as consideration. Selected patent agents and professionals should be made work at HEI IP cells as a part of a schemes and programs made for capacity building in IPR.

Issue 3: Unfruitful University-Industry collaborations

Shortcomings: Innovation output (publications and IP generation) with industrial collaborations is so little in Indian HEIs. Demand side requirements of university-industry collaboration are not met and becoming a demotivating factor for collaborative environment.

Recommendation 3 As Indian national innovation system is not supportive of fruitful collaborations with industries promoting generation and commercialization of IP, programs facilitating exclusively for venture capital funds and researcher spin-offs shlould be designed and university-university, university-Spin-off/MSME collaboration should be adopted as an alternative strategy to offset the industrial collaboration. It should be synergized with government procurement of start-up and MSME products/services; Trade and industrial policies and legislations should be introduced providing supply side monetory and tax incentives to university start-ups and spin-offs and demandside strict government procurement instruments.

Issue 4: Mismatch of innovation output information by HEIs and no record keeping system

Shortcomings: IP output data is not properly maintained at HEIs. Data shown on the website and numbers given in the annual reports do not match. Patent data pertaining to lapsed, invalidated, withdrawn patents are not maintained by concerned departments and there are no guidelines for frequency of updating patent related information on their webpages.

Recommendation 4: There should be strict compliance norms on data presented in annual reports with clear uniform format of budget allocations, innovation output disclosures for all HEIs.

Issue 5: Lack of fulltime IP professionals at state, central and private deemed universities and cost of IP filings

Shortcomings: Schemes proposed for IP facilitation and capacity building are not met at the demand side need of promoting IP at HEIs. Lack of professional for screening, filing and managing of HEI innovations allowing major chunk of allotted IP cell budget spent on processing of inventions by law firms.

Recommendation 5: It must be ensured that trained professionals under IP capacity building schemes get placed at HEIs' IP cells. New schemes should be rolled to link these supply side capacity building programmes matching to meeting with IP professionals demand at Central, State and Private Deemed universities.

Chapter 1

Introduction

Intellectual Property (IP) is considered an engine of growth as it fosters innovation and helps in the economic progress of an organization as well as the country. To harness the potential to generate and leverage IP, a favorable ecosystem must be provided to the actors involved in the innovation chain. The actors involved in the innovation chain include both the public and private sectors. This ecosystems thrive on the policies adopted by the governments. It is important to measure policy and its impact to support innovation; it provides policymakers with much-required data and information to assess the contribution of innovation towards accomplishing social goals; to understand determinants, facilitators, and obstacles to frame policies instruments that might provide a higher rate of success and benchmark it with other countries [1].

India's large infrastructure of Science and Technology (S&T) prompted the government of Indian to lay down Science and Technology Policy in 2003. The policy recognizes the importance of Science and Technology in fostering scientific and industrial development along with the increasing quality of life of the citizens of the country [2]. The expenditure on S&T has steadily improved over the years in India. The emphasis to disseminate knowledge generated in S&T through research and development (R&D) is primarily through publication in journals. This is true in the case of research in S&T emanating from academic institutions. In the United States (US) it is observed that universities encourage an ecosystem of innovation and entrepreneurship thereby creating jobs and strengthening local and regional economies.[3] Further, many of the well-known innovations that have become successful products today have their roots in university research. The list of products, in various areas, includes health and medicine, communications, food, economics, energy, security, etc [4]. No such data exist of India today. The strengths in India's S&T may have the capacity and capability to harness such innovations, IP, and entrepreneurship within Higher Education Institutions (HEIs). This is not fully tapped in academic culture; not imbibed among faculty and students due to lack of awareness on the subject and lack of support systems to foster such engines of growth in HEIs in India. The policies to support these activities may not bear fruits if the environment is not conducive as well as if people are not aware of such facilitating mechanisms. With exception of a few national institutions of importance and a cluster of government laboratories, no notable innovations are carried out by HEIs, which is evident from a number of patents and other forms of IP rights applied and granted. The impetus on publications

and subsequent focus on career growth at HEIs lead to India lagging its counterparts. Much of this can also be attributed to a lack of supporting policies and incentives for the innovators. IP system and policies impacts Foreign Direct Investments (FDI) and R&D collaborations. IP policies of HEIs allows to have fruitful collaborations when plugged efficiently with innovation and IPR policies at national level. They create favourable environment for inventions to thrive during journey from lab to market. Notwithstanding to foreign investments and collaborations, level of IPR protection and IP generation and commercialization of a country became a proxies for innovation rankings and measurement of innovation capacity of a country. Many countries who have stronger protection of IPR and supporting national IP and innovation policies are consistently performing well in these rankings. HEIs IP generation and commercialization contributing significantly in those innovation rankings.

Among many innovation ranking systems, Global Innovation Index (GII) is of high repute due to its chosen indicators, ranking methodology and inclusion of range of countries assessed. India has performed poorly in the rankings between 2011 and 2016 (62, 64, 66, 76, 81 and 66 respectively). India's performance steadily declined before it regained its earlier spot at 66th position[5]. This ranking of India shows poor attention given to innovation policy and IPR earlier. The things are changing with the Ministry of Science and Technology, Government of India through the Department of Science and Technology (DST) brought Science, Technology, and Innovation Policy in the year 2013. Among many objectives two objectives

a) Fostering resource optimized, cost-effective innovations across size and technology domains and

b) Creating a robust national innovation system require a multidisciplinary approach and participation of various players from the public, private and government sectors. HEI's in a way fulfils all the requirements and acts as a crucible for harnessing and fostering innovation.

In India, national IPR policy was implemented in May 12, 2016 with a slogan “creative India, innovative India” and aimed to make IPR as an asset to promote entrepreneurship and innovation and to stimulate innovations from HEIs[39,40] It mentioned seven objectives within which the emphasis was on awareness building, strengthening of IPR enforcement and adjudication, and generation and commercialization of IP. It directed institutions to formulate IP policies and proposed various incentives like tax benefits, financial support to promote IP based R&D start-ups. IP facilitation centres and consultancies were planned to strengthen the innovation activities.

Introduction

Though IP is generated, its commercialization potential has been meagre in most of the Indian RIs and universities. HEI IP policies are so crucial in transformation of universities into entrepreneurial entities.

National IP policy needs to identify key challenges, issues and development goals of a country.[9] The vision, objectives and strategies of these policies guide and stimulate country's Intellectual Capital (IC) and knowledge bases (Higher Education Institutions and industries) to innovate and address societal needs of national importance. Institutions, Intellectual Capital, and Innovation linkages are key enablers of the success of HEIs' innovation. Institutions are formal procedures, rules, practices and guidelines whereas IC is the hidden national potential sustains on institutions aiming for future economic growth of a country.[10-12]

Individuals, enterprises, institutions, communities, and regions are potential sources of IC; whereas, universities and Research Institutions (RIs) are prominent clusters of IC and constituents of national and regional innovation system.[11] Traditionally, universities produce knowledge for the benefit of industries, but in time of rapid globalization and shrinkage of national budgets to research, HEIs were forced to stimulate their IC to generate IP for value creation and for further research activities. In order to leverage IC, innovation and R&D shall focus on IP policy to protect ideas and inventions and for industrial R&D support.

IP policy of any institution needs to address all the stakeholders who involved in the innovation cycle and commercialization.[13] The goals of IP policy and innovation of HEIs shall provide an environment that supports innovation, promote scientific research, advance technological and economic development, and encourage innovators to create innovations for societal benefits.[14] Inter-relationship of IC with institutions and innovation linkages; associate output are shown in the Figure 1.

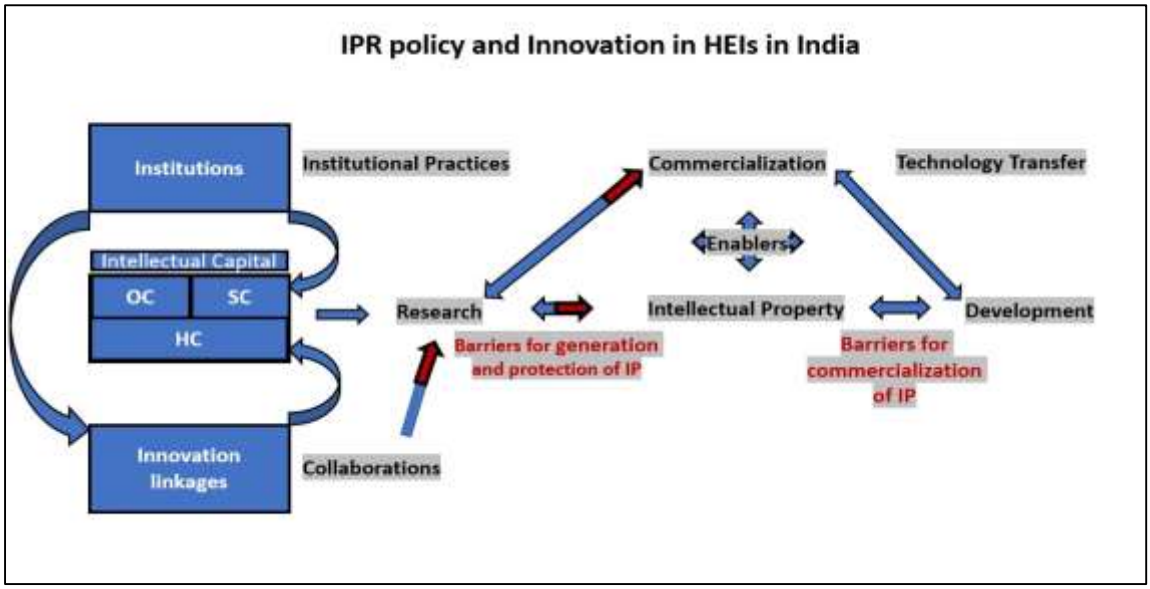

Figure 1 Schematic represention of theme of the study
OC-Organizational Capital SC- Social Capital HC- Human Capital

With this context, this research was carried out with objectives to study Indian HEI IP policies, institutional practices towards innovation and intellectual property rights and understand correlation between collaboration, research and innovation, and IP in HEIs; and to identify the barriers of HEIs for IP generation, commercialization and technology transfer.

Objectives

The Objectives of this study are

a. To compare and contrast intellectual property in HEI's in India and the US

b. To study institutional practices towards innovation and intellectual property rights.

c. To study correlation between collaboration, research and innovation, and intellectual property in university research.

d. To understand barriers towards generation and protection of intellectual property from management and faculty perspective.

e. To understand barriers and enabling factors in technology transfer/commercialization of intellectual property.

Limitations

The study is limited to a small sample size. Respondent bias cannot be ruled out while responding to study questionnaire. Interviewer bias may creep in while analysing data. Results cannot be generalized to entire population.

Chapter 2

Review of Literature

Till the end of the 18th century, Higher Education Institutions (HEIs) were restricted to generate knowledge for free access to industries, which were used by industries for commercial gains. Though HEIs have the potential to contribute to the national economy from their innovative and commercially viable research and development, it was not given much importance due to lack of supportive policies & requisite funds. The increased interest on commercialization of university generated research paved way for development of policies to support such activities.[1] Though industries are the main sources of research and development and innovation, HEIs are the main source of knowledge and information to them.[2] In developed countries like the US, firms contribute to research and development activities, but in in developing countries like India, public funded research in HEIs are the main source of knowledge generation.[3, 4] Christopher Freeman in 1987 identified that industry linkage is an important factor for the economic performance of nations while studying the post-war Japanese technology development. He identified that the linkages among enterprises, government agencies, and universities influence the country's innovation. He termed it as the Japanese system of innovation. Later the concept of National Innovation System (NIS) was developed by him and the same idea was used for studying industrialization in Denmark by various economists.[5] These studies from Japan and Denmark explain the relationship among universities, government research institutions, and their linkages with private enterprises and their effect on economic development. The flow of knowledge and information among these actors results in generation and promotion of innovation and technology development.[6, 7]

Understanding these linkages among universities and research institutes, enterprises and human capital is the main concept involved in NIS[7, 8] and the same helps in improving the economic performance of a country. The role of institutions and organizations and their linkages differ among countries' systems of innovation. For example, universities emphasize on research in the US and Western Europe, whereas in Japan, firms and private research institutes play a major role.[9] The term institution include not only organizations, research institutions, and universities, it also includes policies, legislation, economic activities, and processes involved in shaping them.[10] The frameworks of these processes in institutions make institutional system.

Interaction between technological systems, institutional system innovation policy framework, and design of policy instruments significantly affect the development of the National Innovation

System.[11] Intellectual Property system plays a key role in the NIS by providing a legal protection to the knowledge and technology flow from lab to market. It promotes innovation and encourages innovators by providing temporary monopoly as an incentive to their intellectual output. Balancing the societal needs and promoting innovation is often challenging for governments. It needs an IPR policy at national level along with a legislation harmonizing with international conventions, addressing the issues of the nation in promoting the self-sufficiency in R&D, along with meeting the societal benefits. This IPR policy should be part of national development goals and economic growth programs to attain maximum benefit out of it.

2.1 Position of IPR policy among other related policy areas

Science, Technology and Innovation policies are prominent in building the framework of national system of innovation. How these policy areas are unique and different from each other, and the position of IP policy among other specified policy areas are not studied well. However, it is evident from various Science Policy and Innovation Studies during 1960-1970 that scope of these policies are changing as the innovation studies are advancing. During 1960's Science was considered so broad; it was interpreted as, 'Technology' and 'Innovation' were part of it.[12] Later, from the studies of 1970's, 'Science' was identified as one of the several other components of 'Innovation'. Policy aspects of 'Science' and 'Technology' helps in strengthening innovation. Innovation policy focus is not on specific sectors or technologies, but it concentrates on framework conditions in the system linking those sectors.[7] It constitutes 'science policy' and 'technology policy' integral to it. Reviewing and redesigning the linkages between the parts of the system is the fundamental part of innovation policy.

IPR policy lies within the Science, Technology, and Innovation frameworks; creates environment for protection and exploitation of IP and incentivization of inventors. It is integral to Science and Technology, and at the interface between Science and Technology as well. It deals with the protection of information, knowledge and its flow in science. It helps in the protection of flow of knowledge and technology from lab to market. It provides the dissemination of technology across the different jurisdictions, facilitates competitive market for businesses, and creates employment. If IPR policy is used efficiently as a significant 'policy tool' of Innovation policy, it helps in transformation of a country into a R&D driven economy. National IPR policy itself works as a tool to achieve the goals of innovation policy of a country and sustainable development goals of the world.

Position of IPR in Science, Technology and Innovation

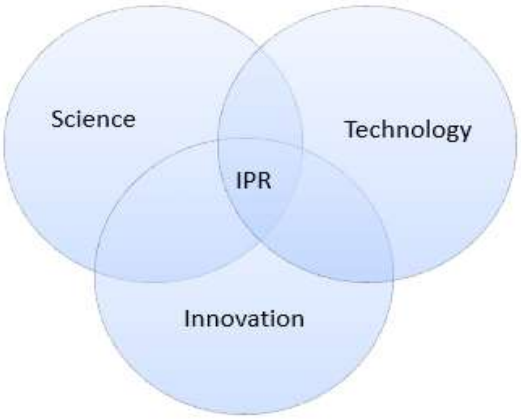

Figure 2 Position of IPR among Science, Technology and Innovation

Position of IP policy among Science, Technology and Innovation policies

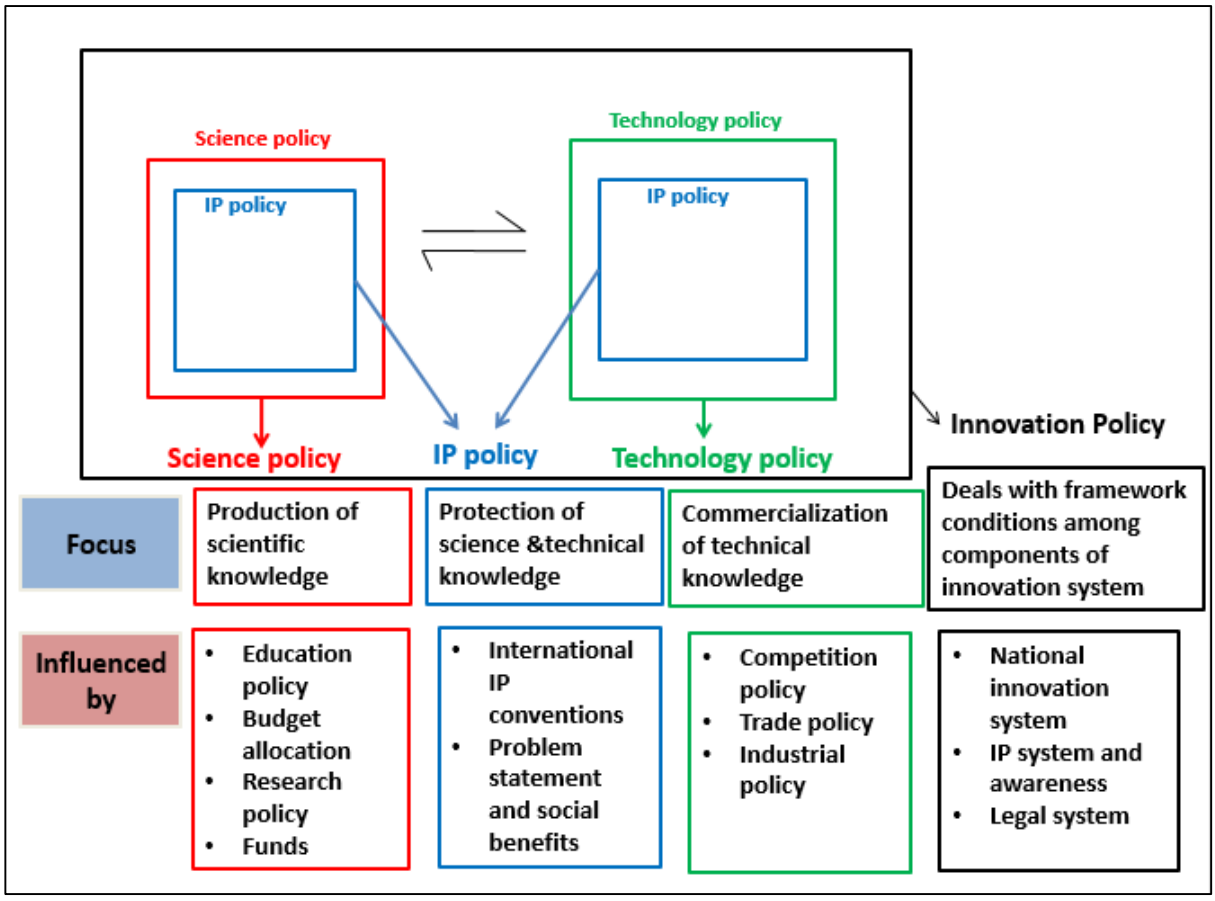

Figure 3 Position of IP policy among Science, Technology and Innovation policies

Source: Adapted from "Science, technology and innovation policy, Lundvall et.al, The Oxford handbook of innovation, 2005, 599-631."

2.2 Innovation and IPR policy

The key objectives of the innovation policy are to promote 'economic growth' and 'international competitiveness. Fulfilments of both objectives are indirectly linked to a nation's knowledge bases which are universities, and public research institutions where knowledge and IPR are generated. Strengthening of IP system to protect the knowledge generated, and promotion of IP awareness is an important aspect of innovation policy of a country. The science sector, which constitutes universities and research institutes may not have a direct contribution in national economic growth, but scientific outputs emanated from this sector are providing important inputs to the firm's and nation's innovation activities. Science, Technology and Innovation (STI) policies are designed to encourage STI in the country specifically.[13, 14] The main difference between 'Science' and Technology' is that, 'Science' produces knowledge for public use and encourages published knowledge, while the 'Technology' produces knowledge that is for private use and often unpublished.[6]

Universities and Research Institutes' (RIs) main activities are to educate future human capital and to conduct research in both basic and applied research, leading to benefit for the industrial sector. Innovation and technical progress are the outcomes of a complex relationships among those actors who involve in producing, distributing, and applying various kinds of knowledge. While science policy helps in the promotion of R&D through knowledge bases, technology policy focuses transfer of knowledge and information for societal benefit and creation of wealth.[15] In both the policy areas IP play a central role. IP policies of HEIs are the prime building blocks of the innovation, where it aims for promotion of generation and commercialization of IP from knowledge bases where the flow of knowledge begins. National IPR policies identify the strengths and weaknesses of the innovation ecosystem and provides needed technological framework balancing competition and social benefits. Leveraging both the National IPR policy and IP policy of HEIs as a tool of innovation policy enables attaining the goals of innovation envisaged.

Protecting and managing IP of creator/inventor requires policy guidance both at the national and institutional level for coordinating and promoting research. Strengthening the industry linkage to universities and research institutes, protecting and managing their IP will have a triggering effect on country's innovation output. Many economists recognized patents as indirect indicators of economic development of the country which also decides the Foreign Direct Investments (FDIs) and international trade.[16] Countries like Jamaica, Sri Lanka, Rwanda, Trinidad and Tobago, and

Serbia identified the role of IP, and integrated IP policy with innovation policy and also as a part of the National Development Plan (NDP).[7]

Just like public policy, innovation, and IP policies are also need reforms with changing times. Policymaking and strategy building is specifically dependent on social, political and cultural backgrounds of the country (path dependence).[17] While framing these policies, the priorities, issues, and specific needs of a country are needed to be balanced along with norms of international conventions. University-based entrepreneurial developments are thought to be improved by national policies. In some countries like the UK, the commercialization of university generated knowledge is crucial part of national and regional policies. In the US, after the implementation of Bayh-Dole Act (BDA), there was surge in patenting and commercialization activity in universities. In developing countries, Intellectual Property Rights (IPR) policy has significant implications for accumulating technological learning and technological capability.[18]

Ranking of a country in terms of innovation performance, national Gross Expenditure on R&D became proxy measures of economic development of a nation[19-21], and these measures impact the Foreign Direct Investments (FDI).[22-26] The countries which are consistently performing well in Global Innovation Index (GII) rankings have significant contribution from HEIs in these indicators leading to better scores; whereas, HEIs from India have traditionally contributed low in these indicators. India's ranking in GII was declining continuously during the years 2011 to 2016.[25, 27] India has the largest Higher Education System which ranks third in the world next to the US and China[28], but this enormous intellectual capital from HEIs of India is not fully utilized. The low performance of India in various innovation indicators was due to lack of supporting national innovation policy to enhance IP from universities[25,29]; whereas, in developed countries, contribution of HEIs in economic development, promoting innovation and IP generation are prominent.[30-32]

2.3 HEI network of India

Post-colonial period, the importance that was given by then Indian government to science and technology, establishment of institutions, policies and schemes of five-year plans helped a lot in attaining self-reliance in the science and technology and resulted in the strong and robust HEIs network and infrastructure currently we are seeing. It made India one of the top ranked countries in basic research area. At present India has public research institutions under the umbrella of various ministries and departments. Council of Scientific and Industrial Research labs (CSIR) under the Department of Science and Industrial Research (DSIR), Department of Science and

Technology (DST), Department of Biotechnology (DBT), which consists of autonomous laboratories under the Ministry of Science and Technology, Department of Atomic Energy (DAE), Department of Space, ISRO, Defence Research and Development Organization under Ministry of Defence, Indian Council of Medical Research (ICMR) under Ministry of Health and Family Welfare (MH&FW), Indian Council of Agriculture Research (ICAR) under Ministry of Agriculture and Farmers Welfare have research institutions where public fund is utilised for research in both basic and applied research areas. Ministry of Human Resource Development (MHRD) consists of central universities, technological institutions (IITs, NITs and IIITs) and science institutions (IISERs, IISc). These all are centrally funded and along with these, state government funded laboratories are instituted in every state.

At the time of independence there were just 20 universities in India.[33] Since 1950, R&D infrastructure has been improved and now India has 41 central universities[34, 35] 32 NITs, 7 IISERs, 1 IISc, 23 IITs, more than 40 CSIR, 64 ICAR and 31 ICMR, 20 DST, 7 DAE and 10 DBT laboratories where public fund is the main source for research and development. All the RIs in India are owned and governed by the central government. Unlike in the US, there are no government owned, and contract operated labs in India. Government owns research results, IP and have rights over commercialization activities with revenue sharing mechanism as per centrally administrated IP policy; whereas, Central and state government universities, Private Deemed universities have stand alone IP policies to protect the knowledge and IP generated from their research activities.

2.4 Importance of HEI IP policies

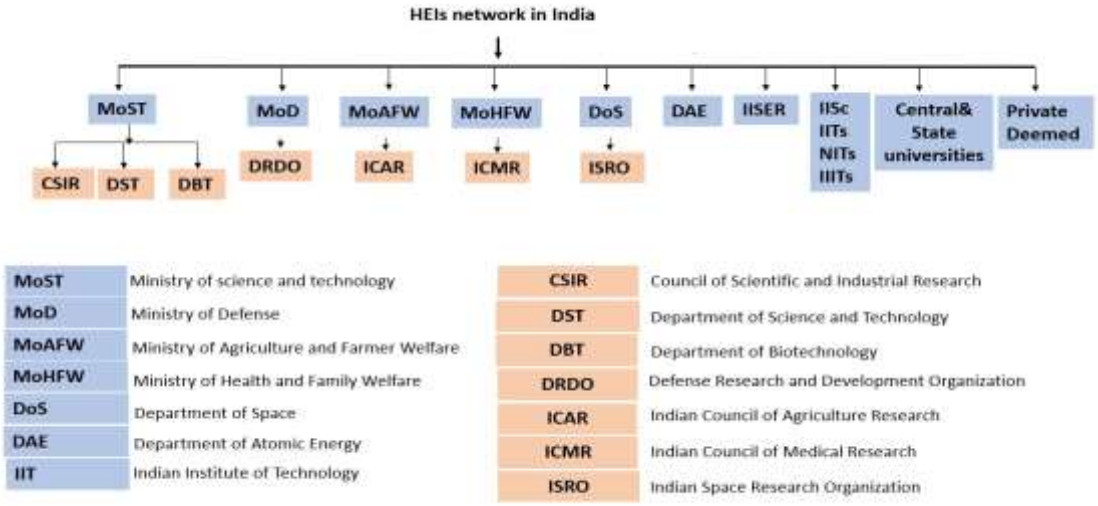

Figure 4 HEIs network of India

2.5 Policy framework variations in different countries

The framework of national IP policies differs mainly on innovation system in a country. It significantly varies between developed, developing and Least Developed economies, and within these economies. Not all the countries have consolidated IP policies yet. In some LDCs, within the sectoral policies they have mentioned their specifications related to IPR. Few countries have released their national IPR strategies consisting of goals and targets, but not as a standalone IPR policy. WIPO has given general guidelines for IP policy making for countries and for HEIs and encourages all member countries to formulate IP policies. For least developed countries, WIPO provide their expertise in setting IP policy for nations. Sri Lanka, South Africa, Nepal were among those LDCs to whom WIPO has involved in setting their IP policies. As per WIPO IP policy-making methodology, there is a need to identify the issues and innovation status of the nation, to decide on priorities of the nation. For that, a survey was recommended to receive the suggestion from all the stakeholders involved in the system. 'A think-tank of IP' representing all the stakeholders in the IP system need to be constituted. Agenda and strategy need to be built, and policy framework is to be made as per the strategy proposed. In between 2010-2018, most of the developing and LDCs formulated their IP. The core objectives of the policy should address the issues identified in the system and policy tools should be framed to answer those issues identified. Historical evolution of policy and Current National IP policies/Strategies of (Developed) USA, Japan, India, China, Bangladesh and Nepal were discussed in this paper. The crucial differences of policy frameworks in these countries are due

to following factors: a) Awareness, IP generation, and commercialization, b) Inter ministerial co-ordinations c) IP administration and d) Coordination for Enforcement. Study and comparison of national IPR policies of the countries classified under 'Developed, Developing and LDCs' were made under the purview of above-mentioned factors.

Developed countries (Japan)

Japan IP Policy

Comparing to other countries Japan lacks the natural resources to stand competitive in world economy. It has targeted to use IP as a main source to improve its economic status, but it was opined by many policy makers and analysts that their IP system was out-dated and need to be revived. It aimed to improve the international competitiveness of its industrial sector by protecting and using their IP developed from their creative and research activities. As a first step in transforming their country into an IP based nation, they enacted 'Basic Act' and established Intellectual Property strategy Headquarters in 1st March 2003. It was headed by Prime Minister and members as all other sector ministers and constitutes 10 experts (4-university Professors, 3- CEOs of private firms, an attorney, a patent agent and a scientist). IP strategy program was designed which includes 5 chapters and 270 action points. Japan realized universities role in knowledge creation and Technology Transfer from universities in 1990; whereas, USA started it in 1980 through Bayh-Dole Act. Before the Basic IP Law enactment, Ministry of Education (MEXT) guidelines allowed university researchers to retaine rights of IP they generate. In Japan, major research activities are undertaken by national universities and they are not given right as independent legal entities. Private universities in Japan were not bound by the rules of Ministry of Education. A legislation was enacted in the year 1998 to encourage the Technology Licensing Organizations at universities. In 1999, Industrial Revitalization Special Law, a Bayh Dole like Act was enacted. As a part of that, IP centres were established in universities across the country. Functions of universities are expanded from conventional types i.e Academia and Research along with Technology Transfer as a new function added to it. Universities were encouraged to enhance IP focused organizations, to set up rules and regulations for IP ownership, and to secure finance for prosecution. Government has chosen 34 universities and provided subsidies to encourage IP related activities. After this Act implementation, professorial patenting with industry fell significantly and university entitled patents were increased. However, these reforms encouraging TLO/TTO mediation in technology commercialization process brought changes in the IP ownership , but didnot improve the quantity and quality of IP output from universities.

Objectives of the Innovation policy of Japan was concentrated on improving its IP system to support the international competition of their industries. IP policy vision document was framed in 2013 and it has proposed 4 main objectives as pillars. They are: Building global IP system for enhancing industrial competitiveness, ii) Promoting support for IP management of small and medium enterprises and venture companies iii) Improving the environment for adjusting to digital network society, and iv) Strengthening of content industry.

Developing countries (India)

In most of the developing countries 'Public consultation on IP issues is underdeveloped. Countries like India, Brazil and Philippines have well developed processes and consultation of experts in IP decision making. Policy setting for developing nations is highly challenging as it is often difficult to balance the national priorities and satisfying international competition and trade pressure from developed countries. Policies supporting for strong IP protection in developing countries may end-up benefiting developed countries with no internal innovation improvements to the nation.

2.6 National Intellectual Property Rights Policy of India 2016

Standalone separate IPR policy of India was released in 2016 by 'Department of Industrial Policy and Promotion' (DIPP), the coordinating department for nurturing Intellectual Property Rights in the country. To draft this policy, it has constituted IP "think tank" comprising 6 academicians for preparation of a base document for a National IPR Policy on October 21 2014.[36] Government has approved the National IPR Policy of India given by DIPP on 12th May 2016, which laid the roadmap for IPR in India. Seven objectives were given in the policy: i) To create awareness in the public about the socio-economic and cultural benefits of IPRs among all sections of society, ii) To stimulate IPR generation, iii) To enact strong and effective IPR laws balancing public interest and owners' rights , iv) To strengthen IPR administration, v) To promote IPRs facilitating commercialization, vi) To strengthen IPR laws of enforcement and adjudication , and vii) To strengthen and expand human resources and skill building in IPR.

Though India has a significant knowledge base, due to lack of IP legislation awareness much of it was not protected. To create public awareness, it has recommended for the introduction of IPR courses in schools and colleges. Specialized IPR institutions were planned for creating skilled professionals. The policy also recommended the setting up of IPR facilitation centres and creating incentives for IPR filings by Micro, Small & Medium Enterprises (MSME). The model guidelines document was prepared and released by Cell for IPR Promotion &

Management (CIPAM) for the implementation of IPR policy in academic institutions.[37] Multiple reforms for enforcement were planned to cull the counterfeit products sale which was reported approximately about 6 billion USD in the year 2013-14 as per FICCI (Federation for Indian Chambers of Commerce) report. This policy recommended amendments to the cinematography Act of 1952 to put criminal liability clause for infringement cases. Legal framework for Standard Essential Patents (SEP) and FRAND (Fair, Reasonable, and Non-discriminatory) rules were proposed.[36, 37] This policy also stressed on traditional knowledge protection. by widening of the scope of TKDL (Traditional Knowledge Digital Library) [38]

Republic of South Africa National IP policy

The draft of the National IP policy of South Africa has been established in the year 2018. In the phase 1 of the IP policy, 10 points objectives were made, and strategies were proposed to achieve those. South Africa focused on public health and international IP cooperation, which are the main issues identified in the nation and the same was mentioned as the government's main objective to strengthen the country's pharmaceutical industry to promote industrial development in phase 1. Flexibilities provided by the TRIPS minimum standards were utilized wherever it is possible. As per United Nations Secretary General's High-Level Panel on Access to Medicines (UNHLP) suggestions, Inter-Ministerial Coordination on Intellectual Property (IMCIP) was established to coordinate with industry policy and IP policy framework formulation. In this phase 1 policy, academic institutions, Public Research organizations' contributions, and policy on leveraging IP from the academic sector were not mentioned. Its focus areas in the phase 2 version of IP policy would be on the commercialization of IP, IP awareness and capacity building, IP in biotechnology and agriculture, and encouraging climate and green technology. The full-fledged IP policy, further development, and formulation procedures in it will be made with the coordination of IMCIP.[39]

Least Developed countries (Bangladesh)

National IP policy of Bangladesh

Bangladesh IP policy draft was made in the year 2018. It aimed to encourage the country's innovation by using IP as the main tool with a vision of socio-economic and cultural growth. This policy has the mission of making IP as an integral part of the National Development Strategy and declared the period from 2018 to 2028 as the innovation decade. It has specified 6 goals and some strategies to attain the said goals to fulfil the objectives of the proposed IP policy. In strategies of goals 1, 2, and 3, it has identified the role of academia for stimulating and promotion of the country's innovation and given importance for funding of academic

research and improving the industry – university linkages. Mechanism of commercializing the public sector research by coordinating innovation, assisting the local scientists on technology transfer and promoting and facilitating the institutional IP policy establishments at universities, R&D organizations and public research organizations, developing and strengthening the human resources in the institutions of IP promotion and protection and introducing IP education in all academic institutions (public and private universities) are other strategies mentioned in the draft policy. It has stipulated a period of 10 years for attaining the goals specified and planned to establish the National Council and Sectoral Committee on intellectual property to follow-up and check the implementation of the policy at the national level.[40]

2.7 HEIs' (universities and research laboratories) IPR Policies in different countries

Aim and Objectives of HEIs' IP policy is to absorb the objectives stipulated in the national and state/regional IP policy to leverage the maximum benefit out of HEIs research activities. Ownership, revenue sharing, and system of incentive specified in the policy plays a major role in promoting the awareness on IP, and the IP generation and commercialization. In this paper, 'description and comparison' of HEIs' IP policy of different countries was made on ownership, revenue sharing mechanism specified in their policies.

Ownership of IP in HEIs can be seen in two models. i) university ownership, and ii) inventor ownership. Both have advantages and disadvantages. US follow university ownership model where there is crucial role of TTO/TLO to commercialize the IP generated. Sweden has inventor ownership model where the inventor has freedom to work on his patent for its commercialization.

Revenue sharing mechanism could be linear (fixed) and non-linear (variable) types. In linear mechanism, there would be fixed share of revenue distribution among those who contributed in the IP generation; whereas, in non-linear mechanism, revenue is distributed based on milestone payments after achieving pre-set target amount during commercialization/ marketing. Most of the European and Australian universities follow this type. This non-linear revenue sharing model can be designed in either i) step up, (low initial royalty sharing at first pre-set milestones and increases gradually as the milestone amount increase), and ii) step down manner. (high initial royalty at first pre-set milestones and decreases gradually as the milestone amount increase)

1.1 IP policies of HEIs' in the USA

3.1.1 Massachusetts Institute of Technology (MIT):

MIT IP policy was last revised in 2018. As per the policy, from the tangible property derived from the single technical disclosure, 15% shall be deducted as administration fee (expenses of Technology License Office) and out of pocket costs (patent filing, prosecution, maintenance and marketing costs), 1/3rd share shall be shared to inventor contingent adherence to applicable sponsored research agreement. Co-inventor(s) share shall be equal unless otherwise agreed by all in written for variable share. Share of technology licensing office (TLO) and any other departments involved in contribution was mentioned clearly. Each contribution in different cases were termed as case contributions. Share of royalty to departments and centres is decided after deductions of each case costs from gross royalties received. i.e (gross royalties) minus (administrative fee and inventors share) minus (royalties owed to third parties). They have included the TLO expenses on patent cost within the total net patent expenses and will be reimbursed after payments from licensees were received. Resulted 50% of revenue shall be shared among departments and centres as per their contribution. Remaining royalties after distribution shall be retained by MIT general fund. Distribution frequency of net income was scheduled in the first quarter after the end of the financial year.. As per policy, royalties earned by departments, centres, inter disciplinaries and MIT general fund must be used only for education and research purposes.

3.1.2 Boston College Policy:

Boston IP Policy has primarily two academic aims. Firstly, to share the existing knowledge with students to promote research and scholarly activities in the university. And the second is to benefit the individuals who involved in those scholarly outputs that have commercial activities and university. Regarding ownership of IP, it states that, if inventor is an employee, uses university resources, funded by university that shall be owned by university and if there is no employment responsibility vested with the individual and not funded by university, resources or facilities are owned by inventor. Revenue share of the inventor after licensing is in non-linear step-down type, where, up to $5,000, Inventor share is 100% , from $5,001 - $10,000 -85% to inventor and rest to Provost and Dean of the faculty, from $10,001 and Above-50% to inventor and rest to provost and dean of the faculty.[10]

3.1.3 Harvard university IP Policy:

Harvard university IP policy clarifies the importance of exploiting financially and it specified that public benefit is high priority for them than financial gain. University Office of Technology Development makes decision whether to protect the IP for the financial benefits of researchers

or to waive off for societal benefits. Unless there is any previous agreement made regarding sharing of revenue, $1/n^{th}$ part would be distributed among all the inventors; where n= number of inventors.

Some universities like California and Columbia universities give more importance to patent protection while universities like Harvard and John Hopkins have not been aggressive in protection of IP on their discoveries and inventions.

1.2 IP policies of HEIs' in India:

Indian higher education network system is the third largest (next to China and the US), and near future, it will become the largest education hubs in the worldS.[27] Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR) and Tata Institute of fundamental research (TIFR) are few of the largest networks of premier research institutions in Asia and Indian Institutes of Technology (IITs), National Institutes of Technology (NIT) and Indian Institute of Science (IISc) are the technical institutions of national importance, where cutting edge basic and applied research facilities were provided and producing more number of patents from India. IIT-Bombay, IIT-Delhi, and IISc were among the few earliest academic institutions framed IPR policies in India. IIT-Delhi first brought its IPR policy in 1994. Rajiv Gandhi School of Intellectual property Law was instituted in IIT-Kharagpur to improve the number of trained lawyers and increasing the capacity building in the IP area to serve the needs of industries. Governing and funding body of universities, University Grants Commission (UGC) drafted guidelines for promotion of awareness and management of IP at university. ICMR, CSIR have framed their IP policies emphasizing on the commercialization of publicly funded research. National Research Development Corporation (NRDC) plays a major role in management of IP from national laboratories and universities.

3.2.1 IIT-Bombay IP policy

IP policy of IIT-B was established in March 2003. The current version of the IP policy was approved on 14 June 2012. The policy vision was specified as "to be the fountain head of new ideas and of innovators in technology and science" and mission was "to create an ambiance in which new ideas, research, and scholarship flourish and from which the leaders and innovators of tomorrow emerge". It clearly said the institution's determination to enhance innovation and promote innovators and entrepreneurship. This policy applies to all the IITB personnel (students, faculty researchers). It has 2 key bodies for the development and promotion of innovation activities in the institute. They are 'Society for Innovation and Entrepreneurship

(SINE) and Industrial Research and Consultancy Centre (IRCC)'. The licensing of IP generated by IITB is done through IRCC, which also takes responsibility of evaluation, licensing negotiations and marketing of IP generated and owned by institute. It is also responsible for facilitating R&D, incentivizing researchers, providing advanced facilities, policy changes, etc. SINE was established in 2004, with accommodation capacity of about 15-17 companies for the purpose of business incubating and promoting entrepreneurship. Institute has followed linear type of revenue sharing mechanism which is shared among multiple contributors. After successful licensing, revenue is shared among the inventor and institute in 70:30 ratios. Ownership of copyrights vests with the creator/author only. The institution is not claiming rights over it. Institute prefers non-exclusive licensing but under few exceptions, exclusive licenses shall be given. As per 2012 IP policy publication, IP protection cost will be part of license sharing agreement. If IP generated from collaborative or multiple research consortiums, those agreement terms shall be applicable along with institution's IP policy. If the collaboration agreement doesn't specify about IP terms ,institution's (IITB) IP policy shall be applicable.[41, 42]

3.2.2 IISc (Indian Institute of Science, Bangalore) IP policy

IISc started managing its IP from 1950. Institute received its first patent in 1951. Professor Goverdhan Mehta conceptualized an exclusive office for promotion of IP from institution. In 2004 IP cell was incorporated and it was renamed as IPTeL from 2015.[43] From 1972-77 it actively participated in developing local know-hows and technology transfer activities.

The recent revision of IISc IP policy was made in 2016. It aims to facilitate the protection and commercialization of IP generated from institutions research activities. It offers scope for wealth generation and promotes research for the betterment of human life. This policy is applicable to all employees, students, and persons engaged in sponsored schemes along with all visiting scientists/professors/personnel. Linear type of IP revenue sharing mechanism was used, of which share of inventor and institution is specified as 60:40 proportion. If it is sponsored research, the sponsor bears the cost of filing of IP and it shall be a joint IP or an absolute institute ownership IP. Same rule is applicable to collaborative research also.[43-48]

3.2.3 IIT Kanpur (Indian Institute of Technology Kanpur) IP Policy

IP Policy of IIT Kanpur was drafted and approved in January 2005. As per its policy, IP ownership is entitled to institution, if it is created using IITK funds/facilities. Policy is applicable to all employees, students, project staff, visitors and others, such as trainees from

other institutes, participating in IITK programs. The policy also clearly mentioned about the logical conclusion of IPR, if IITK decides not to protect the IP. In such case IITK shall waive off the ownership rights to the inventors.

Regarding commercialization of the IP, the Institute followed a revenue sharing model(non-linear step-down type)which clearly divides the earning into 3 parts i.e. Inventors share, Institute's share and a separate account meant for the purpose of commercializing and development of further inventions.

Case	Net earnings	Inventors share	Institute share	Service account/ IPR Cell *
1.	For the first amount upto INR 100 lakhs	65%	25%	10%
2.	For the next amount between INR 100 lakhs to INR 200 lakhs	45%	45%	10%
3.	For the next amount more than INR 200 lakhs	25%	65%	10%

The income generated from IPR cell through technology licensing is allowed to use for the promotion and upgradation of the invention. Unused funds from IPR cell services and technology licensing will be used for IP commercialization and protection.

The institute through the invention disclosure form, asks the inventors of IP to disclose the distribution of IP earnings share among the inventors, In the absence of such disclosure the earnings shall be equally distributed among all the inventors.

In collaboration with the Industry partners, the ownership of IP is decided by the Institute on case by case basis, the Institute signs the agreement beforehand where in the jurisdiction of the IPR's, right to commercialize the IPR's, cost of filing & maintenance and co-applicant status is clearly mentioned in the agreement.[49]

While the latest Faculty Entrepreneurship Policy approved in 2019 at IITK, provides the license of any number of IPRs to the Faculty run company under the umbrella of 10% equity as a licensing consideration.[50]

3.3 IP policies of Chinese HEIs

Tsinghua University:

Tsinghua University is one of the top esteemed higher education and research institutions in China. It has high success rate in technology transfer and commercialisation functions among leading Chinese universities. Most recent IP policy of Tsinghua university was implemented on 31st December 2016. It is applicable to all university employees, including faculty and non-faculty researchers, provisionally hired employees, students, post-docs, and visiting scholars. To whomsoever it is applicable, need to sign a pledge to comply with the policy. Policy mandates all the investigators to disclose all results of their invention to the administrative department first, which would decide whether to apply for a patent. Tsinghua university allots at least 25% revenue share to inventor in terms of cash/equity. For cash income obtained from technology transfer, the university and department get 15%, and other contributors who involved in the ideation, completion and transformation of the invention would get 70% share. Till the first three years after a patent granted, university pay patent costs, including application fees, examination fees, agency fees, and maintenance fees for which separate fund is allocated. For equity obtained from investment by the technology, the university and department gets15% each, and those individual people who have made important contributions to the completion and transformation of the invention would get 70% share.

3.4 IP policies of HEIs in South Africa

University of Pretoria IP Policy

University of Pretoria IP policy specifies that, IP created by employees, contract employees belongs to the university and it may decide in certain cases to waive off the ownership to the employee on request in certain cases. Ownership in-case of IP generated in joint projects outside the organization shall be based on the agreement made with that organization. Visiting lecturers and scholars must sign a confidentiality agreement before their visit saying that IP generation in their visit will get assigned to the university. Generated intellectual property may on university decision upon intimation with the involved inventors, maybe spin- off into separate entity and it would be the part of Enterprise at University of Pretoria (E at UP). University, inventors, and other involved shall be the shareholders and it would be a wholly owned subsidiary of E at UP. The university TTO puts separate account for each IP product. Revenue distribution on commercialization is done in 4 components. First two components deal with the recovery of direct (university surcharge) and indirect expenses (legal expenses) recovery which would be 10% of gross income to university and direct expenses would be recovered from

concerned parties involved in gross sharing and next two components relate to net revenue division the first R400 000 of net income, that is distributed among inventor, university research account and staff involved in the proportions of 50%, 50%, and 25% respectively. And the remainder of the net income after the first R400 000 is distributed among the same as above mentioned in the proportions of 35%, 15%, and 20% respectively and 30% to the University of Pretoria's Intellectual Property Leverage Fund.[51]

Ownership and revenue sharing mechanisms of HEIs were given in the Table 1

Table 1 Ownership and Revenue sharing types of HEIs' IP policies of different countries

HEI	*Country*	*Year*	*IP ownership (NS=Not Specified)*							*Revenue sharing mechanism*		
			Copyrights				Patents/Designs		Know-Hows/ Trade Secrets	Linear	Non-Linear	
			Content		Software	Performance	Incidental	Supported			Step-up	Step down
			Assigned/ Sponsored	Non assigned								
MIT	USA	2018	Institute	Institute	Institute	Institute	Institute	Institute	NS	✓	-	--
Harvard	USA	2019	Institute	Creator	Institute	NS	Inventor	Institute	NS	✓	-	--
Stanford	USA	2013	Institute	Creator	Institute	NS	Institute	Institute	NS	✓	-	-
John Hopkins	USA	2011	Institute	Institute	Institute	NS	Institute	Institute	NS	✓	-	
Cambridge	UK	2012	Institute	Institute	Institute	NS	Institute	Institute	NS	-	-	✓
Oxford	UK	2018	Institute	Institute	Institute	NS	Institute	Institute	NS	✓	-	--
University college of London	UK	2019	Institute	Institute	Institute	NS	Institute	Institute	NS	-	-	✓
University of Manchester	UK	2015	Institute	Institute	Institute	Institute	Institute	Institute	Institute	-	--	✓
University of Malaya	Singapore	2014	Institute	Creator	Institute	Institute	Institute	Institute	Institute	--	-	✓
University Putra Malasia	Singapore	2014	Institute	Creator	Institute	Institute	Institute	Institute	Institute	✓	--	-
University of Waterloo	Canada	2000	Institute	Creator	Creator	Creator	Inventor	Institute	NS	✓		
University of Toronto	Canada	2013	Institute	Creator	Creator	Creator	Inventor	Institute	NS			

HEI	*Country*	*Year*	*IP ownership (NS=Not Specified)*							*Revenue sharing*		
			Copyrights				Patents/Designs		Know-Hows/ Trade Secrets	Linear	Non-Linear	
			Content		Software	Performance	Incidental	Sponsored			Step-up	Step down
			Assigned/-Sponsored	Non assigned								
Mc.Gill university	Canada	2017	Institute	Creator	Equal rights*	NS	Inventor	Institute	NS	NS	NS	NS
Tsinghua university	China	2016	Institute	Institute	Institute	NS	Institute	Institute	Institute	✓	-	-
Peking university	China	2014	Institute	Institute	Institute	NS	Institute	Institute	Institute	✓	-	-
Tokyo Institute of Technology	Japan	2004	Institute	Institute	Institute	NS	Institute	Institute	NS	✓	-	-
Osaka university	Japan	2015	Institute	Institute	Institute	Institute	Institute	Institute	Institute	✓	-	-
Australian national university	Australia	2020	Institute	Institute	Institute	NS	Institute	Institute	NS	-	-	✓
University of Queensland	Australia	2019	Institute	Institute	Institute	NS	Institute	Institute	NS	✓	-	-
IIT-B	India	2012	Institute	Institute	Institute	NS	Institute	Institute	NS	✓	-	-
JNU	India	2017	Institute	Institute	Institute	NS	Institute	Institute	NS	✓		
IIT-M	India	2014	Institute	Institute	Institute	NS	Institute	Institute	NS	NS	NS	NS
IISc	India	2015	Institute	Institute	Institute	NS	Institute	Institute	NS	✓	-	-

2.8 Impact of National IPR policies and HEIs' (Universities and Research laboratories) IP policies on IP generation

Because of the substantial changes, it brought in the patent procedures and the success it has seen, the US IPR policy evolving process be seen as 'policy before 1980' and 'policy after 1980'.

2.8.1 IP Policy of USA before Bayh-Dole Act (BDA) 1980

Before 1980, there were no concrete national-level IP policies and universities involved in innovative activities. Land grant Act signed by Abraham Lincoln was the first major boost during that period in establishing universities which are top-performing institutions now. Till 1975, universities didn't prefer for direct involvement in patent management. Instead, they had an indefinite contract with non-profit, independent foundations that act as patent management agents for all patentable inventions and discoveries. They made agreements with individual inventors for their inventions and also for the entire university as per their requirements. Universities are reluctant and passive to involve in litigations and infringement suits. These independent patent management contractors take the call on litigations and legal issues as universities and national laboratories do not have expertise in handling those issues and apprehend that would affect their relationship with investors, funders of the research, and commercialization channels. 'Research corporations' was one among such non-profit foundation had contractual agreements for managing patents with 39 land grant universities during 1945. The prominent universities established under this are Cornell, Maryland, Michigan State, MIT, Ohio State, Penn State, Rutgers, Texas A&M, West Virginia University, Wisconsin, and the University of California. National Patent Planning Commission, Adhoc body was established in 1945, to examine the patents developed during the war. Over 30 years there was uncertainty regarding the entitlement and exclusive rights of federally funded research innovations till the enactment of BDA, In 1950 congress allocated $15 million to establish NSF to support basic scientific research at universities.

During the 1970s scenario changed and for the first time, private universities started involving directly in the management of their intellectual property. MIT and Wisconsin universities are first among land grant universities, started collaborating with industries. Studies were showing a growth of biomedical patents by universities when it took direct involvement in the

management of IP. Public universities were more heavily represented in patenting than private in that period. Due to an economic slowdown, the US patent system was weak and ineffective at the end of the 1970s. USPTO was overworked and understaffed. In fast-moving technological fields, inventions were found to be getting obsolete by the time PTO granting the patents.

President Nixon in 1971 stated patent policy to promote the commercialization of federal inventions for the benefit of the private sector and to put economic growth on track. In the year 1975, the government had about 28000 patented inventions but less than 5% of them were in practice to business.

2.8.2 IP Policy changes in the US after 1980

The economic slowdown of the USA during the 1970s made the federal government initiate few policy changes to bring it on track. Out of those, the Bayh-Dole Act (BDA) of 1980, the Stevenson-Wydler Act of 1980, the Small Business Innovation and Development Act of 1982, and the National Cooperative Research Act of 1984 are prominent which brought policy changes to technology and innovation in universities, public research laboratories, national laboratories, and small business entities. There were many arguments from policymakers and advocates regarding ownership and exclusive rights for federally funded R&D innovations. Few argued for a government entitlement of the public-funded research results for the wider diffusion of the innovation and few arguments were for policy supporting patent entitlement to contractors and allowing exclusive licenses to them. The government was uncertain between these views before world-war-2.

Jaffe et al categorized the policy objectives of Bayh Dole Act and policy changes after it into 4 groups. They are 1) Establishment of new courts to review patent decisions. 2) Special privileges to researchers and contractors who create commercially viable inventions. 3) Broadening of patentability subject criteria for new technology areas. 4) Harmonization of patent protection across the world.

2.8.3 Impact of IP policy reforms in national laboratories in USA

Land grant universities were the first group of universities that started managing faculty generated IP before the enactment of BDA. Wisconsin university and MIT were among them. The BDA and Stevenson-Wydler Act policies influenced a lot in the promotion of the generation of IP and commercialization in universities and the national laboratories. Before the

enactment of Stevenson-Wydler Act, technology transfer was not facilitated at national laboratories. This Act mandated establishment of Office of Research and Technology to disseminate federally funded research output, having potential applications to state, local government and private industry.[52] Using patent citation method, Jaffe et al studied the impact of 1980 patent policies on patenting activity using patent citation data of two Department of Energy (DOE) laboratories, Lawrence Livermore National Laboratory (LLNL) and Idaho National Engineering and Environmental Laboratory (INEEL). In both the DOE laboratories and NASA, he found increase in patenting without any change in quality of patents. He also found dramatic and positive effect of increase in the commercialization activity due to the policy reforms of 1980.[53]

LLNL was established in 1952, specialized in nuclear weapons research operated by University of California. Even before the enactment of BDA, it has strong relationships with computer and laser industries in Livermore. Relationships with the industries and vendors were informal and LLNL neither seek to patent their inventions nor claimed for holding the patent ownership before 1980. Laboratory contractors were assigned few patents and exclusive licenses are rare. After 1982 implementation of Stevenson-Wydler Act, there was initially limited funding and a formal technology transfer office was established. After the passage of National Competitiveness Technology Transfer Act of 1989, DOE increased funding to CRADAs (Cooperative R&D arrangements) which improved number of projects. Lack of exclusive licenses, issues of conflict of interest caused a lesser number of commercialization of patents generated before 1980. IP policy and management related impediments were clearly seen as reasons for the decrease in the commercialization of Public Research Institutions' inventions before IP policy reforms.[54, 55]

2.8.4 Policies of the USA universities before 1980

IP Policies of USA institutions before 1980 can be seen as 3 types. Institutions that had serious concern over IP matters (formal IP policies), laissez faire attitude institutions (who followed general practises with verbatim policies) and institutions did not pay attention to IP.

Institutions with formal IP policies

Most of the land grant universities first started managing IP with formal IP policies. They had policy framed for every specified instance to handle sponsored/ contract research. They also had in-house non-profit research foundations to look after IP related issues with dedicated IP staff. They had indefinite contract with external non-profit independent patent agent corporations like research corporations to manage the IP. Inventors, on requesting to university,

could take the ownership of IP and collaborate with research corporations for IP management. In absence of such policy, it was carried out based on mutual agreements. Determination of licensing and sharing of benefits were on ad-hoc basis. About 70 institutions were having formalised policies before 1980.

Institutions with informal IP policies: Only for the sake of contract/ sponsored research activities some institutions made verbatim IP practices with general rules. They did not directly involve in legal matters instead they completely relied on research corporations or any such independent contractors IP management.

Institutions without IP policies: Laissez faire attitude was seen in these institutions. Inventors were allowed to take their own decisions on their invention without any formal/ informal policies.[56]

2.9 Impact of IP policy reforms on universities in USA:

Before 1980, IP management and ownership were given to research contractors. Number of invention disclosures and patent filings were very less. After the passage of IP policies, patenting was dramatically increased in those institutions which had formal IP policies and previous patenting experience.

2.9.1 Impact of HEIs' IP Policies on innovation output

Since 1980, a 5% increase in average patent applications and grants were observed than the previous century.[45] Key objectives of post-1980 patent policies in the USA were: i) Entitlement of patents generated from public funded research results, ii) Incentives for licensing and technology transfer of inventions to small businesses, and iii) Increasing the probability of winning the patent cases through establishments of CAFC (Court of Appeals for Federal Circuits).

To what extent, these parameters of major patent policy reforms were the reason for this increase in the rate of inventions and patents were studied and evaluated by various scientists in different methods. Proponent and opponent views regarding the magnitude and direction of the policy impact on promulgating the science and technology output from HEIs are discussed below.

Effect of policy changes on the commercialization of publicly funded research was studied by Josh Lerner and Adam B Jaffe using patent citation analysis. They found that policy caused dramatic and positive effect on technology commercialization. Patenting number increased but

the quality of patents has been reduced in labs. In universities, the overall increase in patents doesn't seem to have affected the quality of patents. Monetary and non-monetary awards and types of formal and informal reward schemes at labs and universities caused this change.

Post Bayh-Dole Act, new university entrants into academic patenting received fewer quality patents compared to the incumbents who have experience of patenting before the Bayh-Dole Act. Mowery et al found in their study, that after 6 years of BDA legislation biomedical patenting required less patenting experience than non-biomedical patents and incumbent universities had more advantages towards non-biomedical patenting than biomedical fields. Institutions who were previous clients to Research Corporations were successful in attaining biomedical patents than non-biomedical patents.[57]

Incentives provided through BDA, it is successful in increasing the rate of patenting and extent of licensing, which increased tremendously from universities. However, BDA and any other corresponding policy changes have not significantly changed the generation of the rate of commercially important inventions at universities. It might be due to, either universities did not shift the areas of research to produce commercial inventions or even if they tried, they failed in it.[58]

Chapter 3

Methodology

Respondents of this study are from administrative authorities or the office of Vice-Chancellor/Registrar/Research Directors/R&D Deans/ IP cell coordinators or such similar offices) in UGC-approved universities. The data was collected with the help of a structured, non-disguised questionnaire. The questionnaire consists of multiple choices, close-ended and dichotomous questions. The questionnaire (Google forms) was deployed to administrative offices of Public (Sate and Central Government affiliated), Private Deemed universities, and Public Research Institutions (PRIs) through e-mail with a Participant Information Sheet. Follow-up action was undertaken, and wherever possible respondents of the study from these universities were personally visited to get the questionnaire filled and completed. Convenience sampling was used for the study and received responses were analyzed using Excel spreadsheets.

Chapter 4

Detailed analysis of the Data

The questionnaire prepared was pilot tested and face validated by experts in the Intellectual Property domain from both industry and academia. The validated questionnaire was deployed and kept open for receiving the responses from January 2021 to June 2021. At the end of the survey 71 responses were received with a response rate of 28.4

Table 1 Response rate of the survey

HEIs responded	Count	Response Rate
Central	7	28.4
State	12	
Private Deemed	9	
INI	36	
RI	7	
Total	**71**	

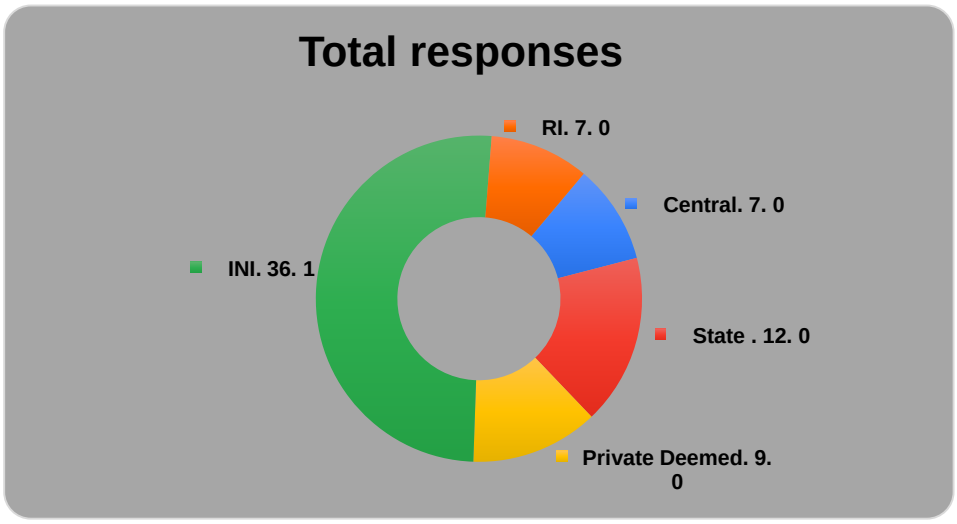

Figure 5 HEI type and responses count

Chapter 5

Result and Discussions

Results are a mixture of qualitative and quantitative data obtained based on validated questionnaire tool framed and deployed. The questionnaire framework sections can be classified broadly as i) HEI IP Policy and Institutional practices towards innovation and IPR; ii) Collaborations and correlation of collaborations, IPR and HEI's innovation; iii) Barriers of IP generation, commercilaization and technology transfer; iv) Perspectives on strategy of HEI's top management focus to promote innovation. Questionnaire tool used for the survey is given in annexure 1.

Results are discussed in the following manner. Firstly, the question framed in the questionnaire is shown; next, number of responses from different HEI types are shown in the table; and the same was exhibited in the form of charts. Name of the HEI and respondent's details were asked in the first part of the questionnaire. Results are shown by categorising the HEIs as Central, State, Private Deemed, INI and RI. Perceptions of the HEI respondents and analysis was carried by using the same categories of HEI.

5.1 HEI IP policy, Institutional practices towards innovation and intellectual property rights

Does your HEI have an Intellectual Property (IP) cell?
(1) Yes (2) No

7 Central universities responded; all 7 have IP cells.
12 State universities responded—10 have and 2 do not have—IP cells.
9 Private Deemed universities responded—all 9 have IP cells.
36 INI responded—28 have and 8 do not have— IP cell.
7 RIs responded—6 have and 1 does not have— IP cell.

Overall, 60 of 71 HEIs specified that they have IP cells; whereas, 11 do not have IP cells. INIs are more who do not have IP cells. HEI responses to this questions are shown in the Table 2.

Table 2 HEI type and presence of IP cell

Presence of IP cell			
HEI type	**Yes**	**No**	**Total**
Central	7		7
State	10	2	12
Private Deemed	9		9
INI	28	8	36
RI	6	1	7
Total	**60**	**11**	**71**

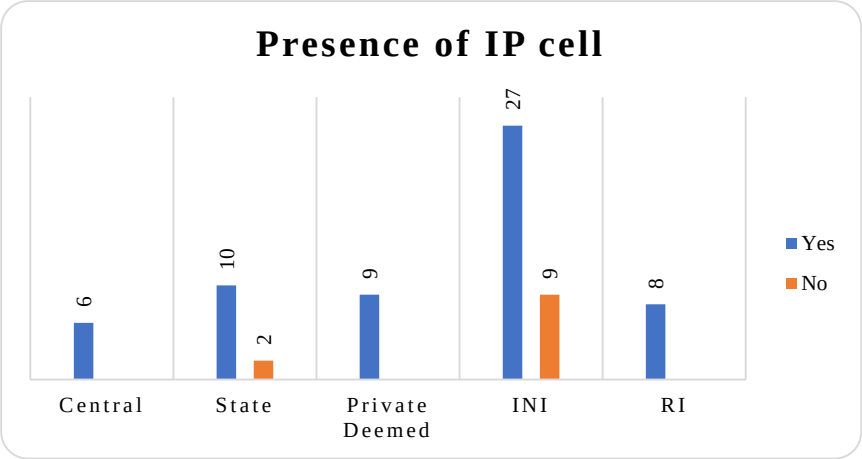

Figure 6 Presence of IP cell

Total 11 HEIs specified that they do not have IP cell instituted. Most of them are planning to establish in the time frame of 2 years.

Does your HEI have an IP policy?

(1) Yes (2) No

If No, please respond to the following questions

Do you plan to implement an IP Policy in near future?

(1) Yes (2) No

If yes, please specify the tentative timeframe to implement

If no, can you please state the reason?

7 Central universities responded—6 have and 1 does not have—IP policy.

12 State universities responded—8 have and 4 do not have— IP policy.

9 Private Deemed universities responded—all 9 have IP policy.

36 INI responded—26 have and 9 do not have— IP policy.

7 RIs responded—6 have and 1 does not have— IP policy.

Overall, 55 of 71 HEIs specified that they have IP cells; whereas 15 do not have and 1 did not specify about it. HEI responses to this questions are shown in the Table 3.

Table 3 HEI type and presence of IP policy

Presence of IP policy				
HEI type	**Yes**	**No**	**Not specified**	**Total**
Central	6	1		7
State	8	4		12
Private Deemed	9			9
INI	26	9	1	36
RI	6	1		7
Total	**55**	**15**	**1**	**71**

All the 15 HEIs who specified that they do not have IP policy yet, are under formulation planned to implement in the timeframe of 2 years.

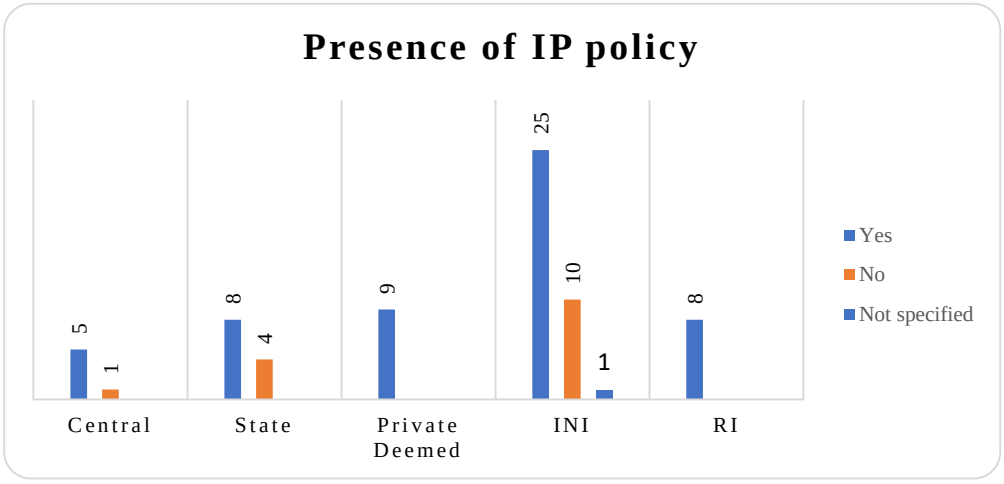

Figure 7 Presence of IP Policy

Correlation between IP policy and age of HEI

Among 71 responses received,

All central universities above 25 years of age have IP policies implemented. 1 central university which is 10-25 years old does not have.

All state universities above 50 years old have IP policies implemented. 4 HEIs who are 25-50 years old do not have an IP policy.

All Private Deemed universities have IP policies implemented.

All in aged above 50 years old except 1 have IP policies. The majority of INIs do not have an IP policy is of 10-25 years old.

All RIs responded have IP policy implemented.

Table 4 Presence of IP policy and age of HEI

IP policy Vs Age of HEI				
HEI type	**Yes**	**No**	**Not specified**	**Total**
Central				
>50 years	2			2
25-50 years	1			1
10-25 years	3	1		4
State				
>50 years	5			5
25-50 years	3	2		5
10-25 years		2		2
Private Deemed				
25-50 years	2			2
10-25 years	5			5
<10 years	2			2
INI				
>50 years	15	1		16
25-50 years	2	1		3
10-25 years	7	5	1	13
<10 years	2	2		4
RI				
>50 years	3			3
25-50 years	3			3
10-25 years		1		1
Total	**55**	**15**	**1**	**71**

Only in few INI system, older the institution and earlier the IP policy implemented it showed positive correlation with high collaboration with innovation output. The same observation is not seen in other types of HEIs (State, Central, Private Deemed and RIs) Though network of inidan higher education institutions have many older state, central, private universities and RIs, they do not have mission and objective focused on research for monetary exploitation. From this, we can say that old institute with early adoption of HEI IP policy when synerzised with consistent funding and intellectual capital showed better innovation performance in Indian HEI innovation system.

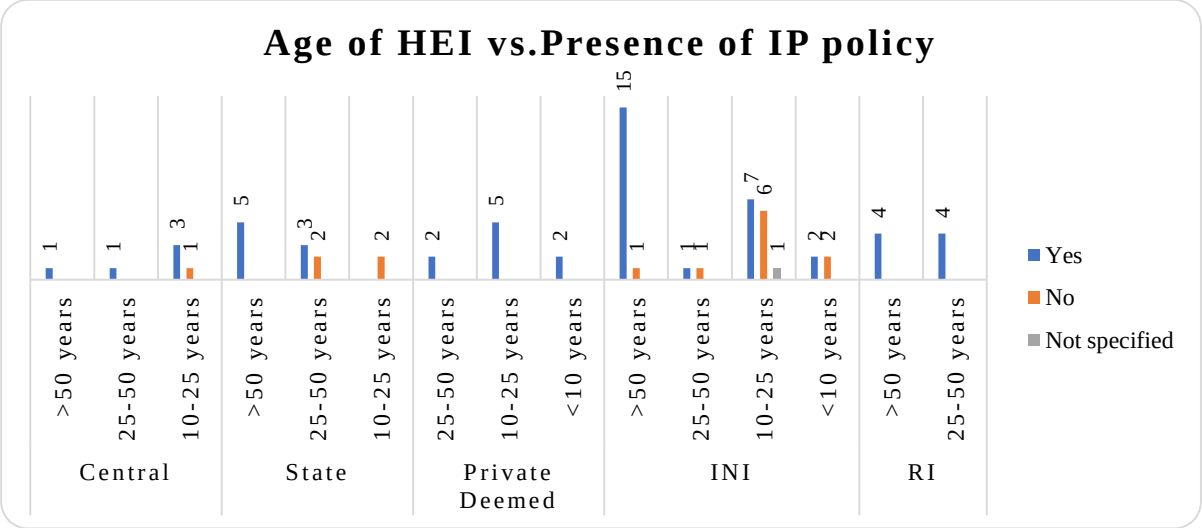

Figure 8 Age of HEI Vs. Presence of IP policy

Is your IP cell funded by a government agency or self-financed?
(1) Government funded (2) Self-financed (3) Others, Please specify

5 of 7 Central universities have self-sustaining IP cell —1 has government-funded and 1 did not specify.

5 of 12 State universities have self-sustaining IP cells and 4 are government-funded.

7 of 9 Private Deemed universities have self-sustaining IP cells and 2 are government-funded.

16 of 36 INI have government-funded IP cell—1 partially funded, 6 self-sustaining, 5 do not have IP cell and 5 did not specify— regarding the source of funding for IP cell.

All 7 RIs have government funding as a source of IP cells.

Overall, 30 of 71 HEIs have government funded and 23 have self-sustaining IP cells.

Table 5 HEI type and source of funding for IP cell

Source of funding for IP cell						
HEI type	**Government funded**	**Partially Govt. funded**	**Self-sustaining**	**No IP cell**	**Not specified**	**Total**
Central	1		5		1	7
State	4		5	2	1	12
Private Deemed	2		7			9
INI	16	1	6	8	5	36
RI	7					7
Total	**30**	**1**	**23**	**10**	**7**	**71**

Not all public universities have IP cells funded by government. Few Central and State universities have IP cells and chairs established by the government under different IP promotion schemes, but majority of them are self sustaining.

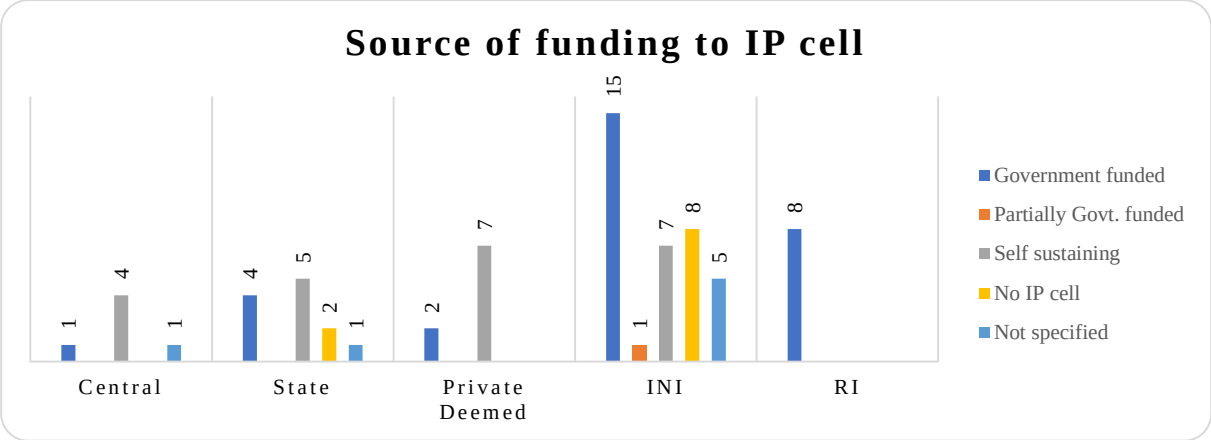

Figure 9 HEIs and Source of funding to IP cell

Mention the year in which the IP policy, if any, was first implemented in your institution? ……..

Central universities' IP policy was implemented during 2014-2018. State universities IP polcies are implemted during 2004 to 2018. Both of their IP cells and policies are newly established;whereas, HEIs in INI system have IP policies implemented from 1994 to 2020. Some newly established NITs and IITs do not have cells and policies yet. Private Deemed universities' IP policies are implemented between 2011-2020. RIs have IP cells at their institution and are centrally administrated by respective counsil or ministry.

Are you aware of National IPR policy of the Government of India?

(1) Yes (2) No
If Yes, please respond to following questions.

Is your HEI IPR policy reflects objectives stated in national IPR policy?

(1) Yes (2) No (3) Not sure/Not aware

If No, Do you plan to align your institutional policy with National IPR policy?

(1) Yes (2) No

Have you set a time frame for aligning your policy?

(1) Yes (2) No

Most of the respondents specified that they are aware of National IP policy, its objectives; and mentioned their implemented policy is inline with the objectives. 28 of 71 HEIs did not like to specify whether they are aware and their policy is inline with the national policy.

Does your institution revise/review IP Policy?

(1) Yes (2) No (3) Not applicable

If yes, please specify how frequently the IP policy is revised?

(1) Annually (2) Every 2 years (3) On need basis (4) Not applicable

If yes, please mention the year in which it was last revised ……

If your institution does not revise IP policy, can you please state the reason(s) for not revising the IP policy?

Implemented IP polcies of HEIs are new which are mostly in the last 5-10 years. 24 of 71 HEIs specified that they review/revision of policy on need basis. Those who implemented 5 years back did not require to review/revise the policy since they do it on need basis.

Can you please state, who were involved in the development of the IP policy of your Institution?

(1) In-house experts (2) External agency/experts (3) Both In-house experts and external agency (4) Others If others, Please specify ……..

15 of 71 HEIs specified that their IP policy was developed by both in-house and external agency. Older INIs IP policy was developed by their in-house experts.

Is the IP policy of your institution available on your institution website?

(1) Yes (2) No (3) Not applicable

If it is not available on institution website, can you please state the reasons for not making your institution IP policy available on website?

32 of 71 HEIs' IP policy is available on their website whereas, 16 specified that they do not make it available on their website. Reasons mentioned by respondents for not making it available are given below:

" IPR policy is confidential/non disclosure document; so we did not make it available online"

"It is internal document for our usage"

"Under process of making it online."

What is the approximate annual budget allocated for IP cell of your institute?

(1) Less than 5 lakhs (2) 5 – 10 Lakhs (3) Above 10 L but less than 15 lakhs (4) 15 – 25 lakhs (5) Above 25 lakhs

Table 6 HEI type and approximate budget to IP cell

Approximate annual budget to IP cell									
HEI type	**>25 lacs**	**15-25 lacs**	**10-15 lacs**	**5-10 lacs**	**< 5 lacs**	**Don't know/ Not aware**	**No specific budget**	**Not specified**	**Total**
Central			1	1	3		1	1	7
State			1	1	3	2		5	12
Private Deemed	1		2	2	3			1	9
INI	4	3	2	4	6		8	9	36
RI	2						1	4	7
Total	**7**	**3**	**6**	**8**	**15**	**2**	**10**	**20**	**71**

7 Central universities responded—4 have and 1 does not have, and 2 did not specify— regarding their IP policy committee establishment to review IP policy and take decisions on IP-related matters.

12 State universities responded—9 have and 2 did not specify— about IP policy committee establishment.

9 Private Deemed universities responded—8 have and 1 not aware—regarding committee establishment.

Among 36 INI responded—23 have, 8 do not have and 5 did not specify— regarding committee establishment.

Overall, 47 of 71 HEIs specified that they have committee for IP policy and its review; whereas, 9 do not have and 14 did not specify.

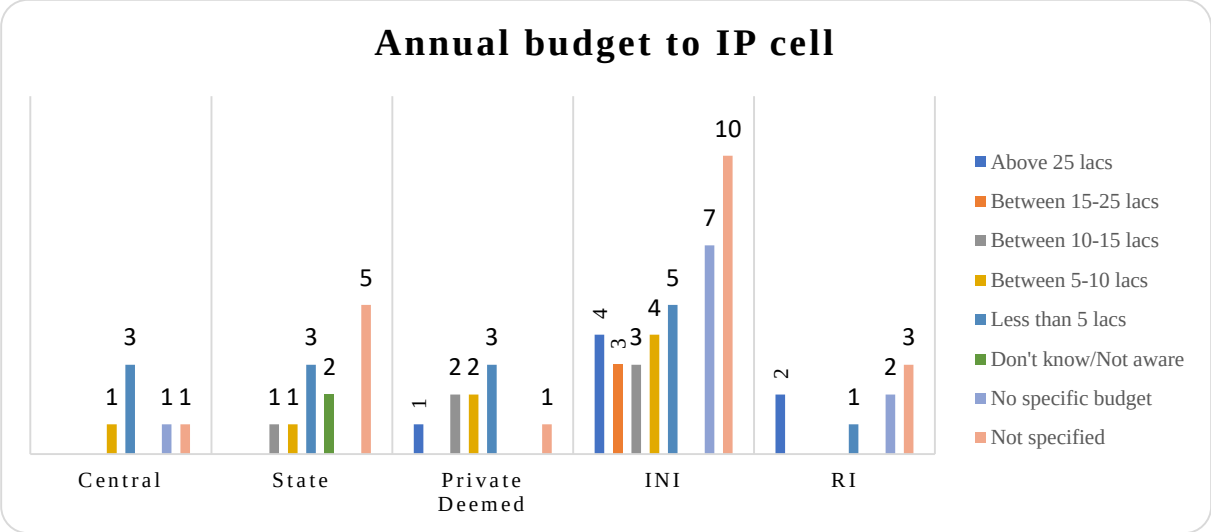

Figure 10 HEI type and approximate annual budget to IP cell

Do you have a committee for implementation/revision of IP policy?
(1) Yes (2) No (3) Not applicable If yes,

Can you please specify the total number of committee members? .....

Can you please specify the composition, experience and qualification of committee members?

How frequently does the committee meet?
(1) Once in a week (2) Once in 15 days (3) Once in a month (4) Once in two months (5) As and when required (6) Not applicable

Do you periodically update data regarding intellectual property generated by your institution on your institution website?
(1) Yes (2) No

If yes, how frequently do you update data on your website?
(1) Every week (2) Once in two weeks (3) Once in a month (4) Quarterly (5) As and when required (6) Not applicable

Among 7 Central universities responded, 4 have IP policy committee established to review IP policy and take decisions on IP related matters; whereas, 1 does not have such establishment. 2 HEIs did not specify. Among 12 State universities responded, 9 have IP policy committees established to review IP policy and take decisions on IP-related matters. 2 HEIs did not specify. Among 9 Private Deemed universities responded, 8 have IP policy committee established to review IP policy and take decisions on IP-related matters; 1 not aware of such things at their HEI.

Among 36 INI respondents, 23 have IP policy committees established to review IP policy and take decisions on IP-related matters; whereas 8 do not have such arrangements; 5 did not specify.

Overall, 47 of 71 HEIs responded in the survey have and 9 of 71 do not have committee for implementation and its periodical review of IP policy. Whereas, 14 did not specify regarding presence of such committee establishments.

Committee meetings in most of the HEIs happen only on need basis. Some of the Central, State, Private Deemed and newly established INIs do not have formal IP policy implemented yet, but committee established to formulate and implement and IP policy and to address related related issues. Though formal IP policy is in place for management and protection of institutional IP specifying clear ownership and revenue sharing statements in the policy which states IP belongs to the institute in general, few NITs (VNIT Nagpur) do not strictly abide to the policy specifications to reduce the cost of filing which is lesser for natural person than larger entity. It is not clear whether they have informal practice of assigning back to HEI during employee transfer or resignation. Using this strategy, though they file more number of IP, it may lead to disputes in various circumstances. In all those HEIs with committee established for IP policy implementation, constituted with minimum of 5 members; whereas, qualification and committee members affiliation (internal/external members) varies among different type of HEIs.

HEIs specified that they update the IP related information on need basis and quarterly but in reality HEI website do not have information of their IP and the updated IP filings and granted information are incomplete and not matching with those numbers mentioned in their annual reports.

Table 7 HEI type and presence of IP policy committee

Presence of IP policy committee					
HEI Type	**Yes**	**No**	**Don't know**	**Not specified**	**Total**
Central	4	1		2	7
State	9			3	12
Private Deemed	8		1		9
INI	23	8		5	36
RI	3			4	7
Total	**47**	**9**	**1**	**14**	**71**

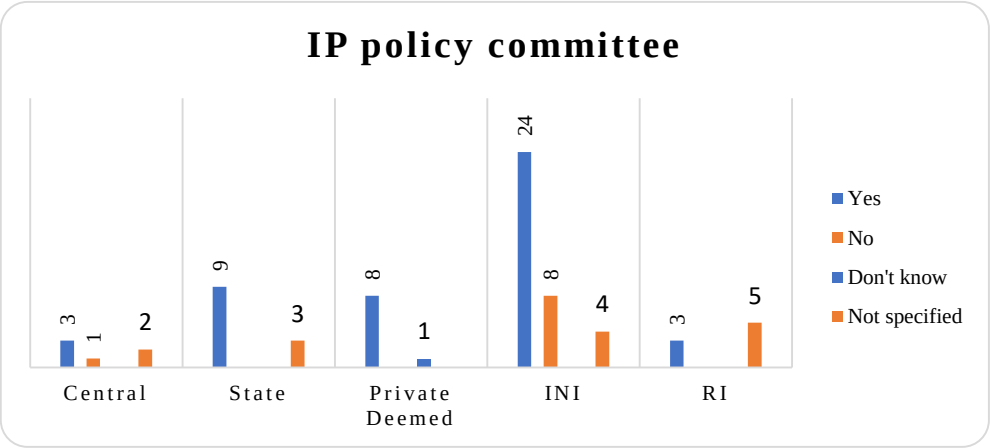

Figure 11 Presence of IP policy Committee

The applicability of IP policy is for which of the following stakeholders of the institution?

(1) Faculty members (2) Research Scholars (3) Students (4) Staff members (5) Not applicable (6) Any other, Please specify……

All implemented IP policies of HEIs are applicable to all faculty members, research scholars, students and staff members.

Does your institution have practice of screening the inventions and R&D results (innovative techniques, processes and products) for potential patenting, before publishing them in high quality journals?
(1) Yes (2) No (3) Sometimes (4) Not aware

If yes, who takes the responsibility of screening the R&D results for identification of potential patenting inventions?
(1) Researcher (2) Principal investigator of the project (3) IP professional (4) Other

25 of 71 HEIs specified that they do screening of R&D results for potential patenting before publishing. It is usually done by their principal investigator or by IP professional. 9 of 71 HEIs do not have practice of screening R&D results before publishing. 9 of 71 HEIs specified that they do it occasionally, usually done by researcher. Others did not specify whether they screen their R&D results before publishing.

Which among the following activities are carried out by the institution to promote awareness on IP and IP policy among faculty members, students and research scholars?
(1) Seminars and workshops conducted by in-house experts (2) Seminars and workshops conducted by outside experts (3) Awareness session on need basis (4) Designing it as part of academic curriculum

6 of 71 HEIs specified that they do all to promote awareness on IP and IP policy among their stakeholders. 5 of 71 conducts awareness sessions on need basis

Can you please specify approximate number of training programs on IP & innovation conducted by your institution annually, in last 5 years?
(1) Less than 10 (2) Between 11-20 (3) 21-30 (4) More than 30

In State, Central and Private Deemed universities, approximate number of training programs conducted in the last 5 years are less than 10. Maximum programs are conducted by INIs and RIs in the range of 11-20 in the span of last 5 years.

Does your institution/university have

Hub/Idea cafe or similar facility for innovators to submit innovative ideas?

Do you have pre-fabrication facilities established in your institution/university?

Does your institution provide incentives (both tangible and non-tangible) for submitting ideas for potential patenting?

Does your institution have provision for providing technical guidance to your faculty/research scholars/students for developing idea into practice/ proof of concept or a prototype?

If under process (Since when)

5 of 7 central universities have institutional establishments like idea hub/idea café to submit innovative ideas; 4 of 7 have prefabrication facilities to make prototypes and give technical guidance to develop ideas for potetnial patenting; 2 of 7 have incentives for submitting potential ideas.

23 of 36 INIs have idea hubs to submit innovative ideas; 21 of 36 have prefabrication facilities and provision of technical guidance for developing ideas for patenting; Wheras only 8 of 36 specified that they have incentives provided for potential ideas of patenting.

7 of 9 Private Deemed universities specified that they have idea hubs and provision of technical guidance for receiving ideas and for developing them for patenting respectively; but, among them only 5 have prefabrication facilities.

1 of 8 RIs have idea hub; none of them have prefabrication facilities and 2 of 8 specified that they have incentives for providing potential ideas for patenting.

Please specify, types of incentives, if any, provided to researchers/staff for submission of Intellectual Property generation
(1) Salary increment (2) Performance Incentives (3) Cadre promotion (4) Providing additional research facilities and support (5) Recognition with awards/certificates (6) Others, please specify ……

Central universities have more of performance incentive structures, INIs have different combinations of incentives structures given in the options. Among them, recognizing with awards and certificates and providing additional research facilities are commonly seen. Private Deemed universities and RIs have similar incentive structures; they are recognizing with awards and certificates and providing additional research facilities.

Please specify the subject domains under which ideas are submitted for potential patenting.
(1) Computer Sciences (2) Pharmaceutical sciences (3) Automobile engineering (4) Biomedical (5) Polymer science (6) Textiles (7) Metallurgy (8) Mechanical (9) Others, please specify ……

More potential patenting ideas are receiving from the domains of mechanical, automobile engineering, biomedical and computer sciences.

Do you have any litigation/infringement cases filed?
(1) Yes (2) No (3) Not applicable If yes, please specify the number and details

23.1 Number of infringements/litigations filed: ……

23.2 Details of it:-
……

HEIs' IPR cells are not having the data related to lapsed, withdrawn, invalidated and litigation patents.

5.2 Innovation linkages of HEIs

Does your IP policy specify details about Ownership of IP with industry/ collaborating institution?
(1) Yes (2) No (3) Not applicable

14.6 Cost/Cost sharing with partner institutions/organizations?
(1) Yes (2) No (3) Not applicable (4) Decided on case to case basis

14.7 Does your institution discusses with collaborating partner regarding Jurisdictions in which the IP would be filed? (National/International or any other)
(1) Yes (2) No (3) Both National and International (4) Only National (5) Only International (6) Any other

Please specify total number of patents filed and granted through collaborations.

14.81 Filed: …… 14.82 Granted: ……. Not applicable

How many patents or other forms of Intellectual Property have been abandoned/ discontinued in the last 10years?

All HEIs IP policy specify regarding ownership and cost sharing during collaborations. Jurisdictions in which IP would be filed is decided on need basis. Number of patents filed and granted in through collaborations are too little by all types of HEIs studied.

Please specify your HEI preferred channel for communicating/exhibiting and diffusing the knowledge and IP generated to technology seekers for commercialization/licensing.
(1) HEI website (2) Central government instituted platforms (3) Technology-exhibitions (4) Others, please specify

Most HEIs specified that they prefer to exhibit generated IP on HEI website, advertisements and technology exhibitions

Collaboration with industries improved research & innovation and further helped for IP generation of your institution.

Table 8 Type of HEI and their perception of impact of collaboration with industries on IP generation

Collaboration with industries improved research & innovation and further helped for IP generation							
HEI Type	**Strongly Disagree**	**Disagree**	**Strongly Agree**	**Agree**	**Not specified**	**Not sure/ Don't know**	**Total**
Central			3	1	2	1	7
State	2	1	3		5	1	12
Private Deemed			3	5	1		9
INI	1		12	6	14	3	36
RI			2		5		7
Total	**3**	**1**	**23**	**12**	**27**	**5**	**71**

Statement: Collaboration with industries improved research & innovation and further helped for IP generation

Among 7 central universities responded, 3 strongly agreed and 1 agreed with the statement. Others did not specify or not sure about whether collaborations are improving their research and innovation and helping for IP generation.

Among 12 state universities responded, 3 strongly agreed; 2 strongly disagreed and 1 disagreed with the statement. Others did not specify or not sure about it.

Among 9 private deemed universities responded, 3 strongly agreed and 5 agreed with the statement.

Among 36 INI responded, 12 strongly agreed, 6 agreed, 17 were not specified/not sure about it.

Among 7 RIs, 2 strongly agreed and 5 did not specify about it.

Altogether 32 out of 71 HEIs did not specify/not sure whether collaboration with industries improved their research and innovation and further helped for IP generation. 23 out of 71 HEIs strongly agreed, 12 out of 71 agreed and 1 disagreed with the statement.

Among all HEIs, INI are more who strongly agreed that their collaborations are helpful for IP generation; however, within the INI system, the same perception is not seen. Only in few INIs collaborated, industries are helpful in their research activities and IP generation.

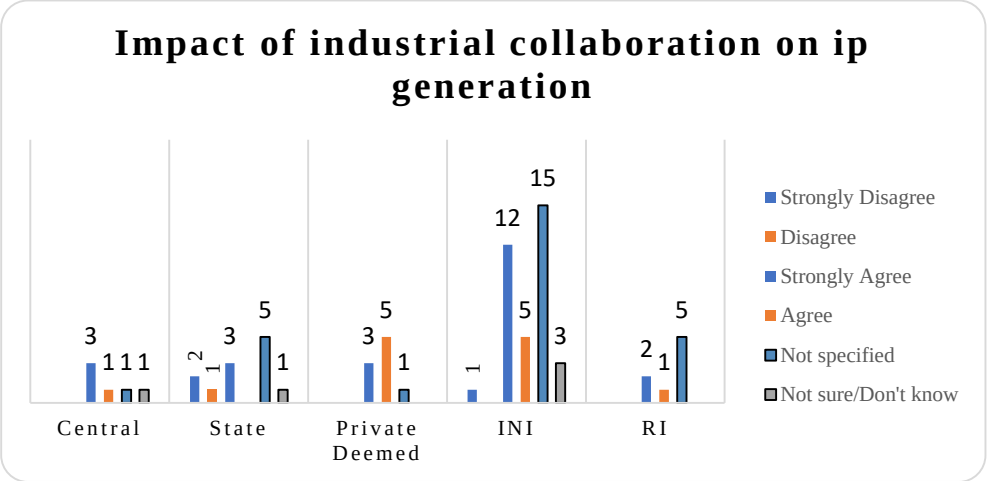

Figure 12 Collaboration with industries and IP generation

Collaboration with Government incubation centers helped research & innovation and further helped in IP generation.

Table 9 Type of HEI and their perception on impact of collaboration with government incubation centres towards IP generation

Collaboration with government incubation centres helped research & innovation and further helped for IP generation						
Type of HEI	**Strongly Disagree**	**Strongly Agree**	**Agree**	**Not specified**	**Not sure/ Don't know**	**Total**
Central		1	3	2	1	7
State	1	3	1	5	2	12
Private Deemed	1	3	3	1	1	9
INI	1	10	7	15	3	36
RI		1	1	5		7
Total	**3**	**18**	**15**	**28**	**7**	**71**

Statement: Collaboration with government incubation centers helped research & innovation and further helped for IP generation

Among 7 Central universities responded, 1 strongly agreed and 1 agreed with the statement. Others did not specify or not sure about whether incubation centers are helpful for research and innovation and generating IP.

Among 12 State universities responded, 3 strongly agreed and 1 agreed. 1 strongly disagreed and none disagreed with the statement. Others did not specify or not sure about it.

Among 9 private deemed universities responded, 3 strongly agreed and 3 agreed; 1 strongly disagreed with the statement.

Among 36 INI responded, 10 strongly agreed and 7 agreed; Only 1 strongly disagreed. while 18 not specified/not sure about it.

Among 7 RIs, 1 strongly agreed and 1 agreed and 5 did not specify about it.

Altogether 28 out of 71 HEIs did not specify/not sure whether incubation centers are helpful for research and innovation and generating IP. 33 out of 71 HEIs responded positively (strongly agreed/agreed) with the statement.

Among all HEIs, INI are more who strongly agreed that their collaborations are helpful for IP generation; however, within the INI system, the same perception is not seen. Only in few INIs incubations with government support are helpful in research and innovation towards IP generation.

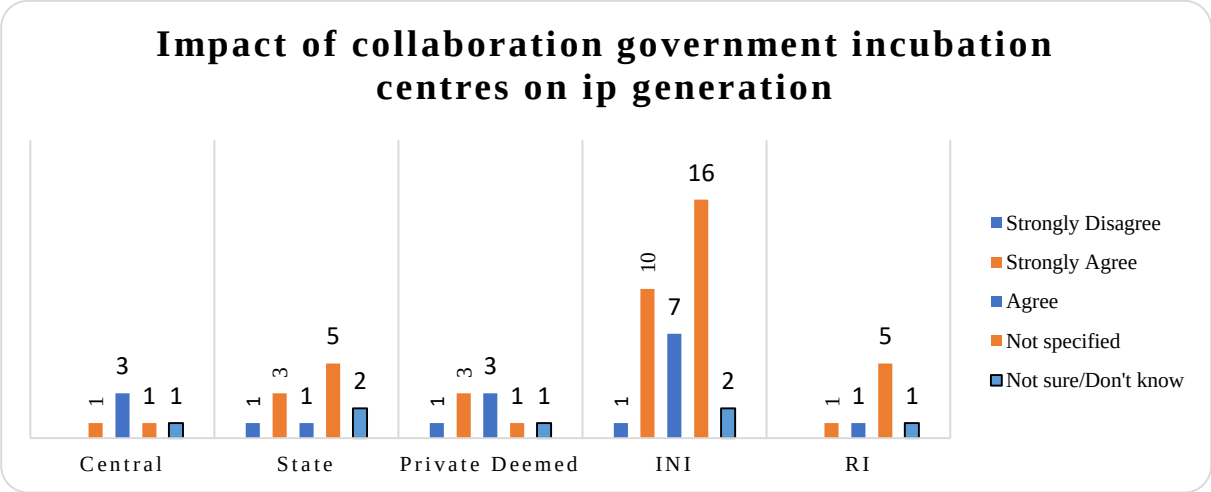

Figure 13 Collaboration with Government incubation centres and IP generation

R&D size of the collaborated company matters for successful research outcomes and IP generation.

Table 10 Type of HEI and their perception on R&D size of the collaborating industry towards IP generation

R&D size of the collaborated company matters for successful research outcomes and IP generation							
HEI Type	**Strongly Disagree**	**Disagree**	**Strongly Agree**	**Agree**	**Not specified**	**Not sure/ Don't know**	**Total**
Central		2		1	3	1	7
State	1	1	1	2	5	2	12
Private Deemed		1	3	2	1	2	9
INI	1	4	5	3	15	8	36
RI			1	1	5		7
Total	**2**	**8**	**10**	**9**	**29**	**13**	**71**

Statement: R&D size of the collaborated company matters for successful research outcomes and IP generation

Among 7 Central universities responded, none strongly agreed and 1 agreed with the statement. None strongly disagreed and 2 disagreed. Others (4) did not specify or not sure about whether R&D size of the collaborated company matters for successful IP generation.

Among 12 State universities responded, 1 strongly agreed and 2 agreed. 1 strongly disagreed and 1 disagreed with the statement. Others (7) did not specify or not sure about it.

Among 9 Private Deemed universities responded, 3 strongly agreed and 2 agreed; none strongly disagreed and 1 disagreed with the statement.

Among 36 INI responded, 5 strongly agreed and 3 agreed; Only 1 strongly disagreed and 4 disagreed. while 23 not specified/not sure about it.

Among 7 RIs, 1 strongly agreed and 1 agreed and 5 did not specify about it.

Altogether 42 out of 71 HEIs did not specify/not sure whether size of collaborated industry matters for research and innovation and generating IP. 19 out of 71 HEIs responded positively (strongly agreed/agreed) with the statement.

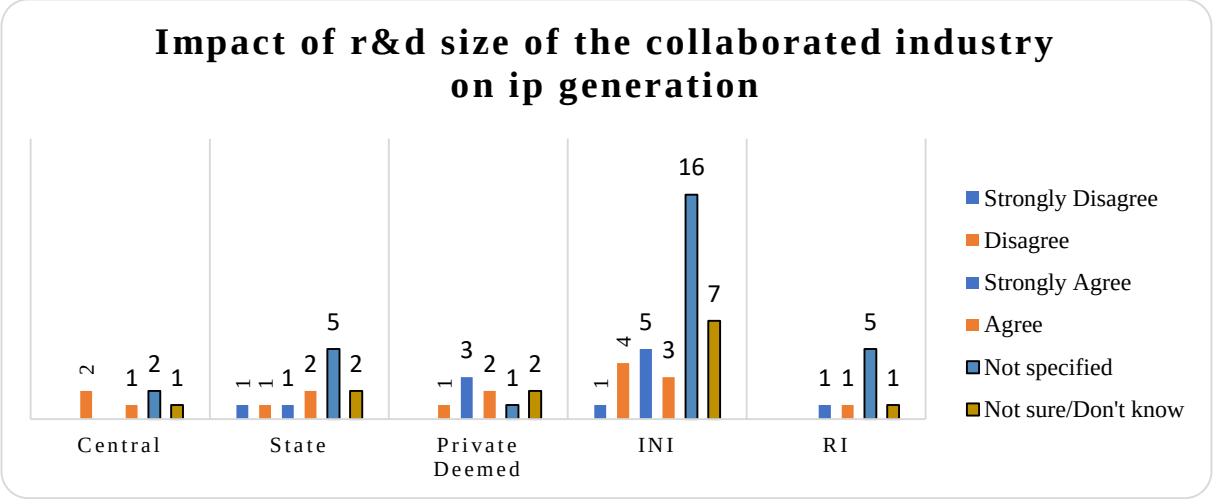

Figure 14 R&D size of the collaborated industry and IP generation

Collaborations with industries outside India are serving better for IP generation than collaborations within India.

Table 11 Type of HEI and their perception on industrial collaboration outside India towards IP generation

Collaborations with industries outside India are serving better for IP generation than collaboration							
HEI Type	**Strongly Disagree**	**Disagree**	**Strongly Agree**	**Agree**	**Not specified**	**Not sure/Don't know**	**Total**
Central		2		1	2	2	7
State		2	1	1	5	3	12
Private Deemed	1	2	2		1	3	9
INI	2	2	2		15	15	36
RI			1	1	5		7
Total	**3**	**8**	**6**	**3**	**28**	**23**	**71**

Statement: Collaborations with industries outside India are serving better for IP generation than collaboration

Among 7 Central universities responded, none strongly agreed and 1 agreed with the statement. None strongly disagreed and 2 disagreed. Others (4) did not specify or not sure about whether foreign collaborations are more helpful in generation of IP.

Among 12 State universities responded, 1 strongly agreed and 1 agreed. None strongly disagreed and 2 disagreed with the statement. Others (8) did not specify or not sure about it.

Among 9 Private Deemed universities responded, 2 strongly agreed and none agreed; 1 strongly disagreed and 2 disagreed with the statement. Others (4) did not specify or not sure about it.

Among 36 INI responded, 2 strongly agreed and none agreed; Only 2 strongly disagreed and 2 disagreed. while 30 not specified/not sure about it.

Among 7 RIs, 1 strongly agreed and 1 agreed and 5 did not specify about it.

Altogether 51 out of 71 HEIs did not specify/not sure whether foreign collaborations are more fruitful than within country collaboration pertaining to research and innovation and generating IP. 9 out of 71 HEIs responded positively (strongly agreed/agreed) with the statement.

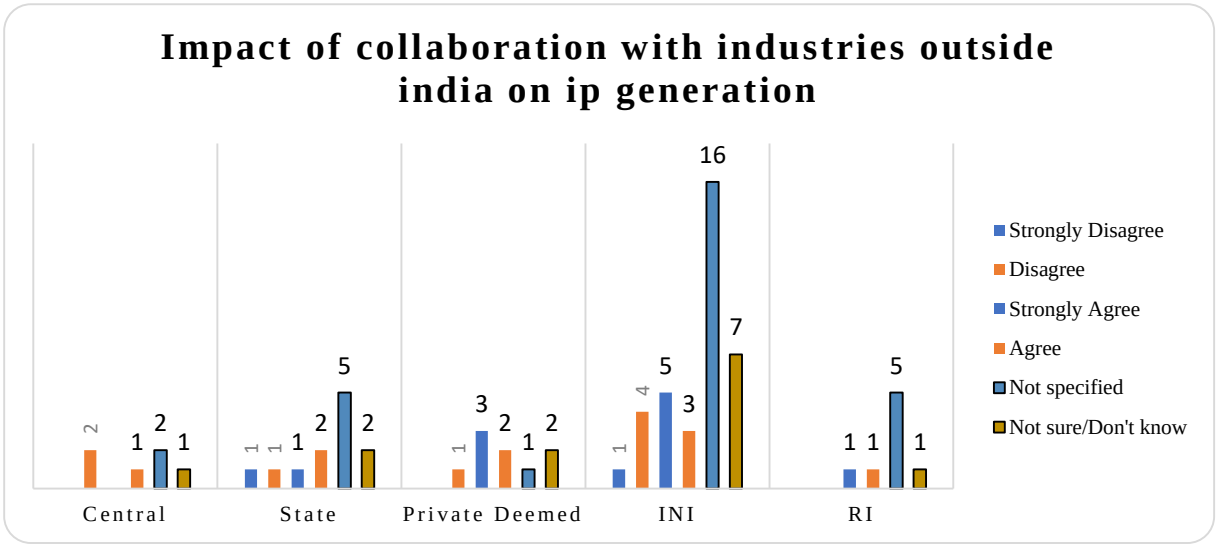

Figure 15 Type of HEI and their perception on industrial collaboration outside India towards IP generation

Does your HEI have research policy/mission/vision statements in IP policy to promote R&D activities of national priority to encourage innovation and IP generation in those thrust areas? (1) Yes (2) No

If your answer is Yes, please specify whether your HEI has mission oriented research initiations and capabilities in the below given thrust areas.
(1) Agriculture and pisciculture (2) Green technologies (3) Energy efficient equipments (4) Affordable drugs in neglected diseases/high incidence/life threatening (5) Food technology (6) Nano technology (7) New materials (8) Not applicable (9) Any other, specify

Excluding external sources like government sponsored projects and industrial consultancy projects, most of the HEIs do not have specific R&D budget allocated. In some INIs and Private Deemed universities, performance based intra-mural R&D fund allocated to teaching staff.

Please specify the approximate annual number of high quality research journal publications produced by your institution/university

Please specify approximate R&D budget of the institution/university per annum (excluding external sources) in the last 10 years.

Web of Science indexed research journals were taken as reference for high quality research publications. Annual number of journals published from 2010-2020 are given in the annexure 3

5.3 Barriers of IP generation, commercialization and technology transfer

Table 12 Type of HEI and their perception on lack of funding as a barrier of IP generation

Lack of Funding for the Research project						
HEI type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central	3	1	1		2	7
State	3		4		5	12
Private Deemed	5	2	1		1	9
INI	7	3	9	1	16	36
RI	2	1			4	7
Total	**20**	**7**	**15**	**1**	**28**	**71**

Among 7 Central universities responded, 3 perceived it as Major, 1 as a minor barrier; 1 specified it as not a barrier. 2 did not specify.

Among 12 State universities responded, 3 perceived it as Major, none as a minor barrier; 1 specified it as not a barrier. 5 did not specify.

Among 9 Private Deemed universities responded, 5 perceived it as Major, 2 as a minor barrier; 4 specified it as not a barrier. 1 did not specify.

Among 36 INI responded, 7 perceived it as Major, 3 as a minor barrier; 9 specified it as not a barrier. 17 did not specify or don’t know.

Among 7 RIs, 2 perceived it as Major, 1 as a minor barrier; none specified it as not a barrier. 4 did not specify.

Altogether 20 out of 71 HEIs specified it as a major barrier; 7 minor barrier and 15 not a barrier.

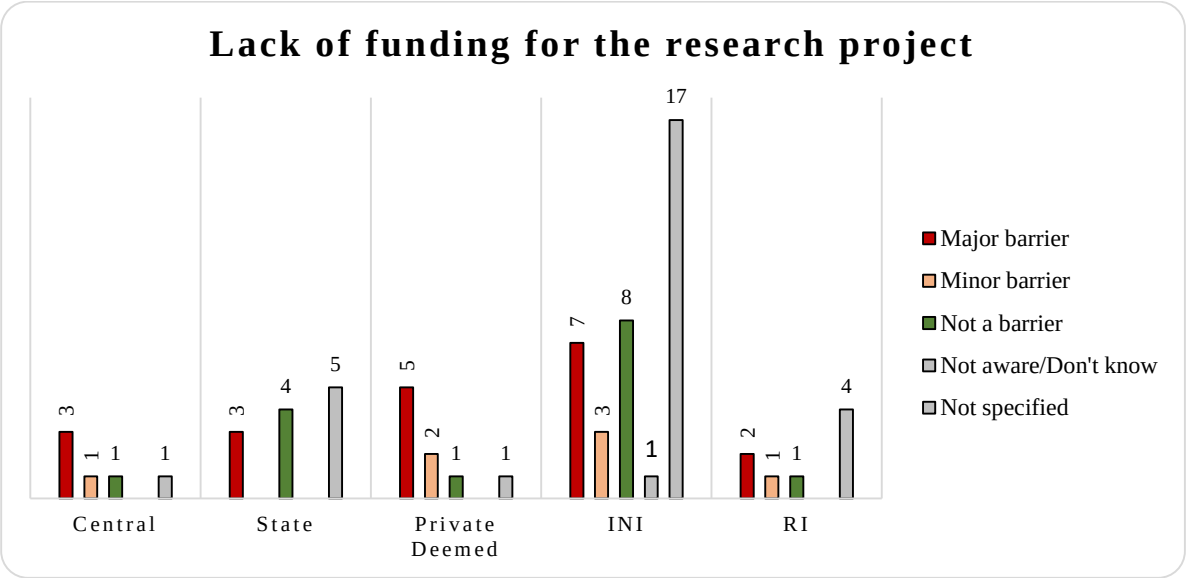

Figure 16 Barrier for IP generation: Lack of funding for the research project

Table 13 Type of HEI and their perception Delay of releasing fund for the research project as a barrier of IP generation

Delay of releasing fund for research project					
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not specified**	**Total**
Central	2		1	4	7
State	2	1	1	8	12
Private Deemed	5		1	3	9
INI	6	7	2	21	36
RI	2	1		4	7
Total	**17**	**9**	**5**	**40**	**71**

Among 7 Central universities responded, 2 perceived it as Major, none as a minor barrier; 1 specified it as not a barrier. 4 did not specify.

Among 12 State universities responded, 2 perceived it as Major, one as a minor barrier; 1 specified it as not a barrier. 8 did not specify.

Among 9 Private Deemed universities responded, 5 perceived it as Major, 1 as a minor barrier; none specified it as not a barrier. 3 did not specify.

Among 36 INI responded, 6 perceived it as Major, 7 as a minor barrier; 2 specified it as not a barrier. 21 did not specify or don’t know.

Among 7 RIs, 2 perceived it as Major, 1 as a minor barrier; none specified it as not a barrier. 4 did not specify.

Altogether 17 out of 71 HEIs specified it as a major barrier; 9 minor barriers and 5 not a barrier.

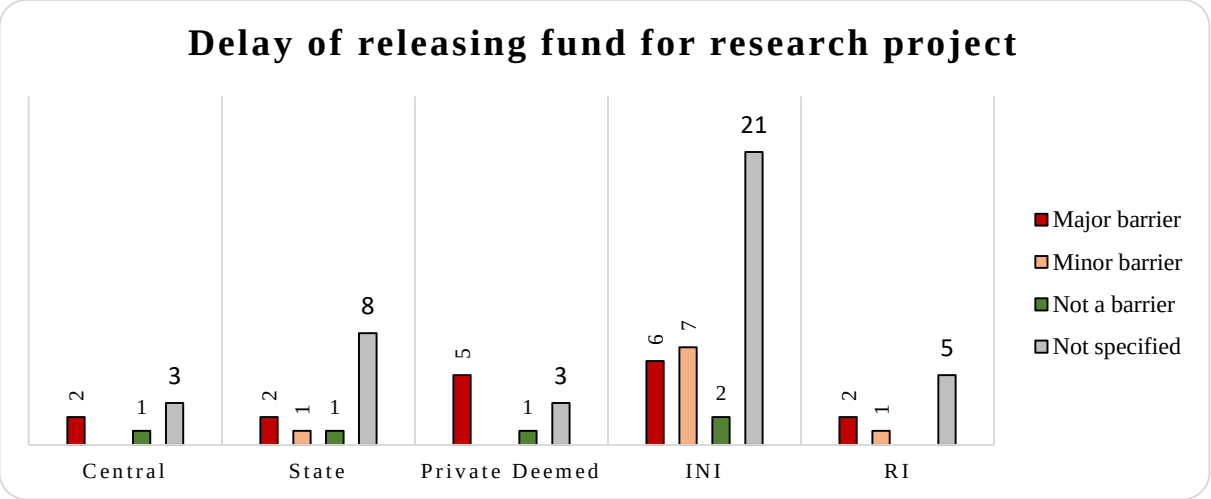

Figure 17 Barrier for IP generation: Delay of releasing fund for research project

Table 14 Type of HEI and their perception on Lack of innovation facilities as a barrier of IP generation

Lack of innovation facilities						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central	2	2	1		2	7
State	1	3	2	1	5	12
Private Deemed	5	2	1		1	9
INI	10	3	5	1	17	36
RI	3				4	7
Total	**21**	**10**	**9**	**2**	**29**	**71**

Among 7 Central universities responded, 2 perceived it as Major, 2 as a minor barrier; 1 specified it as not a barrier. 2 did not specify.

Among 12 State universities responded, 1 perceived it as Major, 3 as a minor barrier; 2 specified it as not a barrier. 6 did not specify or not aware.

Among 9 Private Deemed universities responded, 5 perceived it as Major, 1 as a minor barrier; none specified it as not a barrier. 3 did not specify.

Among 36 INI responded, 10 perceived it as Major, 3 as a minor barrier; 5 specified it as not a barrier. 18 did not specify or don't know.

Among 7 RIs, 3 perceived it as Major. 4 did not specify.

Altogether 21 out of 71 HEIs specified it as a major barrier; 10 minor barrier and 9 not a barrier.

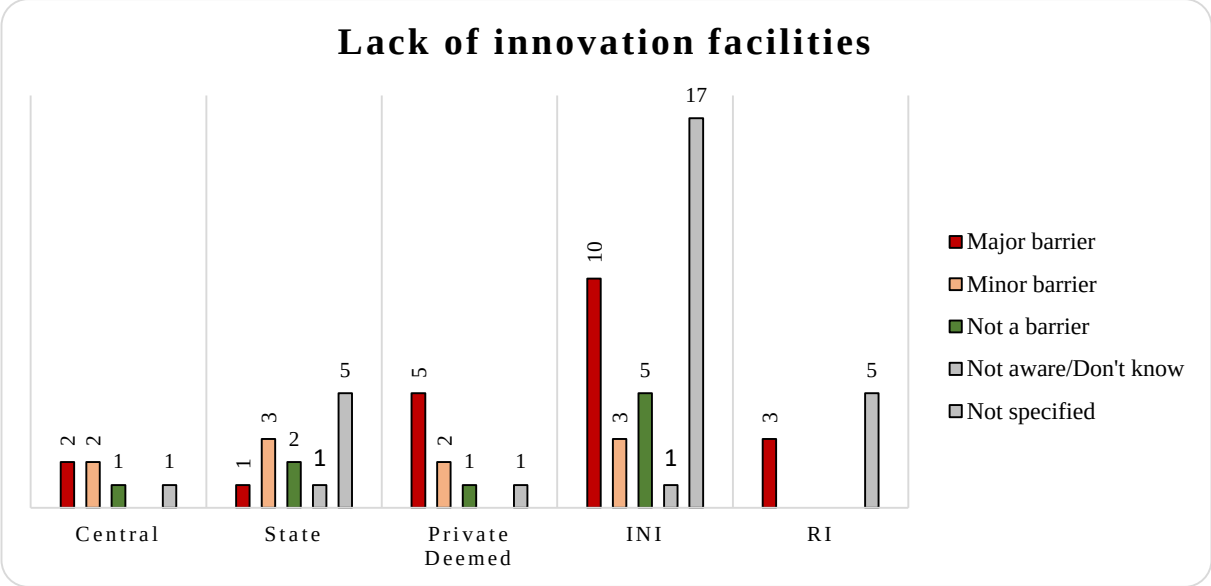

Figure 18 Barrier for IP generation: Lack of innovation facilities

Table 15 Type of HEI and their perception on Lack of technical guidance and support system as a barrier of IP generation

Lack of technical guidance and support system						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central	2	1	2		2	7
State	1	1	4	1	5	12
Private Deemed	5	2	1		1	9
INI	7	6	5	1	17	36
RI	2	1			4	7
Total	**17**	**11**	**12**	**2**	**29**	**71**

Among 7 Central universities responded, 2 perceived it as Major, 1 as a minor barrier; 2 specified it as not a barrier. 2 did not specify.

Among 12 State universities responded, 1 perceived it as Major, 1 as a minor barrier; 4 specified it as not a barrier. 6 did not specify or not aware.

Among 9 Private Deemed universities responded, 5 perceived it as Major, 2 as a minor barrier; 1 specified it as not a barrier. 1 did not specify.

Among 36 INI responded, 7 perceived it as Major, 6 as a minor barrier; 5 specified it as not a barrier. 18 did not specify or don't know.

Among 7 RIs, 2 perceived it as Major and 1 as minor barrier; 4 did not specify.

Altogether 17 out of 71 HEIs specified it as major barrier; 11 minor barrier and 12 not a barrier.

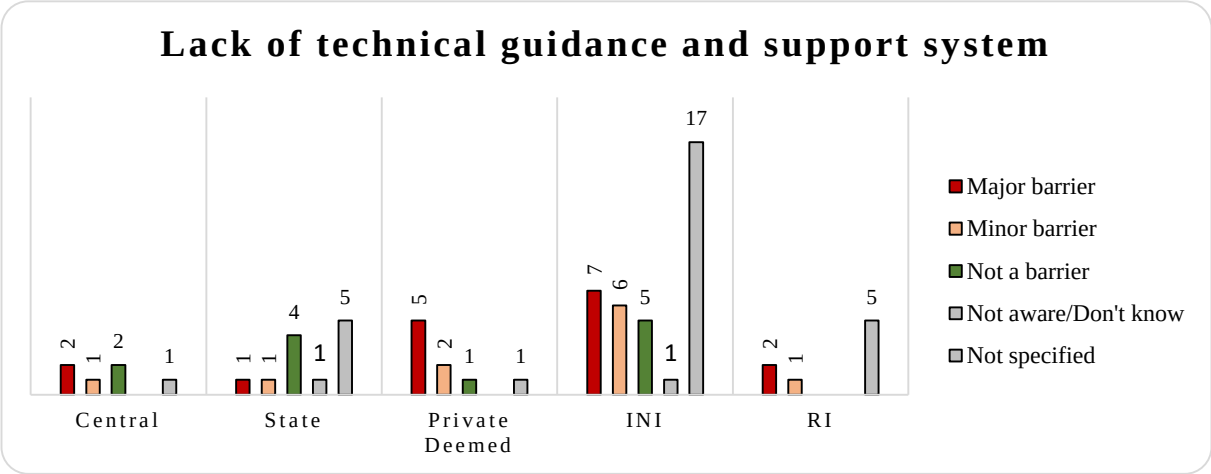

Figure 19 Barrier for IP generation: Lack of technical guidance and support system

Table 16 Type of HEI and their perception on Lack of IP awareness among staff & researchers as a barrier of IP generation

Lack of IP awareness among staff & researchers						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central	2	1	2		2	7
State	2	4	1		5	12
Private Deemed	3	5			1	9
INI	6	8	5	1	16	36
RI	1	2			4	7
Total	**14**	**20**	**8**	**1**	**28**	**71**

Among 7 Central universities responded, 2 perceived it as Major, 1 as minor barrier; 2 specified it as not a barrier. 2 did not specify.

Among 12 State universities responded, 2 perceived it as Major, 4 as a minor barrier; 1 specified it as not a barrier. 5 did not specify.

Among 9 Private Deemed universities responded, 3 perceived it as Major, 5 as a minor barrier; none specified it as not a barrier. 1 did not specify.

Among 36 INI respondents, 6 perceived it as Major, 8 as a minor barrier; 5 specified it as not a barrier. 17 did not specify or don't know.

Among 7 RIs, 1 perceived it as Major and 2 as a minor barrier; 4 did not specify.

Altogether 14 out of 71 HEIs specified it as a major barrier; 20 minor barriers and 8 not a barrier.

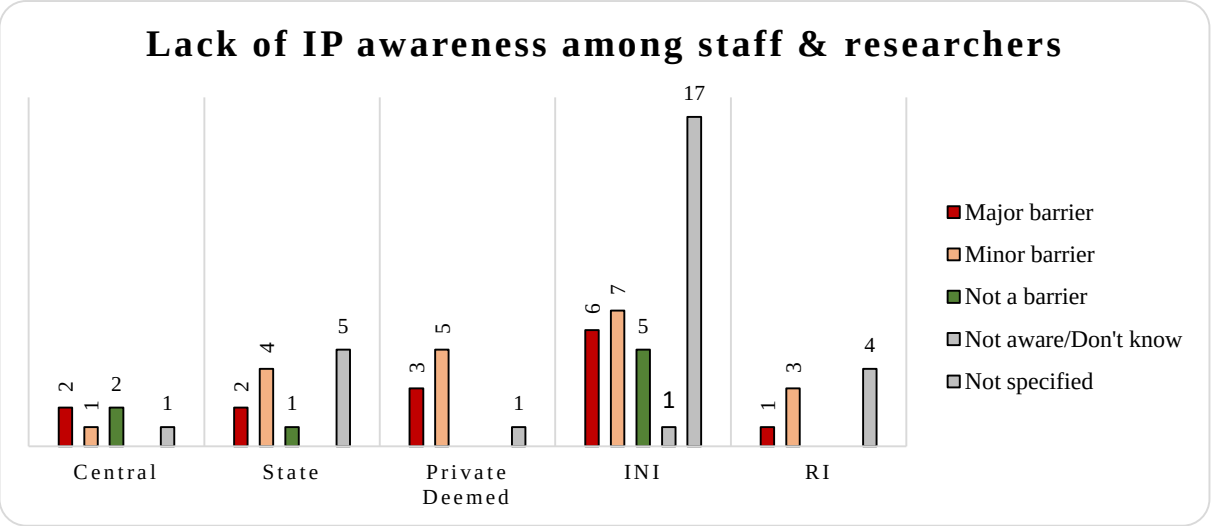

Figure 20 Barrier for IP generation: Lack of IP awareness among staff & researchers

Table 17 Type of HEI and their perception on Lack of financial support to researchers towards IP filing as a barrier of IP generation

Lack of financial support to researchers towards IP filing					
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not specified**	**Total**
Central		1	1	5	7
State	2		2	8	12
Private Deemed	4		2	3	9
INI	7	5	4	20	36
RI	2		1	4	7
Total	**15**	**6**	**10**	**40**	**71**

Among 7 Central universities responded, none perceived it as Major, 1 as a minor barrier; 1 specified it as not a barrier. 5 did not specify.

Among 12 State universities responded, 2 perceived it as Major, none as a minor barrier; 2 specified it as not a barrier. 8 did not specify.

Among 9 Private Deemed universities responded, 4 perceived it as Major, none as a minor barrier; 2 specified it as not a barrier. 3 did not specify.

Among 36 INI responded, 7 perceived it as Major, 5 as a minor barrier; 4 specified it as not a barrier. 20 did not specify.

Among 7 RIs, 2 perceived it as Major, none as a minor barrier, and 1 as not a barrier; 4 did not specify.

Altogether 15 out of 71 HEIs specified it as a major barrier; 6 minor barrier and 10 not a barrier.

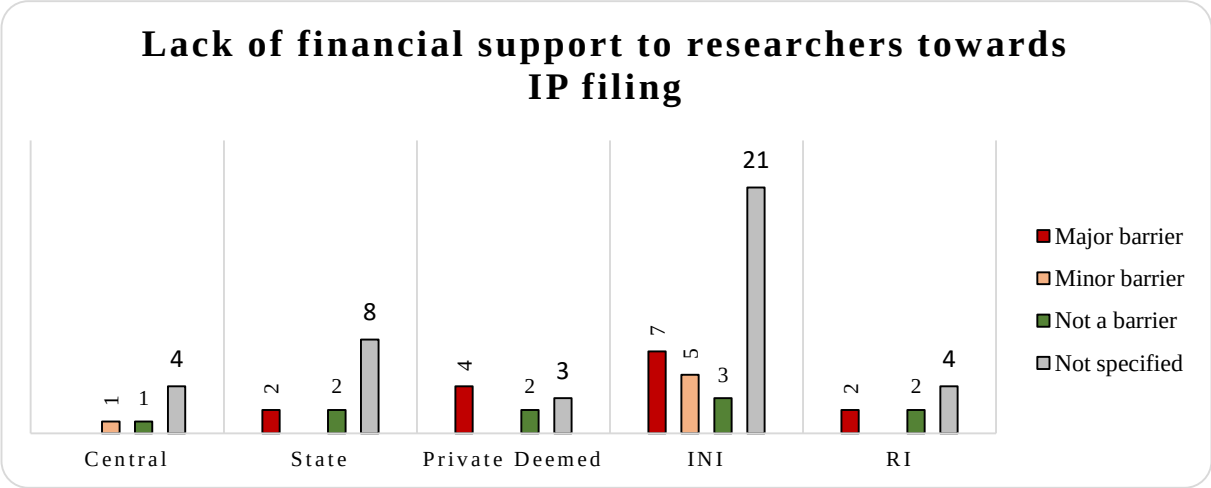

Figure 21 Barrier for IP generation: Lack of financial support to researchers towards IP filing

Lack of sufficient skilled IP professional						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Grand Total**
Central	3		2		1	6
State	3		4		5	12
Private Deemed	1	5	2		1	9
INI	7	7	4	1	17	36
RI		3			5	8
Grand Total	**14**	**15**	**12**	**1**	**29**	**71**

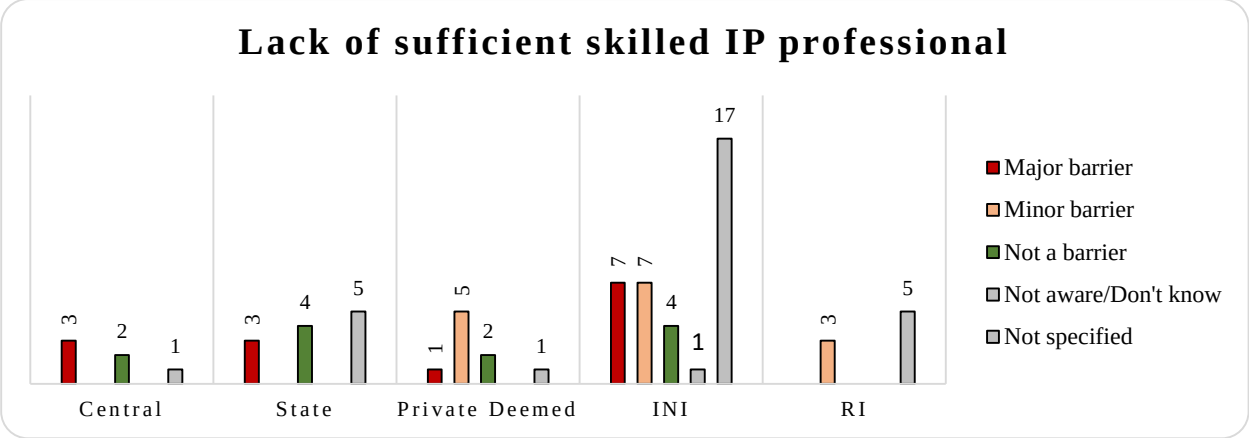

Figure 22 Barrier for IP generation: Lack of sufficient skilled IP professional

Lack full time working staff in University IP cell					
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not specified**	**Grand Total**
Central	2	1		3	6
State	2	1	1	8	12
Private Deemed	2	3	1	3	9
INI	4	6	5	21	36
RI		3		5	8
Grand Total	**10**	**14**	**7**	**40**	**71**

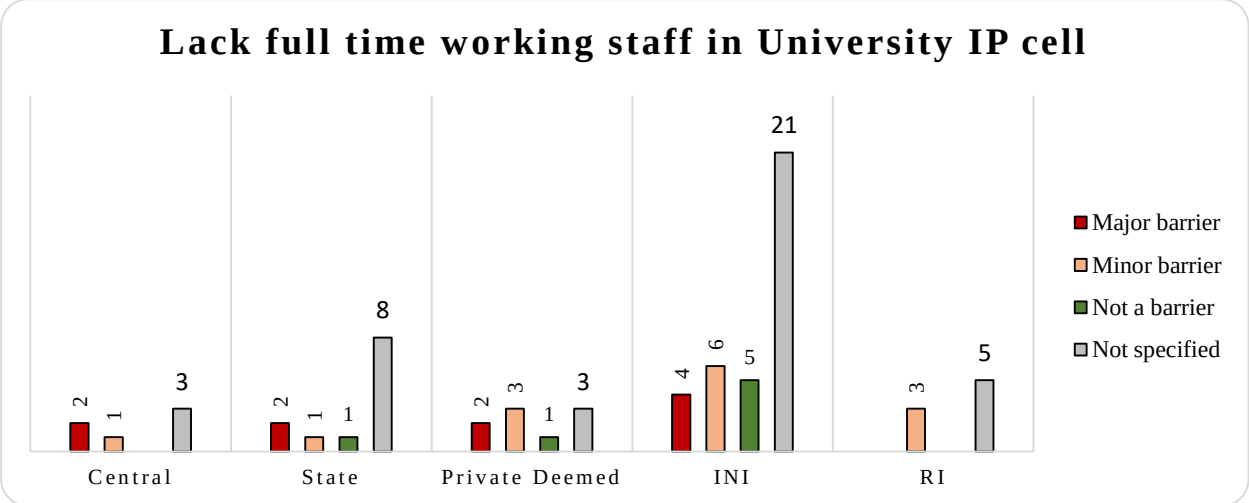

Figure 23 Barrier for IP generation: Lack full time working staff in University IP cell

Lack of researchers focusing on research projects in current research areas						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Grand Total**
Central		1	3	1	1	6
State	1	3	3		5	12
Private Deemed	3	3	1	1	1	9
INI	5	5	6	3	17	36
RI	2	1			5	8
Grand Total	**11**	**13**	**13**	**5**	**29**	**71**

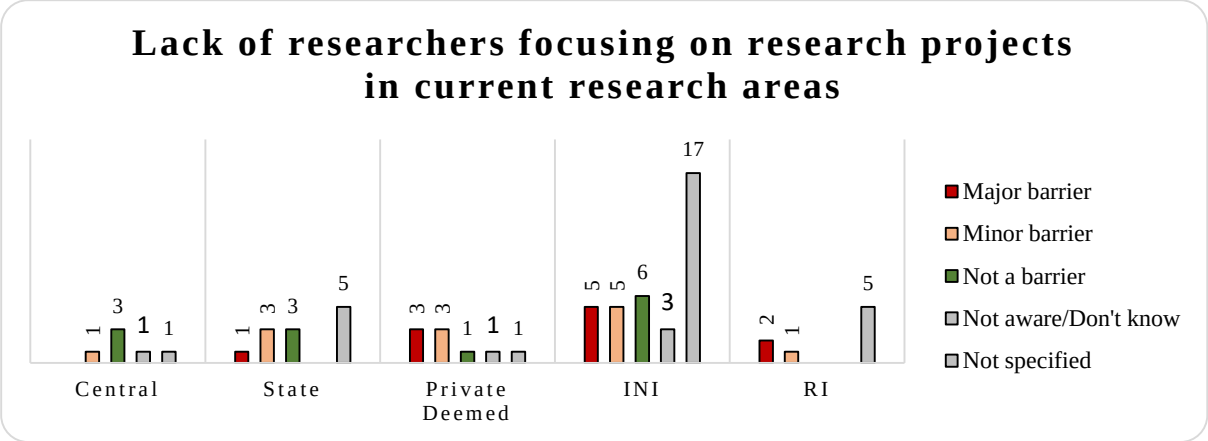

Figure 24 Barrier for IP generation: Lack of researchers focusing on research projects in current research areas

Lack of financial support for managing intellectual property after registration/grant						
HEI Type	Major barrier	Minor barrier	Not a barrier	Not aware/Don't know	Not specified	Grand Total
Central	1		2	1	2	6
State	1	2	4		5	12
Private Deemed	3	1	2	1	2	9
INI	8	4	5	3	16	36
RI	1	1	1		5	8
Grand Total	**14**	**8**	**14**	**5**	**30**	**71**

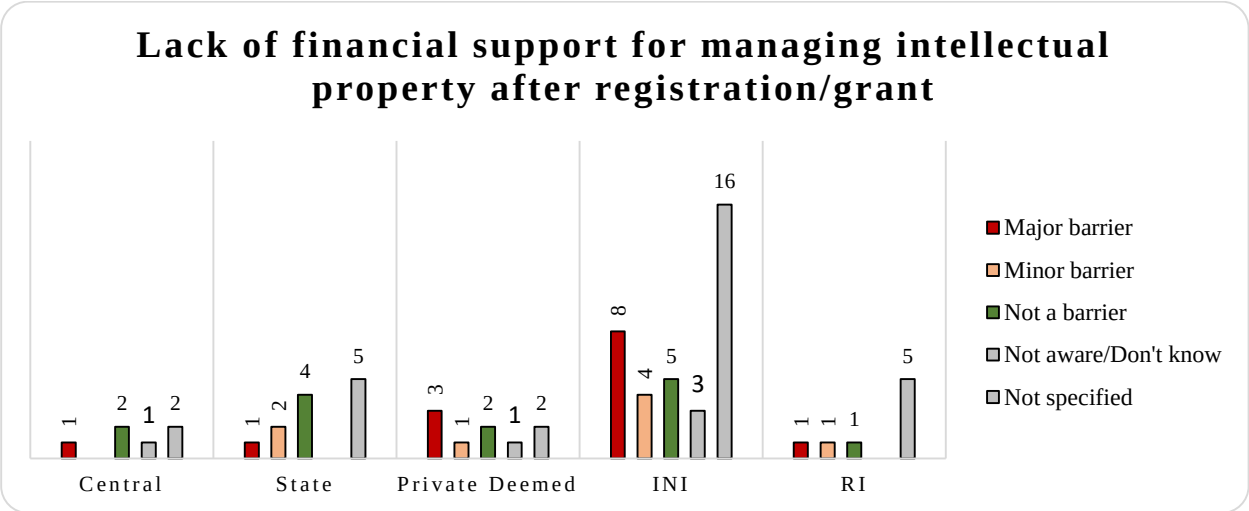

Figure 25 Barriers of IP commercialization and technology transfer: Lack of financial support for managing intellectual property after registration/grant

Table 18 Type of HEI and their perception on Lack of facilities for incubation/commercialization activity filing as a Barriers of IP commercialization and technology transfer

Lack of facilities for incubation/commercialization activity						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central	1		2	1	3	7
State	2	3	1	1	5	12
Private Deemed	4		2	1	2	9
INI	9	4	4	3	16	36
RI	2	1			4	7
Total	**18**	**8**	**9**	**6**	**30**	**71**

Among 7 Central universities responded, 1 perceived it as Major, none as a minor barrier; 2 specified it as not a barrier. 4 did not specify/not aware.

Among 12 State universities responded, 2 perceived it as Major, 3 as a minor barrier; 1 specified it as not a barrier. 6 did not specify/not aware.

Among 9 Private Deemed universities responded, 4 perceived it as Major, none as a minor barrier; 2 specified it as not a barrier. 3 did not specify/not aware.

Among 36 INI responded, 9 perceived it as Major, 4 as a minor barrier; 4 specified it as not a barrier. 19 did not specify/not aware.

Among 7 RIs, 2 perceived it as Major, 1 as a minor barrier and none as not a barrier; 4 did not specify.

Altogether 18 out of 71 HEIs specified it as a major barrier; 8 minor barriers and 9 not a barrier.

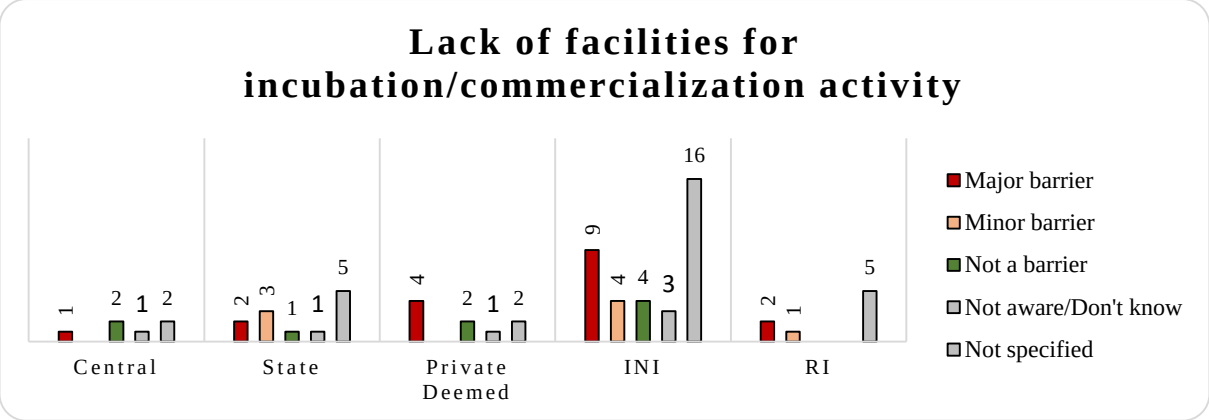

Figure 26 Barriers of IP commercialization and technology transfer:Lack of facilities for incubation/commercialization activity

Table 19 Type of HEI and their perception on Lack of entrepreneurial guidance/training for commercialization activity as a Barriers of IP commercialization and technology transfer

Lack of entrepreneurial guidance/training for commercialization activity					
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not specified**	**Total**
Central	1	1		5	7
State	1	2	1	8	12
Private Deemed	3	1	1	4	9
INI	8	5	4	19	36
RI	2	1		4	7
Total	**15**	**10**	**6**	**40**	**71**

Among 7 Central universities responded, 1 perceived it as Major, 1 as a minor barrier; none specified it as not a barrier. 5 did not specify.

Among 12 State universities responded, 1 perceived it as Major, 2 as a minor barrier; 1 specified it as not a barrier. 8 did not specify/not aware.

Among 9 Private Deemed universities responded, 3 perceived it as Major, 1 as a minor barrier; 1 specified it as not a barrier. 4 did not specify/not aware.

Among 36 INI responded, 8 perceived it as Major, 5 as a minor barrier; 4 specified it as not a barrier. 19 did not specify/not aware.

Among 7 RIs, 2 perceived it as Major, 1 as a minor barrier and none as not a barrier; 4 did not specify.

Altogether 15 out of 71 HEIs specified it as a major barrier; 10 minor barriers and 6 not a barrier.

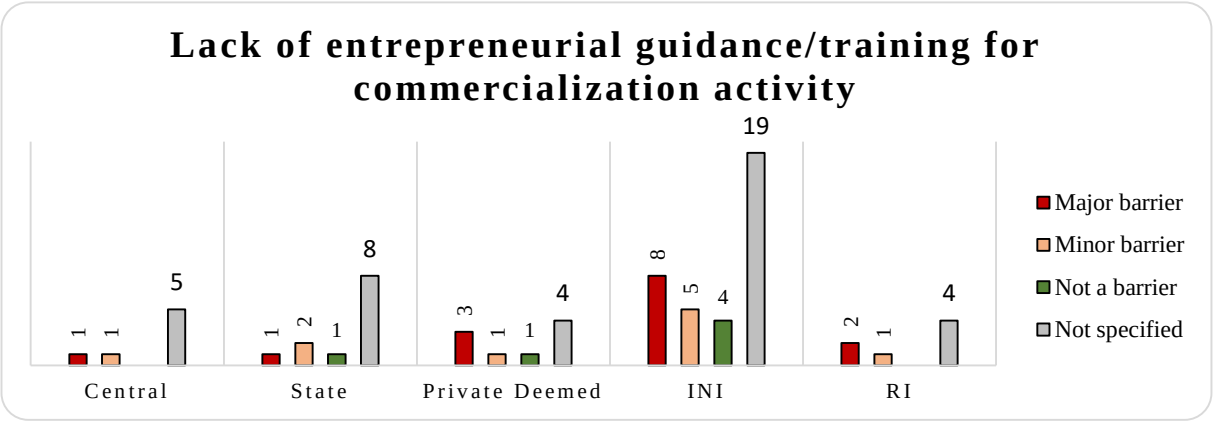

Figure 27 Barriers of IP commercialization and technology transfer: Lack of entrepreneurial guidance/training for commercialization activity

Table 20 Type of HEI and their perception on Low commercial value of innovation as a Barriers of IP commercialization and technology transfer

Low commercial value of innovation						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central		2	1	1	3	7
State	3	3		1	5	12
Private Deemed	3	2	1	1	2	9
INI	8	6	3	3	16	36
RI	2	1			4	7
Total	**16**	**14**	**5**	**6**	**30**	**71**

Among 7 Central universities responded, none perceived it as Major, 2 as a minor barrier; 1 specified it as not a barrier. 4 did not specify/not aware.

Among 12 State universities responded, 3 perceived it as Major, 3 as a minor barrier; none specified it as not a barrier. 6 did not specify/not aware.

Among 9 Private Deemed universities responded, 3 perceived it as Major, 2 as a minor barrier; 1 specified it as not a barrier. 3 did not specify/not aware.

Among 36 INI responded, 8 perceived it as Major, 6 as a minor barrier; 3 specified it as not a barrier. 19 did not specify/not aware.

Among 7 RIs, 2 perceived it as Major, 1 as a minor barrier and none as not a barrier; 4 did not specify.

Altogether 16 out of 71 HEIs specified it as a major barrier; 14 minor barrier and 5 not a barrier.

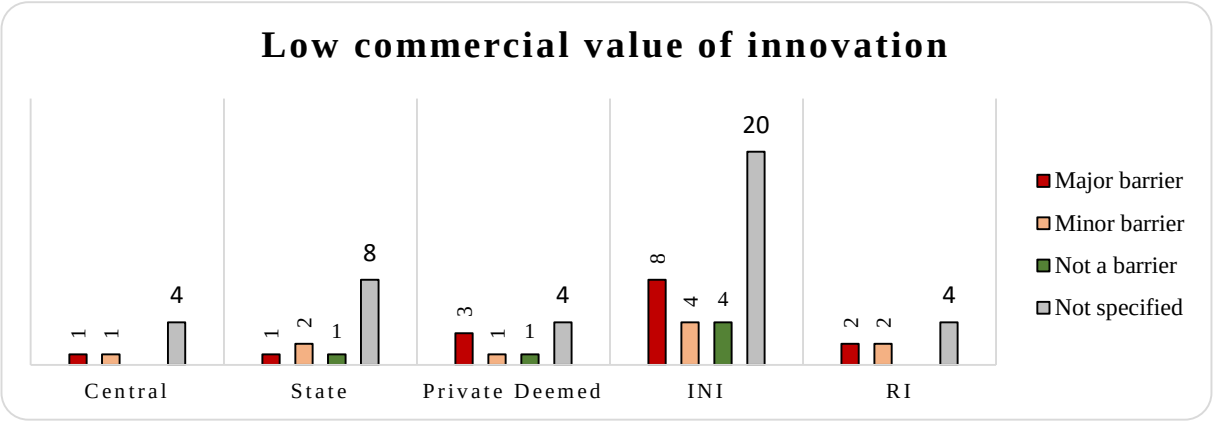

Figure 28 Barriers of IP commercialization and technology transfer: Low commercial value of innovation

Table 21 Type of HEI and their perception on Lack of efficient management level communication channels as a Barriers of IP commercialization and technology transfer

Lack of efficient management level communication channels						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central	1		2	1	3	7
State	1	2	4		5	12
Private Deemed	2	3	1	1	2	9
INI	5	7	5	3	16	36
RI	2	1			4	7
Total	**11**	**13**	**12**	**5**	**30**	**71**

Among 7 Central universities responded, 1 perceived it as Major, none as a minor barrier; 2 specified it as not a barrier. 4 did not specify/not aware.

Among 12 State universities responded, 1 perceived it as Major, 2 as a minor barrier; 4 specified it as not a barrier. 3 did not specify/not aware.

Among 9 Private Deemed universities responded, 2 perceived it as Major, 3 as a minor barrier; 1 specified it as not a barrier. 3 did not specify/not aware.

Among 36 INI responded, 5 perceived it as Major, 7 as a minor barrier; 5 specified it as not a barrier. 19 did not specify/not aware.

Among 7 RIs, 2 perceived it as Major, 1 as a minor barrier and none as not a barrier; 4 did not specify.

Altogether 11 out of 71 HEIs specified it as a major barrier; 13 minor barrier and 12 not a barrier.

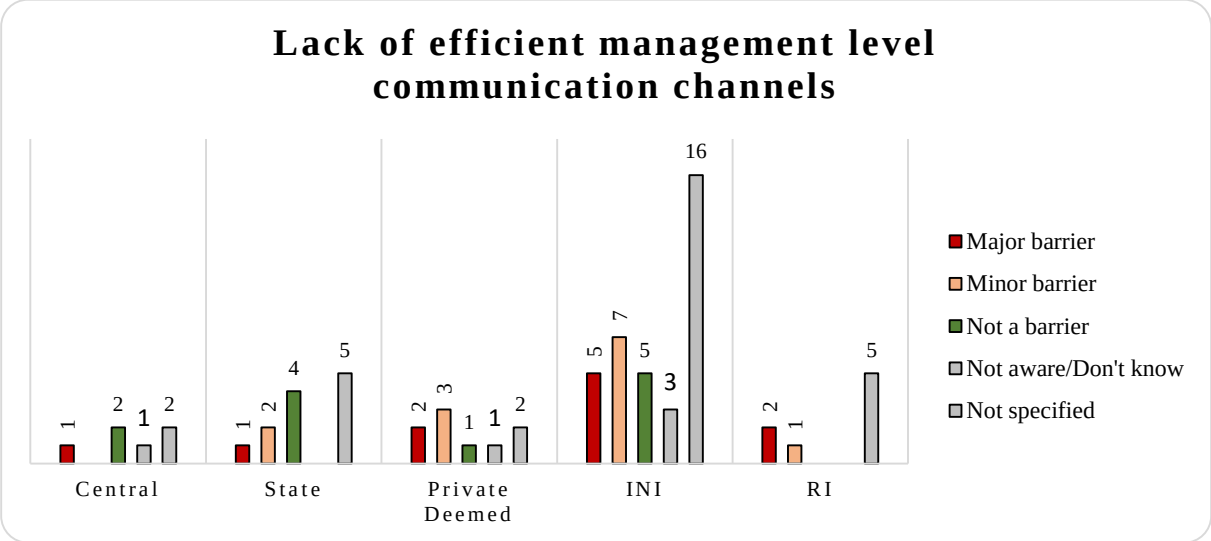

Figure 29 Barriers of IP commercialization and technology transfer: Lack of efficient management level communication channels

Table 22 Type of HEI and their perception on Complexity of the innovation as a barrier of IP generation

Complexity of the innovation						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central		2	1	1	3	7
State	2	4	1		5	12
Private Deemed	2	2	2	1	2	9
INI	5	8	5	3	15	36
RI	2	1			4	7
Total	**11**	**17**	**9**	**5**	**29**	**71**

Among 7 Central universities responded, none perceived it as Major, 2 as a minor barrier; 1 specified it as not a barrier. 4 did not specify/not aware.

Among 12 State universities responded, 2 perceived it as Major, 4 as a minor barrier; 1 specified it as not a barrier. 5 did not specify/not aware.

Among 9 Private Deemed universities responded, 2 perceived it as Major, 2 as a minor barrier; 2 specified it as not a barrier. 3 did not specify/not aware.

Among 36 INI responded, 5 perceived it as Major, 8 as a minor barrier; 5 specified it as not a barrier. 18 did not specify/not aware.

Among 7 RIs, 2 perceived it as Major, 1 as a minor barrier and none as not a barrier; 4 did not specify.

Altogether 11 out of 71 HEIs specified it as a major barrier; 17 minor barriers and 9 not a barrier.

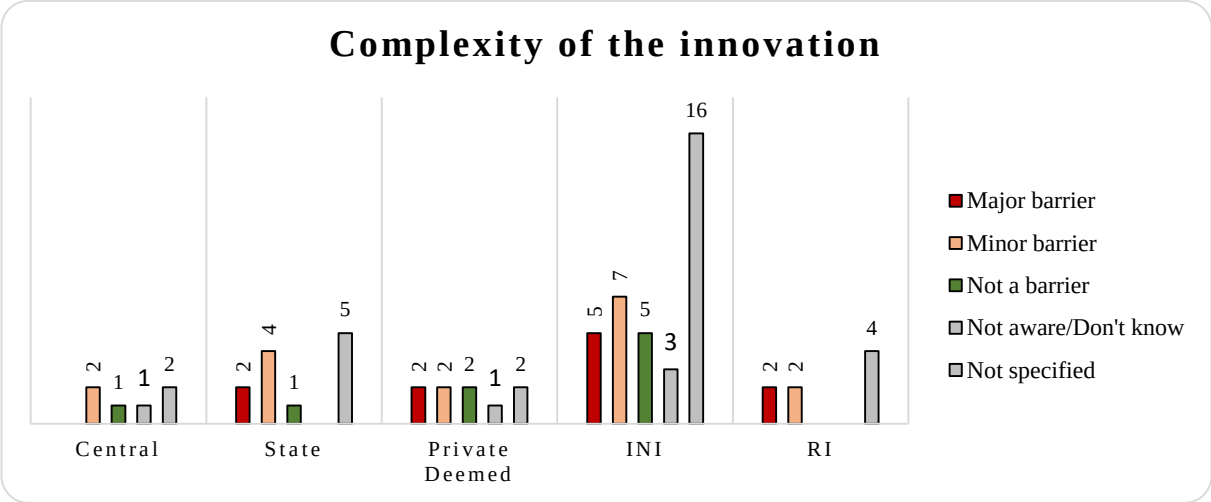

Figure 30 Barriers of IP commercialization and technology transfer: Complexity of the innovation

Table 23 Type of HEI and their perception on Lack of interest shown by the industry to license the technology as a barrier of IP generation

Lack of interest shown by the industry to license the technology						
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not aware/Don't know**	**Not specified**	**Total**
Central	1	1	1	1	3	7
State	4	3			5	12
Private Deemed	4		2	1	2	9
INI	9	5	3	3	16	36
RI	2	1			4	7
Total	**20**	**10**	**6**	**5**	**30**	**71**

Among 7 Central universities responded, 1 perceived it as Major, 1 as a minor barrier; 1 specified it as not a barrier. 4 did not specify/not aware.

Among 12 State universities responded, 4 perceived it as Major, 3 as a minor barrier; none specified it as not a barrier. 5 did not specify.

Among 9 Private Deemed universities responded, 4 perceived it as Major, none as a minor barrier; 2 specified it as not a barrier. 2 did not specify.

Among 36 INI responded, 9 perceived it as Major, 5 as a minor barrier; 3 specified it as not a barrier. 19 did not specify/not aware.

Among 7 RIs, 2 perceived it as Major, 1 as a minor barrier and none as not a barrier; 4 did not specify.

Altogether 20 out of 71 HEIs specified it as a major barrier; 10 minor barriers and 6 not a barrier.

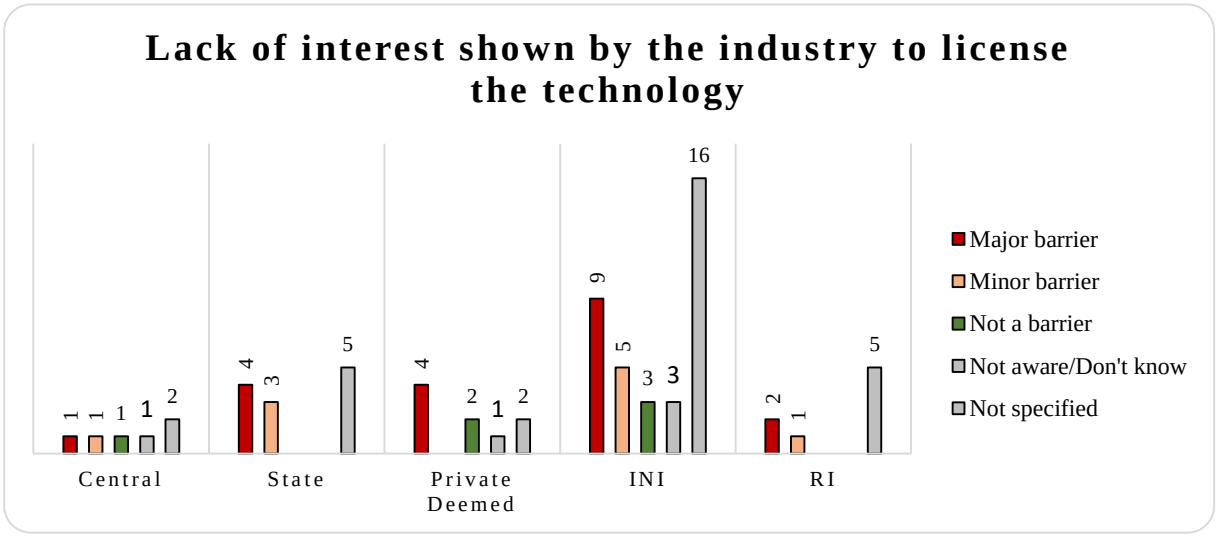

Figure 31 Barriers of IP commercialization and technology transfer: Lack of interest shown by the industry to license the technology

Table 24 Type of HEI and their perception on Lack of government support technology as a barrier of IP generation

Lack of government support					
HEI Type	**Major barrier**	**Minor barrier**	**Not a barrier**	**Not specified**	**Total**
Central	1		1	5	7
State	1	1	2	8	12
Private Deemed	1	3	1	4	9
INI	8	5	3	20	36
RI	1		2	4	7
Total	**12**	**9**	**9**	**41**	**71**

Among 7 Central universities responded, 1 perceived it as Major, none as a minor barrier; 1 specified it as not a barrier. 5 did not specify.

Among 12 State universities responded, 1 perceived it as Major, 1 as a minor barrier; 2 specified it as not a barrier. 8 did not specify.

Among 9 Private Deemed universities responded, 1 perceived it as Major, 3 as a minor barrier; 1 specified it as not a barrier. 4 did not specify.

Among 36 INI responded, 8 perceived it as Major, 5 as a minor barrier; 3 specified it as not a barrier. 20 did not specify/not aware.

Among 7 RIs, 1 perceived it as Major, none as a minor barrier, and 2 as not a barrier; 4 did not specify.

Altogether 12 out of 71 HEIs specified it as a major barrier; 9 as a minor barrier and 9 as not a barrier; 41 did not specify.

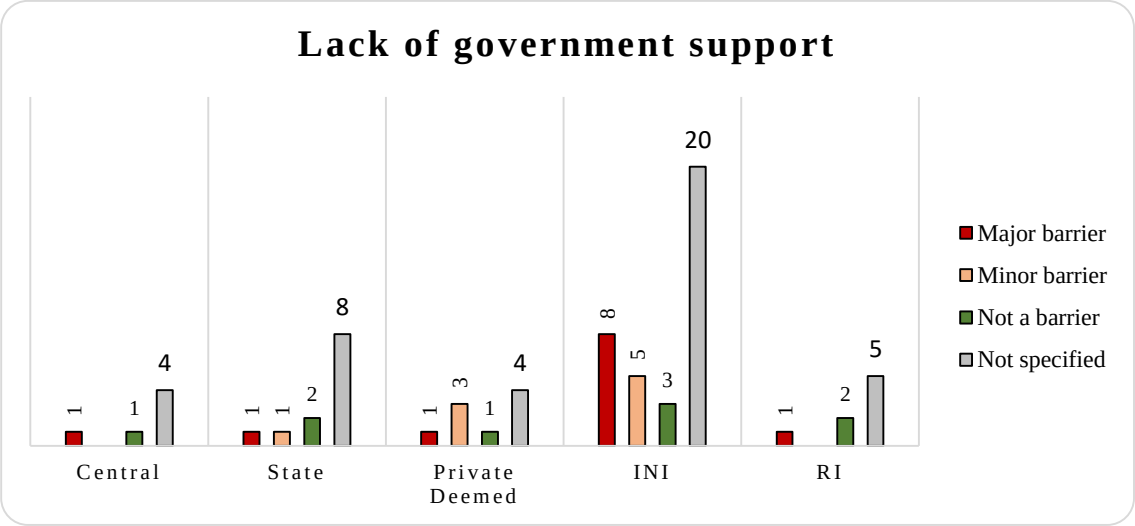

Figure 32 Barriers of IP commercialization and technology transfer: Lack of government support

5.4 Top management's perspective and strategy of HEIs' innovation promotion

Table 25 Type of HEI and top management focus on Establishing research teams for making innovations in basic research

Establishing research teams for making innovations in basic research					
HEI Type	**High focus**	**Medium focus**	**Planned for future**	**Not specified**	**Total**
Central			2	5	7
State	2		2	8	12
Private Deemed	4	2	1	2	9
INI	15	1	2	18	36
RI	2	1		4	7
Total	**23**	**4**	**7**	**37**	**71**

Among 7 Central universities responded, 2 planned for the future and 5 did not specify.

Among 12 State universities responded, 2 perceived it as high focus, none as medium focus; 2 specified it as planned for the future. 8 did not specify.

Among 9 Private Deemed universities responded, 4 perceived it as high focus, 2 as medium focus; 1 specified it as planned for future. 2 did not specify.

Among 36 INI responded, 15 perceived it as high focus, 1 as medium focus; 2 specified it as planned for future. 18 did not specify.

Among 7 RIs, 2 perceived it as high focus, 1 as medium focus and none planned for future; 4 did not specify.

Altogether 23 out of 71 HEIs specified it as high focus; 4 medium focus and 7 planned it for future; 37 did not specify.

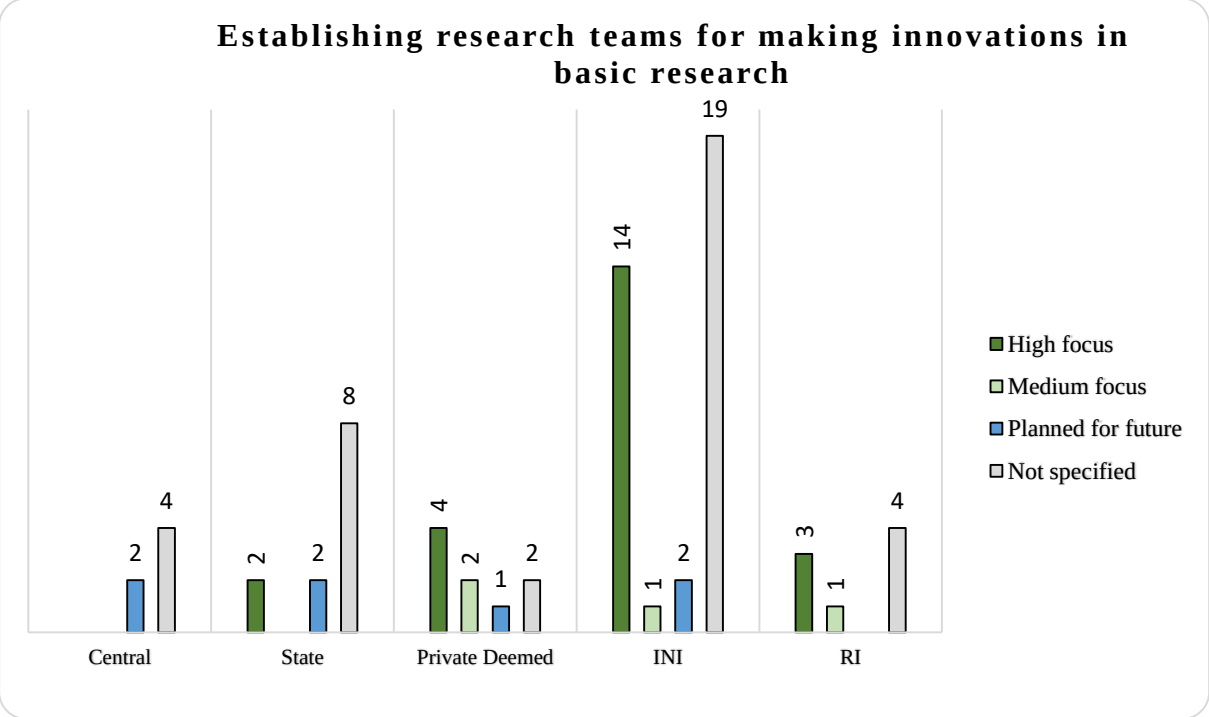

Figure 33 Focus of top management on Establishing research teams for making innovations in basic research

Table 26 Type of HEI and top management focus on IP asset generation

IP asset generation					
HEI Type	**High focus**	**Medium focus**	**Planned for future**	**Not specified**	**Total**
Central			1	6	7
State		1	1	10	12
Private Deemed		1		8	9
INI	4	2	2	28	36
RI	1			6	7
Total	**5**	**4**	**4**	**58**	**71**

Among 7 Central universities responded, None of them have high focus and medium focus. 1 planned it for future and 6 did not specify.

Among 12 State universities responded, none perceived it as high focus, 1 as medium focus; 1 specified it as planned for future. 10 did not specify.

Among 9 Private Deemed universities responded, none perceived it as high focus, 1 as medium focus; none specified it as planned for future. 8 did not specify.

Among 36 INI responded, 4 perceived it as high focus, 2 as medium focus; 2 specified it as planned for future. 28 did not specify.

Among 7 RIs, 1 perceived it as high focus, none as medium focus and none planned for future; 6 did not specify.

Altogether 5 out of 71 HEIs specified it as high focus; 4 medium focus and 4 planned it for future; 58 did not specify.

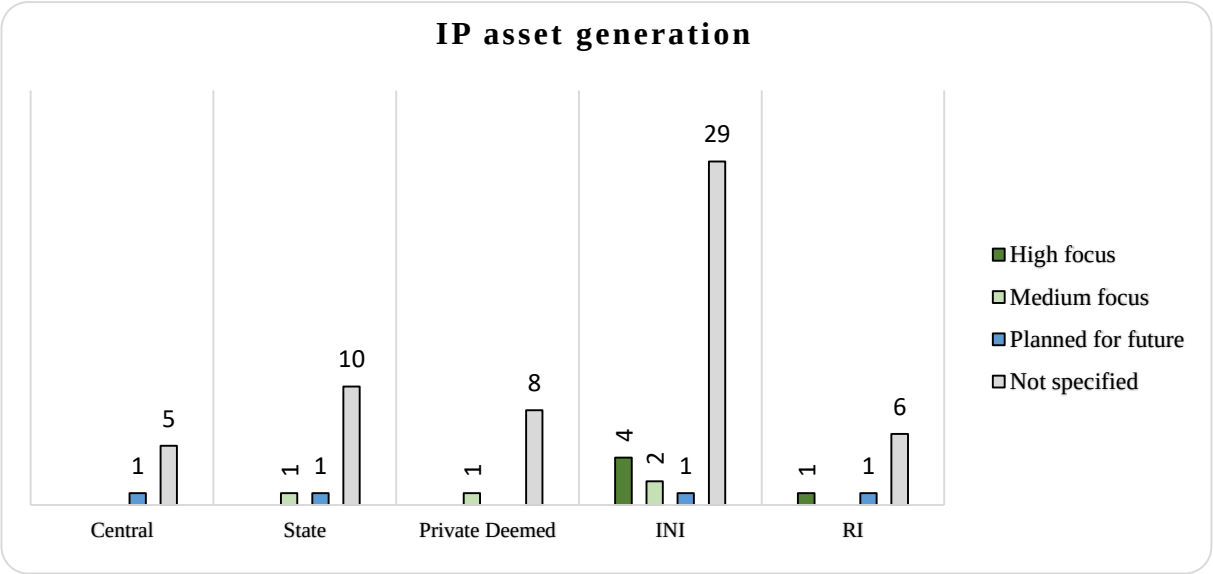

Figure 34 Focus of top management on IP asset generation

Table 27 Type of HEI and top management focus on Commercialization of institution's IP

Commercialization of institution's IP					
HEI Type	**High focus**	**Medium focus**	**Planned for future**	**Not specified**	**Grand Total**
Central			2	5	7
State		1	2	9	12
Private Deemed	4	2	1	2	9
INI	9	4	5	18	36
RI	2	1		4	7
Grand Total	**15**	**8**	**10**	**38**	**71**

Among 7 Central universities responded, None of them have high focus and medium focus. 2 planned it for future and 5 did not specify.

Among 12 State universities responded, none perceived it as high focus, 1 as medium focus; 2 specified it as planned for future. 9 did not specify.

Among 9 Private Deemed universities responded, 4 perceived it as high focus, 2 as medium focus; 1 specified it as planned for future. 2 did not specify.

Among 36 INI responded, 9 perceived it as high focus, 4 as medium focus; 5 specified it as planned for future. 18 did not specify.

Among 7 RIs, 2 perceived it as high focus, 1 as medium focus and none planned for future; 4 did not specify.

Altogether 15 out of 71 HEIs specified it as high focus; 8 medium focus and 10 planned it for future; 38 did not specify.

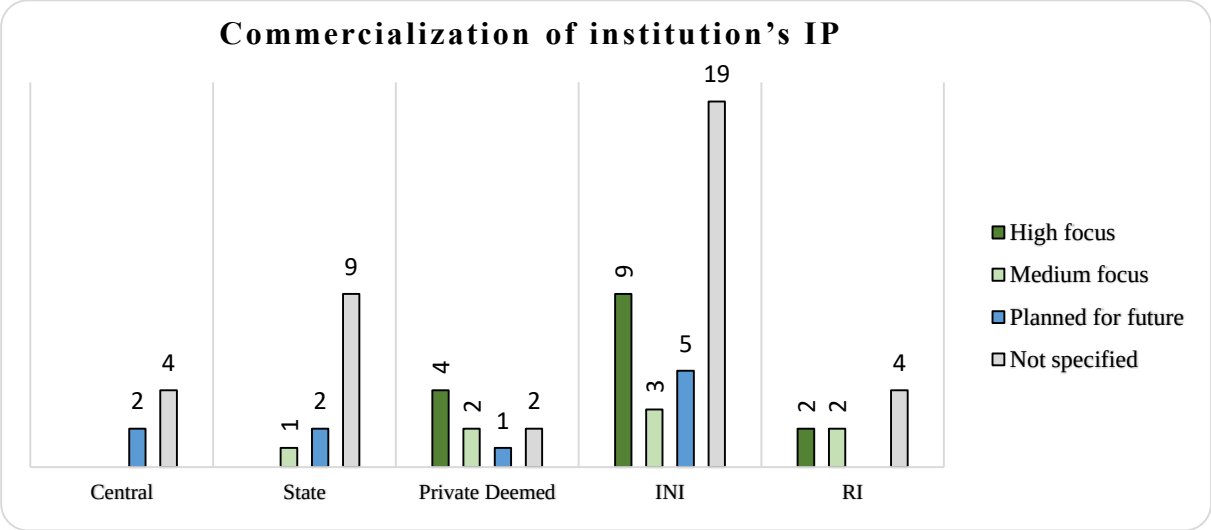

Figure 35 Focus of top management on Commercialization of institution's IP

Table 28 Type of HEI and top management focus on Promoting IP generating collaborations

Promoting IP generating collaborations					
HEI Type	**High focus**	**Medium focus**	**Planned for future**	**Not specified**	**Total**
Central		1	1	5	7
State		1	2	9	12
Private Deemed	5	1	1	2	9
INI	12	4	2	18	36
RI	3			4	7
Total	**20**	**7**	**6**	**38**	**71**

Among 7 Central universities responded, None of them have high focus and one has it as medium focus. 1 planned it for future and 5 did not specify.

Among 12 State universities responded, none perceived it as high focus, 1 as medium focus; 2 specified it as planned for future. 9 did not specify.

Among 9 Private Deemed universities responded, 5 perceived it as high focus, 1 as medium focus; 1 specified it as planned for future. 2 did not specify.

Among 36 INI responded, 12 perceived it as high focus, 4 as medium focus; 2 specified it as planned for future. 18 did not specify.

Among 7 RIs, 3 perceived it as high focus, none as medium focus and none planned for future; 4 did not specify.

Altogether 20 out of 71 HEIs specified it as high focus; 7 medium focus and 6 planned it for future; 38 did not specify.

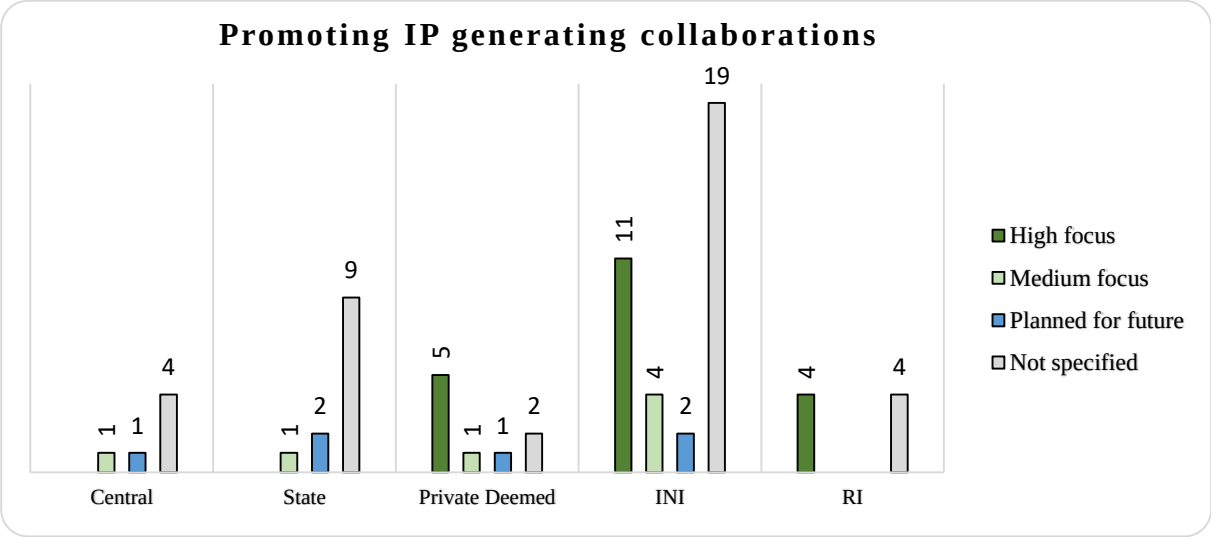

Figure 36 Focus of top management on Promoting IP generating collaborations

Table 29 Type of HEI and top management focus on Type of HEI and top management focus on Promoting IP generating collaborations

Promoting collaborations for commercialization of IP based innovations					
HEI Type	**High focus**	**Medium focus**	**Planned for future**	**Not specified**	**Total**
Central		1	1	5	7
State		1	2	9	12
Private Deemed	5	1	1	2	9
INI	12	2	4	18	36
RI	3			4	7
Total	**20**	**5**	**8**	**38**	**71**

Among 7 Central universities responded, None of them have high focus and 1 has it as medium focus. 1 planned it for future and 5 did not specify.

Among 12 State universities responded, none perceived it as high focus, 1 as medium focus; 2 specified it as planned for future. 9 did not specify.

Among 9 Private Deemed universities responded, 5 perceived it as high focus, 1 as medium focus; 1 specified it as planned for future. 2 did not specify.

Among 36 INI responded, 12 perceived it as high focus, 2 as medium focus; 4 specified it as planned for future. 18 did not specify.

Among 7 RIs, 3 perceived it as high focus, none as medium focus and none planned for future; 4 did not specify.

Altogether 20 out of 71 HEIs specified it as high focus; 5 medium focus and 8 planned it for future; 38 did not specify.

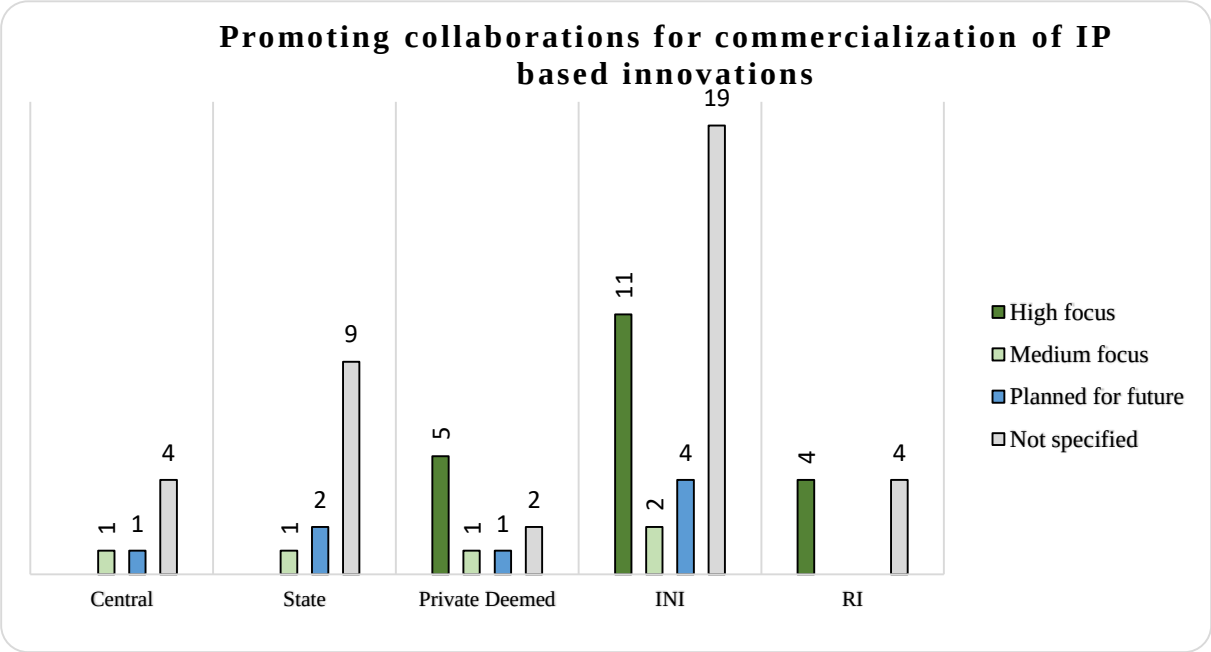

Figure 37 Focus of top management on Promoting collaborations for commercialization of IP based innovations

Table 30 Type of HEI and top management focus on Supporting start-ups/spinoffs by faculty/students/staff

Supporting start-ups/spinoffs by faculty/students/staff					
HEI Type	**High focus**	**Medium focus**	**Planned for future**	**Not specified**	**Total**
Central		2		5	7
State		1	2	9	12
Private Deemed	5	1	1	2	9
INI	14	2	2	18	36
RI	2			5	7
Total	**21**	**6**	**5**	**39**	**71**

Among 7 Central universities responded, None of them have high focus and 2 has it as medium focus. none planned it for future and 5 did not specify.

Among 12 State universities responded, none perceived it as high focus, 1 as medium focus; 2 specified it as planned for future. 9 did not specify.

Among 9 Private Deemed universities responded, 5 perceived it as high focus, 1 as medium focus; 1 specified it as planned for future. 2 did not specify.

Among 36 INI responded, 14 perceived it as high focus, 2 as medium focus; 2 specified it as planned for future. 18 did not specify.

Among 7 RIs, 2 perceived it as high focus, none as medium focus and none planned for future; 5 did not specify.

Altogether 21 out of 71 HEIs specified it as high focus; 6 medium focus and 5 planned it for future; 39 did not specify.

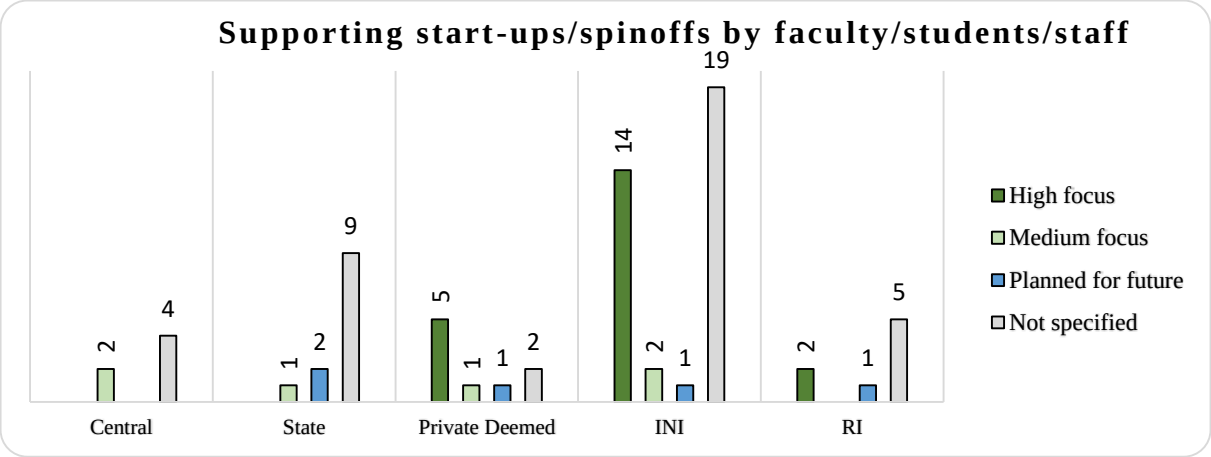

Figure 38 Focus of top management on Supporting start-ups/spinoffs by faculty/students/staff

Table 31 Type of HEI and top management focus on Collaborative research with top global 100 universities

Collaborative research with top global 100 universities						
HEI Type	**High focus**	**Medium focus**	**Low focus**	**Planned for future**	**Not specified**	**Total**
Central				2	5	7
State				2	10	12
Private Deemed	3	3		1	2	9
INI	12	3		3	18	36
RI	2		1		4	7
Total	**17**	**6**	**1**	**8**	**39**	**71**

Among 7 Central universities responded, none of them have high focus and none has it as medium focus and low focus. 2 planned it for future and 5 did not specify.

Among 12 State universities responded, none of them have high focus and none has it as medium and low focus. 2 planned it for future and 10 did not specify.

Among 9 Private Deemed universities responded, 3 perceived it as high focus, 3 as medium focus none has low focus; 1 specified it as planned for future. 2 did not specify.

Among 36 INI responded, 12 perceived it as high focus, 3 as medium focus and none has low focus; none specified it as planned for future. 3 have low focus and 18 did not specify.

Among 7 RIs, 2 perceived it as high focus, none as medium focus; one has low focus, and none planned for future; 4 did not specify.

Altogether 17 out of 71 HEIs specified it as high focus; 6 medium focus and 1 has low focus and 8 planned it for future; 39 did not specify.

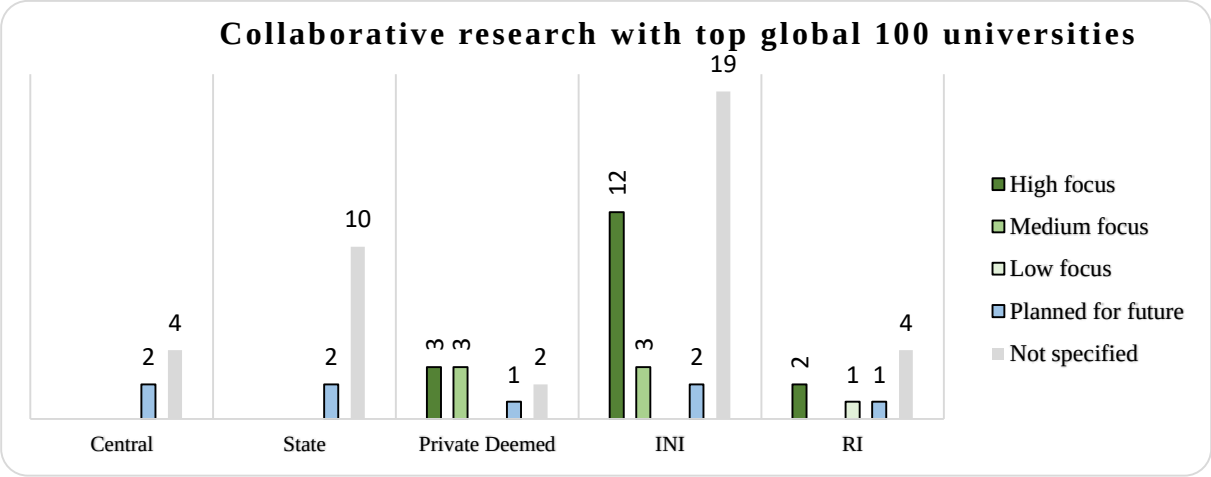

Figure 39 Focus of top management on Collaborative research with top global 100 universities

Table 32 Type of HEI and top management focus on Improving research funding from government

Improving research funding from government					
HEI Type	**High focus**	**Medium focus**	**Planned for future**	**Not specified**	**Total**
Central		1		6	7
State			3	9	12
Private Deemed	5	1	1	2	9

INI	15	2	1	18	36
RI	2	1		4	7
Total	**22**	**5**	**5**	**39**	**71**

Among 7 Central universities responded, none of them have high focus and 1 has it as medium focus and none with low focus. none planned it for future and 6 did not specify.

Among 12 State universities responded, none of them have high focus and none has it as medium and low focus. 3 planned it for future and 9 did not specify.

Among 9 Private Deemed universities responded, 5 perceived it as high focus, 1 as medium focus none has low focus; 3 specified it as planned for future. 9 did not specify.

Among 36 INI responded, 15 perceived it as high focus, 2 have medium focus and none has low focus; 1 specified it as planned for future. 18 did not specify.

Among 7 RIs, 2 perceived it as high focus, 1 has medium focus; none has low focus, and none planned for future; 4 did not specify.

Altogether 22 out of 71 HEIs specified it as high focus; 5 medium focus and none has low focus and 5 planned it for future; 39 did not specify.

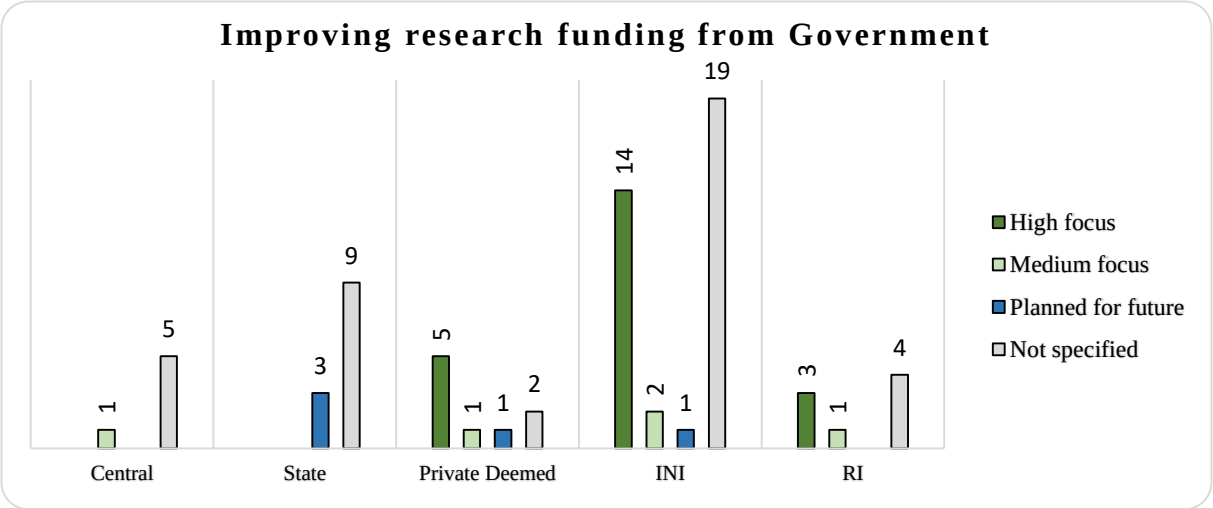

Figure 40 Focus of top management on Improving research funding from Government

Table 33 Type of HEI and top management focus on Improving research funding from industries

Improving research funding from industries					
HEI Type	**High focus**	**Medium focus**	**Planned for future**	**Not specified**	**Total**
Central		1		6	7
State			3	9	12

Private Deemed	5	1	1	2	9
INI	13	4	1	18	36
RI	2	1		4	7
Total	**20**	**7**	**5**	**39**	**71**

Among 7 Central universities responded, none of them have high focus and 1 has it as medium focus and none with low focus. none planned it for future and 6 did not specify.

Among 12 State universities responded, none of them have high focus and none has it as medium and low focus. 3 planned it for future and 9 did not specify.

Among 9 Private Deemed universities responded, 5 perceived it as high focus, 1 as medium focus none has low focus; 3 specified it as planned for future. 9 did not specify.

Among 36 INI responded, 13 perceived it as high focus, 2 have medium focus and none has low focus; 1 specified it as planned for future. 18 did not specify.

Among 7 RIs, 2 perceived it as high focus, 1 has medium focus; none has low focus, and none planned for future; 4 did not specify.

Altogether 20 out of 71 HEIs specified it as high focus; 7 medium focus and none has low focus and 5 planned it for future; 39 did not specify.

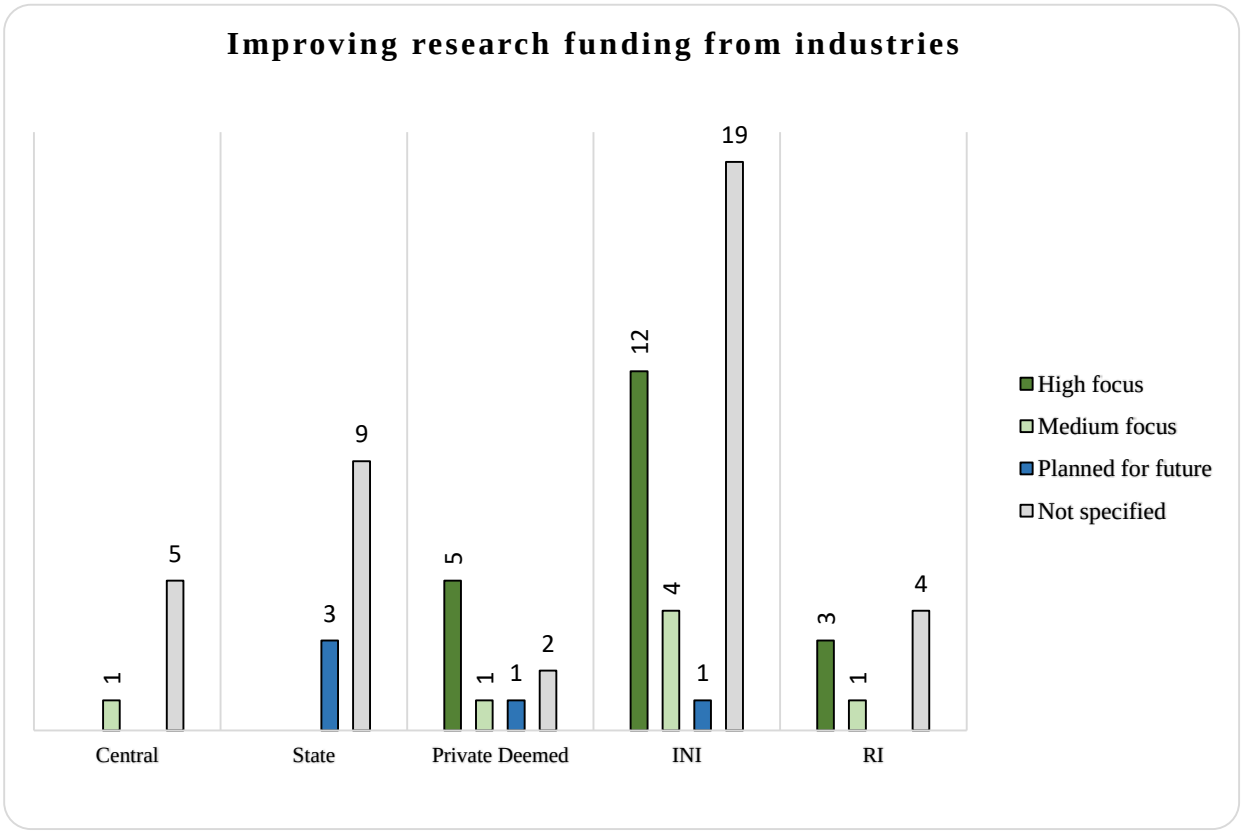

Figure 41 Focus of top management Improving research funding from industries

Discussion

In the US, practice of HEI IP policy implementation was there a decade before the enactment of Bayh-Dole Act which significantly impacted the surge in the generation of IP and commercialization of innovations with the help of subsequent supportive legislations. Nevertheless, mere institutional factors like IP cell, IP and TTO policy implementation alone has no impact on the promoting collaborations for IP generation, commercialization and technology transfer in HEIs. Synergizing the IP policy of HEI with other supportive institutional practices, leadership, organizational culture and intellectual capital are essential for the successful generation and commercialization of IP contributing to regional and national economy. These factors are interlinked and deficiency in one factor will amputate the subsequent phases of HEI innovations. Based on observations from this study, we found that HEIs of different types in India have unique deficiencies in their innovation ecosystem which impact their innovation efficiency and output. Correlation between collaboration, research and innovation and IP in university research and barriers and enablers of innonvation of respective HEI types (Central, State, Private Deemed universities, INIs and RIs) are explained separately.

Barriers and Enablers of IP generation and commercialization at Institutions of National Importance (INI)

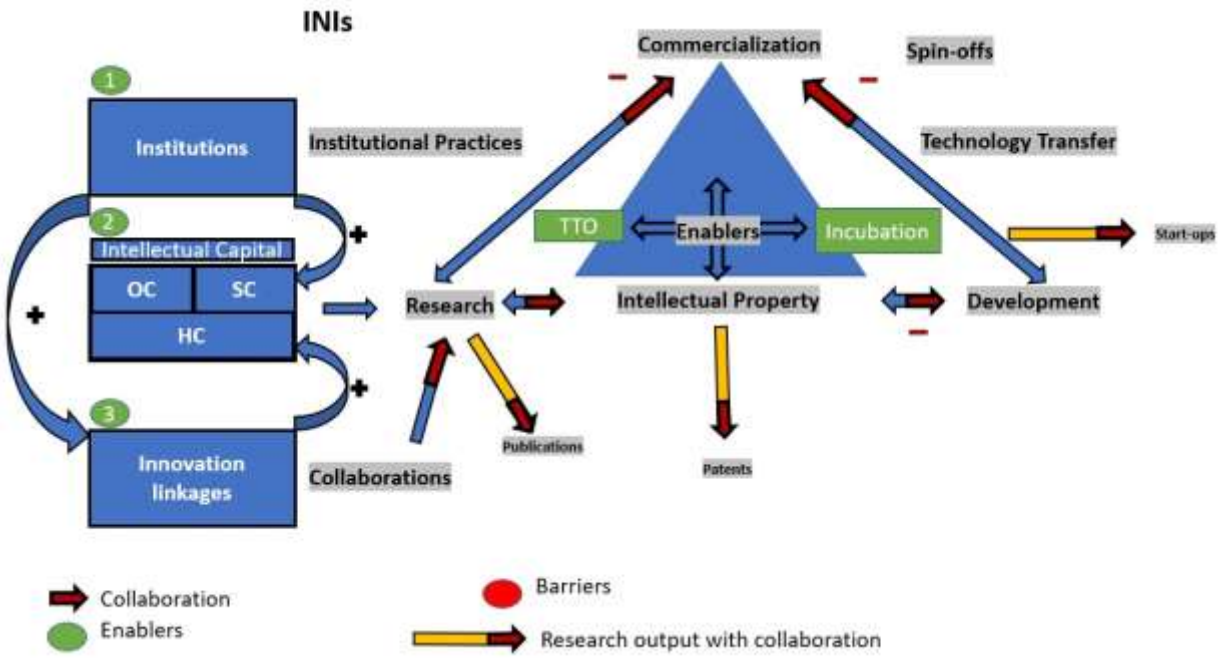

Figure 42 Correlation between collaboration, research and innovation; barriers and enablers of innovations in INI innovation ecosystem

In old INIs, policies and practices established are favouring for establishment of innovation linkages but, these innovation linkages though promoting research activities and IP. Generated IP with these collaborations are not incentivizing inventors. It is leaving inventor behind with narrow scope for benefitting from their innovations. Newly established INI do not have policies and intellectual capital supportive for collaborations. Complexity of innovation and inadequacy of funds for complex innovations are seen as barriers.

Barriers and Enablers of IP generation and commercialization at Private Deemed universities

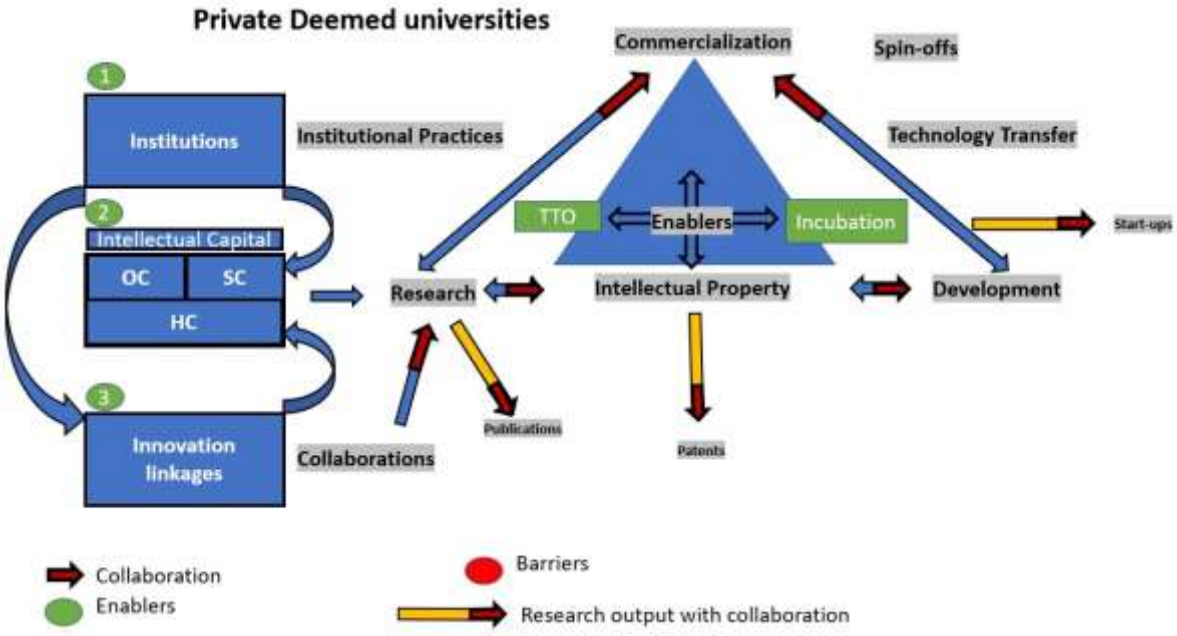

Figure 43 Correlation between collaboration, research and innovation; barriers and enablers of innovations in Private Deemed Univesity innovation ecosystem

Private Deemed universities have IP policies implemented and supportive structures established for making innovations. Organizational culture, lack of top management focus on IPR cell making them to have inadequate funds for IP management. The existing policies are not supportive of making collaborations for research and development for IP generation and commercialization.

Inadequacy of skilled human capital in IPR cell, lack of inhouse IP filing and funds for IP management are becoming major barriers.

Provision of dedicated funding schemes, programs providing IP human capital would enable to contribute better in generation and commercialization of generated IP by Private Deemed universities.

Barriers and Enablers of IP generation and commercialization at Central universities

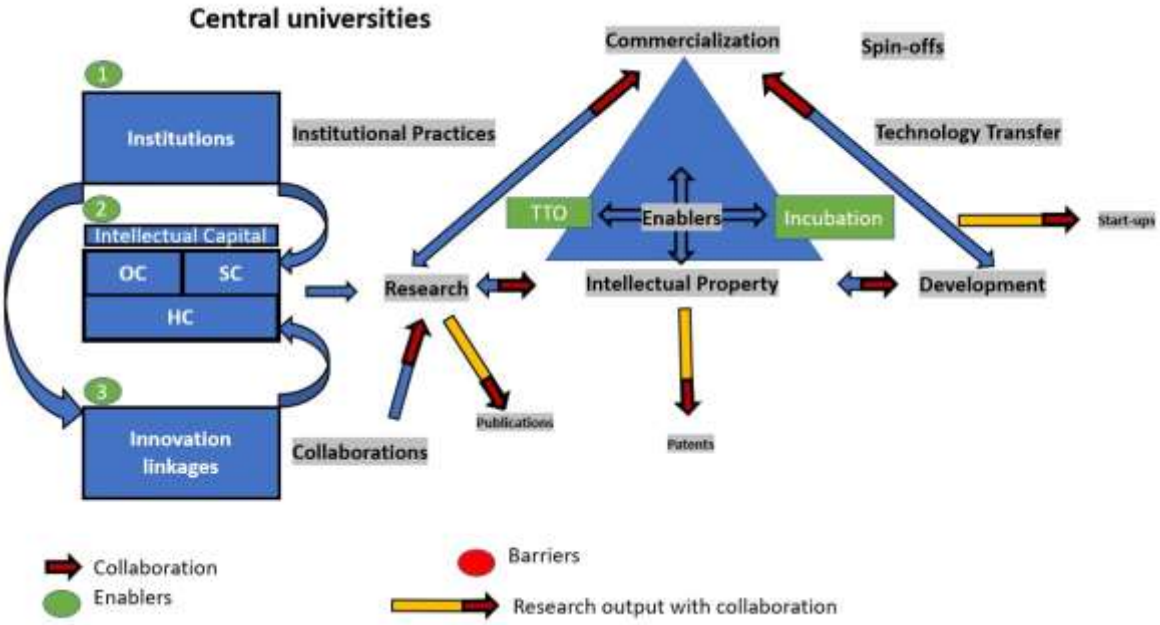

Figure 44 Correlation between collaboration, research and innovation; barriers and enablers of innovations in Central Univesity innovation ecosystem

Mission and objective of research in Central universities are not focused on creating value to research output. Institutional practices and policies are not creating an environment to build supportive innovation linkages for research and IP. IP polcies and other procedures of making innovation are recently established. Intellectual Capital of state universities are not entrepreneurial in nature. Due to this, Intellectual capital facilitated at State universities are inadequate for innovation linkages to build trust. These are the potential barriers.

Leadership, mission and objectives of State universities need to be re calibrated as per their regional innovation needs and strengths to deliver the research output accordingly. Reviewing of State innovation policies and specialized S&T schemes for state universities shall enable to stir innate potential of state universities to foster innovation.

Barriers and Enablers of IP generation and commercialization at State universites

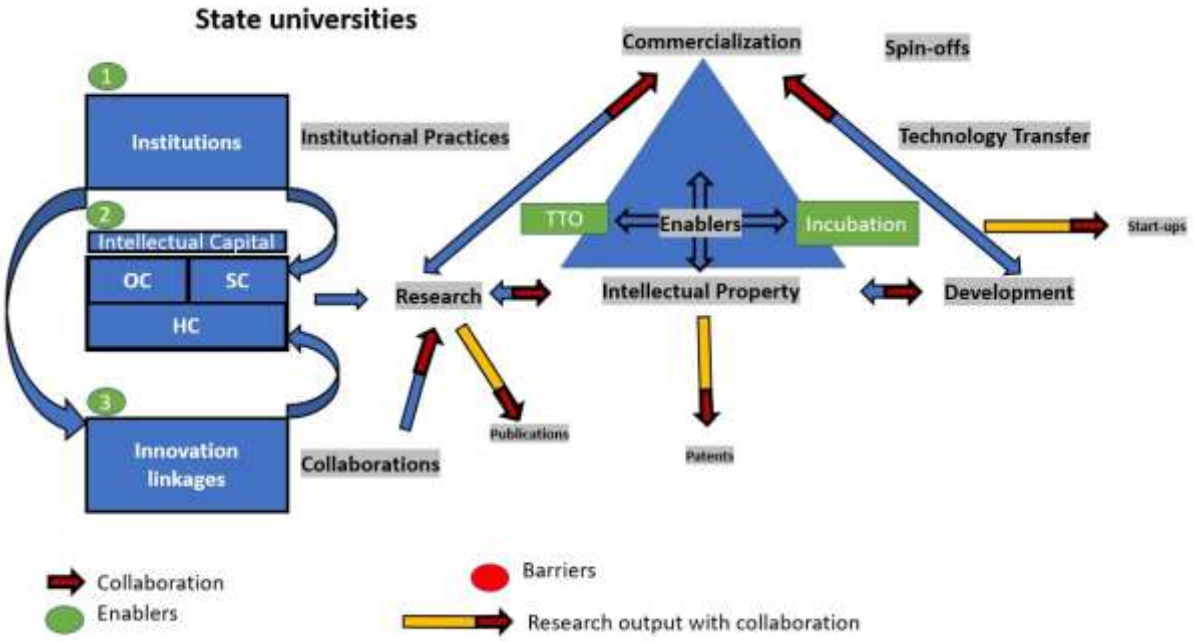

Figure 45 Correlation between collaboration, research and innovation; barriers and enablers of innovations in State Univesity innovation ecosystem

Mission and objective of research at State universities are not focused on valorization of research output. Institutional practices and policies are not creating an environment to build supportive innovation linkages for research and IP. IP polcies and other procedures of making innovation are recently established;which needs to be optimized further. Intellectual Capital of state universities are not entrepreneurial in nature. Due to this, Intellectual capital facilitated at State universities are inadequate for innovation linkages to build trust. These are the potential barriers.

Mission and objectives of State universities need to be re calibrated as per their regional innovation needs and strengths to deliver the research output accordingly. Reviewing of State innovation policies and specialized S&T schemes for state universities shall enable to stir innate potential of state universities to foster innovation.

Barriers and Enablers of IP generation and commercialization at Research Institutions (RIs)

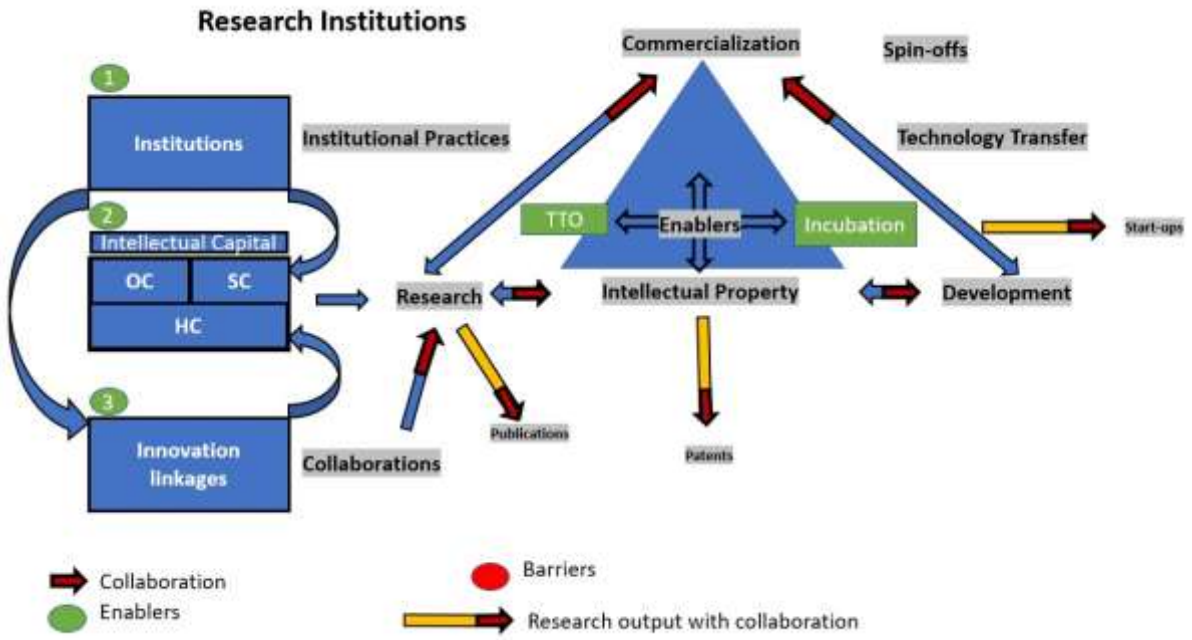

Figure 46 Correlation between collaboration, research and innovation; barriers and enablers of innovations in Central Univesity innovation ecosystem

Central IP management and administration of RIs are performing well in generation of IP, but lagging in commercialization and technology transfer. Institutional practices and organizational culture are not benefitting inventor for their invention disclosures. Leaving the inventor behind without significant incentives for their innovations in RI organization culture is observed. Though revenue sharing policies are in place, that benefit will not reach the inventor in near future. Recognizing the inventor role in the deal negotiations during IP commercialization and providing equity based incentives to the inventor in the commercialization process and recognizing the inventor with performance based special fund for research and innovations would motivate further towards working of the patent.

I. Institutional policy for incentivizing patent filing in overall ecosystem

Type of organizational mechanisms used in HEIs to promote the filing of IP can be seen as

i. Monetary incentives- institutions follow to promote IP generation include i. bearing complete cost of filing of the IP, ii) incentive benefits to students and staff for IP filings

ii. Non-monetary incentives - These include recognition with awards, certificates of appreciation, salary increment, cadre promotions, providing additional research support towards commercialization.

iii. Revenue sharing post commercialization of IP - Among all types of HEIs, INIs share more than 50% of the revenue after successful commercialization of IP (IIT Madras, IIT Kanpur, IIT Indore, IIT Delhi, IIT Patna, IIT Gandhinagar, NIT Raipur etc). Very few private deemed universities share more than 50% with inventors. Yenepoya, chitkara share more than 80% revenue, State universities (Bharatiar, Shivaji, Savithribahiphule Pune universities) have policy to share more than 50% with inventor.

Overall, both monetary and non-monetary incentives, revenue sharing policy of HEIs did not show significant impact on the promotion of IP generation in Indian HEI ecosystem. National innovation system and national IP policy objectives and goals are not imbibed into HEIs' IP policy and organization culture. The organization structure of HEIs' IP cell as per their IP policy are not aligned towards promoting working of IP from academic research output. However, it has been observed that implementation of IP policy and monetary incentives increased the number of patent filings in private deemed and INIs, but they did not increase the quality of patents generated. Limited annual budget, ill-structured incentives and low priority given by leadership of private deemed, state and central universities crippled the IP output. Existing incentive strategies in HEIs did not improve the working (commercialization) of patents due to low quality of the invention in the patent filings.

II. Role of organization structure, procedures, policies, and culture within organizations for its IP portfolio

Organizational structure and operational activities at HEIs related to establishment of IP cells, committee for IP activities, organizing awareness sessions, ownership of IP, IP revenue sharing, annual budget allocation for IP cell, number of staff in IP cell, impact of collaboration on IP generation and commercialization are similar in almost every State, Central and Private Deemed HEIs. The features that are common in all IP policies of HEIs are

Goals of IP policy: IP policy goals are not measurable in all these HEIs. They are not tailor made for their current innovation capacity of the institution. The specified goals did not absorb the priorities of national IPR policy and thrust areas given. The goals specified are mismatch with the kind of attention given by the top management towards promotion and commercialization of IP. It

can be seen from the meagre annual budget allocation and provision of incentives made by the institution. It is either due to lack of qualified intellectual capital with the institution to drive research as envisaged or lack of sufficient research budget supporting intellectual capital or lack of motivating incentives for them or lack of full time IP professionals in the institutions.

III. Evaluation of IP cell organizational effectiveness in HEIs

Internal practices of HEIs

Although IP policies were implemented, IP policy committees are not constituted in all the types of HEIs studied. The minimum qualification of members of the committee is Ph.D awarded staff, but IP professionals and external IP law experts are not usually observed. Except in RIs, IP cells established are centralized, directly controlled by university Vice-Chancellors/Directors. Full time IP cell coordinators are rarely seen in Central, State and Private Deemed universities. At institution level, mode of organization funding structure for IPR generation (project centric, research centre/department centric, university/institution centric), type of patent applicant (individual, joint and institution) and enabling institutional IP policies are showing significant impact on promotion of patent filing and commercialization in HEIs.

Mode of organization funding structure for IP generation varies among type of HEIs. Research Institutions and top INIs (IIT Madras, IIT Kanpur) have both centrally managed, research project centre centric, and it is observed that patents from INIs are filed by institute and research centres singly/jointly with collaborated academic/industrial partners. Joint patent applications filed by INIs are mostly with reputed research centres and industries nationally. Patents filings with international collaborated academic/industrial partners are little. In State, Central and Private Deemed universities decision of filing, maintenance of patents and annual budget allocation is controlled by institution through its IP cell. Low annual budget allocation to IP cell and low priority towards IP asset creation by top management (leadership) are demotivating generation and commercialization of patents in Private Deemed universities. Though potential ideas for filing get filed and published, decision for examination kept on pending which might be due to insufficient annual budget for IP filing and protection, or due to identified no worthful novelty in invention to seek protection. The strategy of HEIs behind screening invention disclosures for IP filing, applying for examination and maintenance fees of granted patents varies among different types of HEIs.

Type of patent applicant/ownership of the IP generated by HEIs can be seen at 2 levels.

i. University as an applicant
ii. Inventor as an applicant

Though institutional IP policies have clauses specified for inventor ownership, waiving-off of the IP ownership by HEI, allowing inventor to own the IP is not usually observed in state and central universities, private deemed universities and RIs. It is observed in some INIs (IITs and NITs), that institution allowed filing of patents with inventor as an applicant and provided ownership to the inventor. The strategy of institutions allowing filing of patents with inventor as an applicant could be by using provisions of IP policy adopted in such institutions; i) which specifies first right of refusal to institution for giving the ownership to inventor, ii) waiving off of ownership, iii) Inventor's motive to develop and commercialize it further. The policy of few INIs allowed inventor ownership; but the impact of inventor ownership of IP on successful working of the patent needs to be studied further in these institutions to evaluate the success rate towards working of the patent. However, most successful IP generating and commercializing institution like IIT Madras, inventor ownership is not seen, but joint IP ownership is observed between the Institute and RIs, and institute and INI.

Although most of the State, Central and Private Deemed universities have identical provisions in the implemented IP policy for inventor ownership under specific conditions, it is not usually seen in practise. Inventors and researchers are Intellectual Capital (IC) for the HEIs for generation of IP and for creating revenue out of it. High quality intellectual capital and facilitation of infrastructure and funds with strong motivating incentives are supply side factors for generation and commercialization of IP. All first generation INIs have these supply side factors in the ecosystem of the organization. Priority given by these organizations' leadership paved way for creation of organization culture that is necessary for the innovation to flourish. Though all INIs have similar funding and high qualified intellectual capital, second and third generation INIs, central and state universities, private deemed universities could not create organizational culture that is needed for promotion of innovation.

Summary and recommendations

Higher Education Institutions (HEIs) which constitute universities (public and private) and research institutions (knowledge bases) are prominent in creation of knowledge and innovations in any country. These innovations are engine of economic growth; whereas, Intellectual Property Rights (IPR) are fuel to it. Effective utilization of Intellectual Property (IP) created in HEIs is underpinning for consistent economic growth in developed nations. HEI's IP policy is corner stone which enables innovation linkages and significantly decides the inventions' viability from lab to market. Lack of supportive HEI IP policy cripples the innovation system. Despite having high

potential Intellectual Capital (IC) and institutions to lead the world in technology, HEIs in India are performing low; inadequate IP policies at HEIs could be prime attributable reason for this. Purpose of the research is to study IP policies and innovation practices of HEIs towards generation and commercialization of IP, to understand the correlation between collaboration, R&D and innovation and IP of HEIs. It further identifies the barriers of IP generation, commercialization and technology transfer in the perspective of top management and management focus to promote innovation at HEIs.

We found that most HEIs have IP cells, Technology Transfer Offices (TTO), and policies with committee members for reviewing formulated and implemented IP policy and others are in tow to implement them soon. Among all HEIs, very few INIs (Madras, Kanpur, Delhi, Bombay, and Kharagpur) are leading in innovation output with their adopted innovation practices. Next to INIs, both RIs and Private Deemed universities are better equipped and have high potential with supporting IC to drive innovation in the country, but entrepreneurial oriented structural, funds, and social capital are inadequate and inefficient in Private Deemed universities.

IP policies formulated in few newly established as well as institutions aged more than 50 years are mere emulations of best performing HEIs (INIs); HEI IP policies are not tailormade as per their innovation strengths and needs. It could not create efficient innovation linkages which lead to the creation of a non-competitive environment in the HEI ecosystem. It is further impacted by the lack of top management focus on facilitating innovation infrastructure, consistent fund and operational staff to strengthen IP-based innovations in HEIs. Issues like ‘Lack of awareness of researchers towards IP’ and ‘prevalence of more incentives for publication of research results’ are added to ‘lack of incentives for researchers for generating and commercilaizing IP’ causing inhibition to the IP generation and commercialization. Further, there are no formal practices of screening the R&D results for protecting potential IP; it is draining out the potential innovations which can be exploited through protection.

It is also observed that established HEI’s IP cell/TTOs are inefficiencient; engaged with little entrepreneurial oriented and no suffice fulltime IP and TTO staff employed with them. Though HEIs have collaborations, they are unfruitful for generation and commercialization of IP. A great push strategy is needed by government and HEIs’ top management to facilitate and prioritize for specialized intellectual capital and financial capital to strengthen innovation ecosystem.

Recommendation 1: It is an inevitable need for stirring and catalyzing the HEIs’ innate innovation potential towards regional and national economy goals envisaged. For this, HEIs’ top management

Chancellors, Vice-Chancellors and Directors should design and articulate their mission and objective of university research and re-formulate their IP policies and reasonable authority and power handed over to IP management entity established. IP policy of HEIs should be revived with clear ownership specifications during different conditions; with mandatory first right of refusal to inventor to proceed for commercialization; and not withstanding to any clause in presence of consultancy or funder's agreement— first and equal preference to inventor to exploit the IPR— during collaboration; committee constitution of atleast one member representing wide range of stake holders (students, staff, institute directors, external promoters, governing board members and industry heads) of university innovation. Most HEIs excluded students, teaching and research staff and top management of industry in the constitution of IP committee. Lack of participation of students and researchers in the committee created vacuum in promoting awareness. Policy should also emphasise the innovation demand specific to geographical location of HEIs and should build structural and organizational capital accordingly. Overall, inventor first approach should be manifested in the policies of HEI innovation ecosystem.

Recommendation 2: A great push in fund allocation for customised programs and schemes should be designed. Programs must be tailor made for different statutory establishments of HEIs— Institutions of National Importance, Central, State and Private Deemed universites and Research Institutions—by taking their geographical locations and innovation performance as consideration. Selected patent agents and professionals should be made work at HEI IP cells as a part of a schemes and programs made for capacity building in IPR.

Recommendation 3: As Indian national innovation system is not supportive of fruitful collaborations with industries promoting generation and commercialization of IP, programs facilitating exclusively for venture capital funds and researcher spin-offs shlould be designed and university-university, university-Spin-off/MSME collaboration should be adopted as an alternative strategy to offset the industrial collaboration. It should be synergized with government procurement of start-up and MSME products/services; Trade and industrial policies and legislations should be introduced providing supply side monetory and tax incentives to university start-ups and spin-offs and demandside strict government procurement instruments.

Recommendation 4: There should be strict compliance norms on data presented in annual reports with clear uniform format of budget allocations, innovation output disclosures for all HEIs.

Recommendation 5: It must be ensured that trained professionals under IP capacity building schemes get placed at HEIs' IP cells. New schemes should be rolled to link these supply side

capacity building programmes matching to meeting with IP professionals demand at Central, State and Private Deemed universities.

Research Summary/annotation of project

Title: Intellectual Property Rights Policy and Innovation in Higher Education Institutions (HEIs) in India

Author:

Institution: Manipal Academy of Higher Education (MAHE), Manipal

Year: 2021

Higher Education Institutions (HEIs) which constitute universities (public and private) and research institutions (knowledge bases) are prominent in creation of knowledge and innovations in any country. These innovations are engine of economic growth; whereas, Intellectual Property Rights (IPR) are fuel to it. Effective utilization of Intellectual Property (IP) created in HEIs is underpinning for consistent economic growth in developed nations. HEI's IP policy is corner stone which enables innovation linkages and significantly decides the inventions' viability from lab to market. Lack of supportive HEI IP policy cripples the innovation system. Despite having high potential Intellectual Capital (IC) and institutions to lead the world in technology, HEIs in India are performing low; inadequate IP policies at HEIs could be prime attributable reason for this. Purpose of the research is to study IP policies and innovation practices of HEIs towards generation and commercialization of IP, to understand the correlation between collaboration, R&D and innovation and IP of HEIs. It further identifies the barriers of IP generation, commercialization and technology transfer in the perspective of top management and management focus to promote innovation at HEIs.

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Annexure

Annexure

Annexure 1 Questionnaire

Intellectual Property Rights Policy and Innovation in Higher Education Institutions (HEIs) in India

PART-A: Questions about Institutional Intellectual Property Rights Policy

1. Name of the Institution:

2. How old is your Institution:

(1) ☐ <10 years (2) ☐ 10-25 years (3) ☐ 26-50 years (4) ☐ >50 years

3. Type of Institution:

(1) ☐ Private (2) ☐ Deemed (3) ☐ Central government (4) ☐ Stategovernment

(5) ☐ Autonomous (6) ☐ Aided (7) ☐ Others, Please specify ——————

Please respond to below questions to related to IP policy of your institution

4. Does your HEI have an Intellectual Property (IP) cell?

(1) ☐ Yes (2) ☐ No

5. Is your IP cell funded by a government agency or self-financed?

(1) ☐ Government funded (2) ☐ Self-financed (3) ☐ Others, Please specify

6. Does your HEI have an IP policy?

(1) ☐ Yes (2) ☐ No

If No, please respond to the following questions.

6.1 Do you plan to implement an IP Policy in near future?

(1) ☐ Yes (2) ☐ No

6.2 If yes, please specify the tentative timeframe to implement

6.3 If no, can you please state the reason? _____

7. Mention the year in which the IP policy, if any, was first implemented in your institution? ……..

8. Are you aware of National IPR policy of the Government of India?

(1) ☐ Yes (2) ☐ No

If Yes, please respond to following questions.

8.1 Is your HEI IPR policy reflects objectives stated in national IPR policy?

(1) ☐ Yes (2) ☐ No (3) ☐ Not sure/Not aware

8.2 If No, Do you plan to align your institutional policy with National IPR policy?

(1) ☐ Yes (2) ☐ No

8.3 Have you set a time frame for aligning your policy?

(1) ☐ Yes (2) ☐ No _____

9. Does your institution revise/review IP Policy?

(1) ☐ Yes (2) ☐ No (3) ☐ Not applicable

9.1 If yes, please specify how frequently the IP policy is revised?
(1) Annually (2) Every 2 years (3) On need basis (4) Not applicable

9.2 If yes, please mention the year in which it was last revised _____

9.3 If your institution does not revise IP policy, can you please state the reason(s) for not revising the IP policy? _____

10. Can you please state, who were involved in the development of the IP policy of your Institution?

(1) ☐ In-house experts (2) ☐ External agency/experts (3) ☐ Both In-house experts and external agency (4) ☐ Others If others, Please specify ……..

11. Is the IP policy of your institution available on your institution website?

(1) ☐ Yes (2) ☐ No (3) ☐ Not applicable

11.1 If it is not available on institution website, can you please state the reasons for not making your institution IP policy available on website?

_____

12. Do you have a committee for implementation/revision of IP policy?

(1) ☐ Yes (2) ☐ No (3) ☐ Not applicable

If yes,

12.1 Can you please specify the total number of committee members?

.....

12.2 Can you please specify the composition, experience and qualification of committee members?

12.3 How frequently does the committee meet?

(1) ☐ Once in a week (2) ☐ Once in 15 days (3) ☐ Once in a month (4) ☐ Once in two months (5) ☐ As and when required (6) ☐ Not applicable

12.4 Do you periodically update data regarding intellectual property generated by your institution on your institution website?

(1) ☐ Yes (2) ☐ No

12.5 If yes, how frequently do you update data on your website?

(1) ☐ Every week (2) ☐ Once in two weeks (3) ☐ Once in a month

(4) ☐ Quarterly (5) ☐ As and when required (6) ☐ Not applicable

13. The applicability of IP policy is for which of the following stakeholders of the institution?

(1) ☐ Faculty members (2) ☐ Research Scholars (3) ☐ Students (4) Staff members

(5) ☐ Not applicable (6) ☐ Any other, Please specify……

14. Does your IP policy specify on

14.1 Ownership of IP between inventors and your institution?

(1) ☐ Yes (2) ☐ No (3) ☐ Not applicable

14.2 Revenue sharing in case of licensing/Technology transfer

(1) ☐ Yes (2) ☐ No (3) ☐ Not applicable

14.3 If 'Yes', please specify the HEI policy on percentage of revenue distribution/royalty from successfully commercialized/licensed IP to researchers, faculty members and other contributing departments.

Contributors	Percentage share of revenue
Inventor(s)	
Department	
HEI	

Any other contributing departments	
14.4 Any other revenue sharing mechanism specific to your institution?	

Questions on IP policy regarding Collaborative Research,

14.5Does your IP policy specify details about Ownership of IP with industry/ collaborating institution?

(1) ☐ Yes (2) ☐ No (3) ☐ Not applicable

14.6 Cost/Cost sharing with partner institutions/organizations?

(1) ☐ Yes (2) ☐ No (3) ☐ Not applicable (4) Decided on case to case basis

14.7Does your institution discusses with collaborating partner regarding Jurisdictions in which the IP would be filed? (National/International or any other)

(1) ☐ Yes (2) ☐ No (3) ☐ Both National and International (4) ☐ Only National (5) ☐ Only International (6) ☐ Any other _____

14.8Please specify total number of patents filed and granted through collaborations.

14.81 Filed: …… 14.82 Granted: …….

☐ Not applicable

15. What is the approximate annual budget allocated for IP cell of your institute?

(1) ☐ Less than 5 lakhs (2) ☐ 5 – 10 Lakhs (3) ☐ Above 10 L but less than 15 lakhs (4) ☐ 15 – 25 lakhs (5) Above 25 lakhs

PART-B: Questions about institutional practices for promoting innovation and IP awareness

16. Does your institution have practice of screening the inventions and R&D results (innovative techniques, processes and products) for potential patenting, before publishing them in high quality journals?

(1) ☐ Yes (2) ☐ No (3) ☐ Sometimes (4) ☐ Not aware

16.1 If yes, who takes the responsibility of screening the R&D results for identification of potential patenting inventions?

(1) Researcher (2) Principal investigator of the project (3) IP professional (4)

Other_ _____

17. Which among the following activities are carried out by the institution to promote awareness on IP and IP policy among faculty members, students and research scholars? (Please tick all that are applicable)

(1) ☐ Seminars and workshops conducted by in-house experts (2) ☐ Seminars and workshops conducted by outside experts (3) ☐ Awareness session on need basis

(4) ☐ Designing it as part of academic curriculum

18. Can you please specify approximate number of training programs on IP & innovation conducted by your institution annually, in last 5 years?

(1) ☐ Less than 10 (2) ☐ Between 11-20 (3) ☐ 21-30 (4) ☐ More than 30

19. Please specify about **institutional practices & provision** for stimulating and promoting innovation among various stakeholders in your institution/university.

Sl.No.	Variables	Yes	No	If Under process (Since when)
19.1	Does your institution/university have an idea cell/idea hub/Idea cafe or similar facility for innovators to submit innovative ideas?			
19.2	Do you have pre-fabrication facilities established in your institution/university?			
19.3	Does your institution provide incentives (both tangible and non-tangible) for submitting ideas for potential patenting?			
19.4	Does your institution have provision for providing technical guidance to your faculty/research scholars/students for developing idea into practice/ proof of concept or a prototype?			

Annexure

20. Please specify, types of incentives, if any, provided to researchers/staff for submission of Intellectual Property generation (Please tick ( ) all that are applicable)

    (1) ☐ Salary increment (2) ☐ Performance Incentives (3) ☐ Cadre promotion

    (4) Providing additional research facilities and support
    (5) Recognition with awards/certificates

    (6) Others, please specify ……

21. Please specify the subject domains under which ideas are submitted for potential patenting. (Please tick( ) all that are applicable)

    (1) ☐ Computer Sciences (2) ☐ Pharmaceutical sciences (3) ☐ Automobile engineering (4) ☐ Biomedical (5) ☐ Polymer science (6) ☐ Textiles

    (7) ☐ Metallurgy (8) ☐ Mechanical

    (9) ☐ Others, please specify ……

22. Please specify the number of Intellectual Property filed annually in the last 10 years

    (National & International)

Year	Patents filed		Trademarks	Industrial designs	Integrated circuits	Copy rights
	Product	Process				
2010						
2011						
2012						
2013						
2014						
2015						
2016						
2017						

2018						
2019						

23. Please specify the number of Intellectual Property granted, annually, in the last 10 years (National & International)

Year	**Patents granted**		**Trademarks**	**Industrial designs**	**Integrated circuits**	**Copy rights**
	Product	**Process**				
2010						
2011						
2012						
2013						
2014						
2015						
2016						
2017						
2018						
2019						

24. Do you have any litigation/infringement cases filed?
(1) ☐ Yes (2) ☐ No (3) ☐ Not applicable

If yes, please specify the number and details

23.1 Number of infringements/litigations filed: ……

23.2 Details of it:- ……

25. How many patents or other forms of Intellectual Property have been abandoned/ discontinued in the last 10years?

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019

No. of IP abandoned/ discontinued										

26. Please specify your HEI preferred channel for communicating/exhibiting and diffusing the knowledge and IP generated to technology seekers for commercialization/licensing.

(1) ☐ HEI website (2) ☐ Central government instituted platforms

(3) ☐ Technology-exhibitions (4) ☐ Others, please specify

PART-C Questions about some parameters of HEI that has contribution in Global Innovation Index (GII) and objectives of national IPR policy for promotion of innovation

i. Innovation linkages:

27. Please respond to the following questions regarding **IP Policy** of your institution **supporting collaborations** to promote innovation by generation of knowledge, technology and IP. Please tick as ( ) as applicable.

Sl. No.	Parameters of innovation	Yes	No
27.1	Does your university have collaborations for research projects with other institutions or industry?		
27.2	Does your IP policy specify provisions regarding joint IP filing with other institutions/industries?		

Annexure

28.Please tick ( ) how strongly you agree/disagree for the given statements about **collaboration** and its effect on your Institution's innovation output.

Sl. No	Variables	Strongly agree	Agree	Not sure/ Don't know	Disagree	Strongly disagree
28.1	Collaboration with industries improved research & innovation and further helped for IP generation of your institution.					
28.2	Collaboration with Government incubation centers helped research & innovation and further helped in IP generation.					
28.3	HEI have collaborations with R&D centers and industries outside India.					
28.4	Collaborations with industries outside India are serving better for IP generation than collaborations within India.					
28.5	R&D size of the collaborated company matters for successful research outcomes and IP generation.					

29. Does your HEI have research policy/mission/vision statements in IP policy to promote R&D activities of national priority to encourage innovation and IP generation in those thrust areas?

(1) ☐ Yes (2) ☐ No

30. If your answer is Yes, please specify whether your HEI has mission oriented research initiations and capabilities in the below given thrust areas. Please tick all that are applicable.

(1) ☐ Agriculture and pisciculture (2) ☐ Green technologies (3) ☐ Energy efficient equipments (4) ☐ Affordable drugs in neglected diseases/high incidence/life threatening

(5) ☐ Food technology (6) ☐ Nano technology (7) ☐ New materials

(8) ☐ Not applicable (9) ☐ Any other, specify _____ **ii.**

R&D funding

31. Please specify approximate R&D budget of the institution/university per annum (excluding external sources) in the last 10 years.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
HEI's R&D expenditure										

iii. R&Doutput

32. Please specify the approximate annual number of high quality research journal publications produced by your institution/university.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
No. of high quality publications made										

PART-D Questions about Barriers for successful IP generation and technology transfer

33. Please specify, whether the given variables are **barriers towards IP generation**
Please tick mark ( ) as appropriate.

Sl. No.	Variables	Major barrier	Minor barrier	Not a Barrier
33.1	Lack of funding for research project/developing idea into practice(Lack of fund includes no financial support from institution in filing & maintaining IP rights)			
33.2	Delay of releasing fund for research project			
33.3	Lack of innovation facilities			
33.4	Lack of technical guidance and support system			
33.5	Lack of IP awareness among staff & researchers			
33.6	Lack of financial support to researchers			
33.7	Lack of sufficient skilled IP professional			
33.8	Lack of full time working staff in University IP cell			
33.9	Lack of researchers focusing on research projects in current research areas			

33.10	If any other, please specify and tick the barrier level as appropriate i. ii.			

34. Please specify, whether the given variables are **barriers towards Technology Transfer**. Please tick mark ( ) as appropriate.

Sl. No.	Variables	Major barrier	Minor barrier	Not a Barrier
34.1	Lack of financial support for managing intellectual property after registration/grant			
34.2	Lack of facilities for incubation/commercialization activity			
34.3	Lack of entrepreneurial guidance/training for commercialization activity			
34.4	Low commercial value of innovation			
34.5	Lack of efficient management level communication channels			
34.6	Complexity of the innovation			
34.7	Lack of interest shown by the industry to license the technology			
34.8	Lack of government support			
34.9	If any other, please specify and tick the barrier level as appropriate i. ii.			

35.Please mention the views of the higher management of your institution/university on strategies and future plans of Intellectual Property and Innovation activities to promote research. Please **tick one** as per your institution's priority level.

Annexure

Sl.No.	Top management strategy	Priority level				
		High focus	**Medium focus**	**Low focus**	**Planned for future**	**Not relevant**
34.1	Establishing research teams for making innovations in basic research					
34.2	Establishing research teams for making innovations in applied research					
34.3	Generating consistent & sufficient funds for specialized research teams					
34.4	Promoting IP Asset generation of institution					
34.5	Commercialization of IP					

34.6	Promoting IP generating research collaboration with industries					
34.7	Collaborative commercialization of IP based innovations					
34.8	Supporting start-ups/spinoffs by faculty/students/staff					
34.9	Collaborative research with top global 100 universities					
34.10	Improving research funding from government					
34.11	Improving research funding from industries.					

36.What are the barriers to achieve the stated objectives of your HEI in terms of IP/Innovation/Research?

37.In your opinion, what changes could be made in the National IPR Policy to make it more favorable to generate IP in HEIs?

Annexure

Annexure 2: List of HEIs participated in the study

HEI Name

Andhra university	Kuvempu University	IISER Kolkata
RIPER Ananthapur	Bharatiar university	IIT Ropar
UPES	IICT	IIT Delhi
NIT Warangal	Pandit RaviShankar Shukla university	IIT Dhanbad
Bharatheedasan university	Savithribaiphule Pune university	IISER Mohali
IIT-Kanpur	Rajiv Gandhi university of Health Sciences	IIT Patna
NIT-Allahabad	Central university of Punjab	IIT Bhubaneswar
NIT-Jalandhar	IIEST Shibpur	IGIB
NIPER-Hyderabad	IISER Tirupati	Sri Devaraj Urs Academy of Higher Education and Research
JSS	IIT Gandhinagar	IIT Allahabad
Gujarat tech university	NIT Raipur	NIT Puducherry
NIT Karnataka	NIT Manipur	NIT Rourkerla
CSIR-Central Drug Research Institute	IISER Thiruvanantapuram	
IIIT Hyderabad	Shivaji University	Maharshi Dayanand University
The Gandhigram Rural Institute	NIT Calicut	CCMB
ICGEB, New Delhi	Institute of Himalayan Bioresource Technology	Padmavati Mahila Vidhyalaya
IIT Kanpur	Indian Institute of Toxicology Research	IIT Goa
Yenepoya University	Sri Ramachandra university	IIT Indore
IIS deemed to be University	IIT Kharagpur	JNTU-H
Tezpur University	Central Leather Research Institute	
Gitam Deemed to be university	Marwadi university	
Chitkara University, Punjab	Mizoram university	
IISER Pune	IISc	
IIT Palakkad	NIT Agartala	
IIT Tirupati	IIT Madras	
NIT-Tiruchurapalli	IIT Hyderabad	

Annexure

Annexure-3: Research output of Indian HEIs (publications)

Indexed by Web of Science from 2010-2020 (collected during May 2021-July 2021)

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
IIT Kanpur	IIT System	831	863	942	1041	1157	1302	1466	1488	1565	1573	1475	13703
IIT Tirupati	IIT System	0	0	0	0	0	0	8	26	64	79	120	297
IIT Goa	IIT System	0	0	0	0	0	0	0	0	4	11	9	24
IIT Ropar	IIT System	18	45	83	103	174	217	205	250	309	393	353	2150
IIT Delhi	IIT System	998	1009	1169	1386	1505	1604	2023	2071	2143	2249	2214	18371
IIT Dhanbad	IIT System	114	146	212	309	407	692	1043	1103	1349	1275	1252	7902
IIT Patna	IIT System	35	76	91	140	179	233	265	309	400	480	494	2702
IIT Bhubaneswar	IIT System	29	43	87	142	195	222	265	338	461	451	422	2655
IIT Madras	IIT System	1142	1154	1185	1255	1487	1683	1888	2132	2390	2647	2381	19344
IIT Bombay													0
IIT Hyderabad	IIT System	39	79	134	213	328	401	439	525	688	772	820	4438
IIT Kharagpur	IIT System	1334	1281	1455	1546	1718	1994	2161	2186	2381	2578	2371	21005
IIT Guwahati	IIT System	507	591	666	774	912	976	1245	1344	1573	1659	1538	11785
IIT Roorkee	IIT System	708	748	1015	968	1184	1422	1572	1578	1644	1672	1705	14216
IIT Gandhinagar	IIT System	18	14	32	72	132	194	249	325	299	401	456	2192
IIT Jodhpur	IIT System	4	17	36	42	66	109	138	173	239	249	331	1404
IIT Ropar	IIT System	18	45	83	103	174	217	205	251	312	400	379	2187
IIT Mandi	IIT System	2	17	29	59	128	197	249	279	377	344	410	2091
IIT Palakkad	IIT System	0	0	0	0	0	1	9	22	61	91	96	280
IIT Indore	IIT System	10	16	87	170	260	297	417	515	650	771	726	3919
IIT Bhilai	IIT System	0	0	0	0	0	0	0	1	28	60	79	168
IIT Jammu	IIT System	0	0	0	0	0	0	0	3	35	63	96	197
IIT BHU	IIT System	269	348	290	420	456	519	678	695	768	1005	1176	6624
IIT Dharwad	IIT System	0	0	0	0	0	0	0	5	33	48	49	135
IISER Mohali	IISER system	35	53	79	104	140	157	189	257	292	338	322	1966
IISER Kolkata	IISER system	118	151	203	211	274	278	337	378	377	448	472	3247
IISER Pune	IISER system	58	103	155	192	222	284	406	492	530	524	493	3459
IISER Berhampur	IISER system	0	0	0	0	0	0	1	3	14	58	66	142

Annexure

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
IISER Bhopal	IISER system	20	35	47	100	149	168	263	297	285	320	338	2022
IISER Thiruvananthapuram	IISER system	19	33	43	64	86	80	153	171	161	149	202	1161
IISER Tirupati	IISER system	0	0	0	0	0	3	15	37	58	94	144	351
CSIR CLRI	CSIR	160	177	200	185	214	217	163	139	130	153	146	1884
CSIR IGIB	CSIR	105	138	158	171	163	192	202	177	179	150	141	1776
CSIR CCMB	CSIR	132	174	172	185	162	167	150	153	143	118		1556
CSIR CDRI	CSIR	320	332	302	312	384	380	393	336	326	291	256	3632
CSIR ICGEB	CSIR	207	221	253	252	280	308	253	279	257	233	276	2819
CSIR CBRI	CSIR	1	1	4	3	3	4	2	7	11	13	12	61
CSIR CECRI	CSIR	126	154	129	155	211	178	207	263	281	282	244	2230
CSIR CEERI	CSIR	42	72	84	85	104	137	135	111	151	138	119	1178
CSIR CFTRI	CSIR	194	219	207	175	208	260	192	187	171	163	200	2176
CSIR CIMAP	CSIR	92	78	102	123	149	122	117	96	88	104	65	1136
CSIR CIMFR	CSIR	25	24	38	54	53	46	71	53	71	67	78	580
CSIR CMERI	CSIR	6	9	44	71	65	62	80	42	62	74	67	582
CSIR CRRI	CSIR	6	14	10	25	17	15	41	28	32	21	27	236
CSIR IICB	CSIR	156	178	224	223	242	224	266	189	221	190	183	2296
CSIR IICT	CSIR	528	576	643	595	797	767	713	659	589	556	447	6870
CSIR IIIM	CSIR	66	91	107	151	150	164	182	165	126	137	127	1466
CSIR IITR	CSIR	136	195	134	136	143	134	146	141	135	138	97	1535
CSIR IHBT	CSIR	68	100	104	103	87	108	107	96	81	104	153	1111
CSIR IMTECH	CSIR	82	83	120	120	135	120	134	107	112	91	108	1212
CSIR IMMT	CSIR	92	99	122	141	157	122	127	118	115	124	163	1380
CSIR NBRI	CSIR	122	115	123	134	114	141	159	139	120	144	136	1447
CSIR NAL	CSIR	70	91	128	149	166	140	202	141	125	107	94	1413
CSIR NEERI	CSIR	116	118	119	82	111	103	116	111	136	120	143	1275
CSIR NGRI	CSIR	155	159	171	172	176	144	138	154	148	143	172	1732
CSIR NIIST	CSIR	190	207	153	188	222	229	214	248	239	199	226	2315
CSIR NIO	CSIR	178	192	183	185	220	219	187	227	206	204	235	2236
CSIR NISCAIR	CSIR	23	15	22	20	10	4	5	16	11	5	14	145
CSIR NISTADS	CSIR	13	5	11	12	9	9	10	10	5	1	11	96
CSIR NML	CSIR	132	103	117	142	124	94	104	96	103	119	118	1252

Annexure

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
CSIR NEIST	CSIR	45	64	55	78	85	99	98	114	134	126	122	1020
CSIR SERC	CSIR	19	37	36	51	41	61	43	57	59	66	69	539
CSIR IIP	CSIR	32	36	50	61	84	123	100	78	72	83	100	819
CSIR CGCRI	CSIR	143	156	165	179	198	194	206	180	194	198	158	1971
IIIT Hyderabad	IIIT System	100	101	101	145	139	213	262	244	270	245	197	2017
IIIT Gwalior	IIIT System	43	55	78	99	120	114	89	75	93	87	107	960
IIIT Kanchipuram	IIIT System	11	7	15	20	17	28	48	46	60	76	108	436
IIIT Kottayam	IIIT System												0
IIIT Allahabad	IIIT System	28	41	45	79	105	164	164	194	211	235	284	1550
IIIT Jabalpur	IIIT System	12	31	48	88	101	156	202	192	241	163	193	1427
The Gandhigram Rural Institute	Central	99	120	118	113	129	139	184	139	126	156	146	1469
Yenepoya University	Private Deemed	29	24	28	28	21	41	64	55	82	80	135	587
IIS Deemed to be University	Private Deemed												0
Tezpur Central University	Central	133	169	232	297	375	348	348	406	350	324	308	3290
Gitam Deemed to be university	Private Deemed	48	67	102	89	119	210	225	248	299	276	274	1957
Chitkara University	Private Deemed	14	12	16	26	27	66	37	47	67	112	247	671
JNU	Central	293	388	435	384	541	588	688	699	869	836	887	6608
NIT Nagpur	NIT System	60	76	99	108	189	232	390	431	563	506	461	3115
NIT Jalandhar	NIT System	98	87	99	137	125	158	195	185	321	343	406	2154
NIT Raipur	NIT System	22	27	24	40	82	139	199	272	299	368	464	1936
NIT Rourkela	NIT System	210	223	345	451	565	736	833	926	1017	1037	1038	7381
NIT Silchar	NIT System	35	37	39	76	162	217	244	313	422	478	528	2551
NIT Srinagar	NIT System	21	18	14	30	63	66	76	123	125	171	229	936
NIT Surat	NIT System	112	137	187	233	300	278	328	357	420	385	408	3145
NIT Karnataka	NIT System	148	234	185	258	358	461	480	528	765	703	644	4764
NIT Trichy	NIT System	225	290	366	403	510	481	550	599	657	832	899	5812
NIT Warangal	NIT System	79	132	148	199	283	333	340	386	475	505	564	3444
NIT Delhi	NIT System	0	0	0	8	16	23	39	47	78	127	131	469
NIT Mizoram	NIT System	0	0	0	3	5	12	25	28	48	53	72	246
NIT Sikkim	NIT System	0	0	3	3	5	8	8	27	67	46	53	220

Annexure

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
NIT Puducherry	NIT System	0	1	1	5	18	19	16	25	19	38	52	194
NIT Agratala	NIT System	9	21	50	69	118	152	234	220	212	249	264	1598
NIT Allahabad	NIT System	125	123	191	238	269	283	310	365	389	378	483	3154
NIT Arunachalpradesh	NIT System	0	0	2	3	12	43	49	53	45	52	81	340
NIT Bhopal	NIT System	48	56	101	133	155	176	213	265	256	233	248	1884
NIT Calicut	NIT System	73	112	150	194	221	290	315	349	381	459	439	2983
NIT Durgapur	NIT System	168	190	253	273	350	397	425	454	439	513	466	3928
NIT Goa	NIT System	0	0	2	4	5	39	48	74	100	109	94	475
NIT Hamirpur	NIT System	106	133	117	149	182	165	180	189	205	180	240	1846
NIT Manipur	NIT System	0	0	4	5	7	26	35	82	79	104	119	461
NIT Meghalaya	NIT System	0	0	1	10	24	54	99	90	154	146	195	773
NIT Nagaland	NIT System	0	0	1	3	5	11	14	27	39	55	81	236
NIT Patna	NIT System	1	10	14	15	34	58	124	133	200	250	391	1230
NIT Jamshedpur	NIT System	3	8	11	43	31	60	72	75	103	123	193	722
NIT Kurukshetra	NIT System	81	102	109	131	372	411	482	411	520	426	368	3413
NIT Uttarakhand	NIT System	0	0	1	5	8	5	34	45	67	82	81	328
NIT Andhrapradesh	NIT System	0	0	0	0	0	1	15	3	33	57	55	164
NIT Jaipur	NIT System	62	80	111	161	210	276	415	489	536	545	596	3481
IISc	IISc	1686	1719	1915	2064	2306	2351	2351	2489	2759	2723	2493	24856
ICMR BMHRC	ICMR	19	24	20	15	14	12	6	15	4	4	6	139
ICMR National Institute of Medical Statistics	ICMR	7	6	4	2	3	11	13	9	15	20	35	125
ICMR National Institute of Nutrition (NIN)	ICMR	45	75	87	106	73	71	78	83	93	94	100	905
ICMR NIV	ICMR	44	41	52	43	60	57	68	52	59	67	78	621
ICMR AIDS research Institutte	ICMR	20	33	50	47	36	35	34	31	31	35	53	405
ICMR NCDI	ICMR	5	5	1	2	5	1	3	2	13	14	8	59
ICMR NIIRNCD	ICMR	5	2	5	0	4	3	4	1	4	2	1	31
ICMR NIREH	ICMR				1	1	2	7	10	25	23	31	100
ICMR NIRH	ICMR	36	35	31	65	56	56	76	55	74	56	72	612

Annexure

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Maharshi Dayanand University	State	78	97	133	153	154	141	190	174	201	236	307	1864
JNTU Hyderabad	State	0	0	0	1	3	1	1	2	2	9		19
Mizoram university	State	30	42	51	48	53	81	124	99	101	114	179	922
Marwadi university	Private Deemed												0
Sri Ramachandra university	Private Deemed	84	104	81	116	95	119	142	141	113	155	189	1339
Shivaji University	State	211	273	229	282	257	295	317	326	265	296	270	3021
Central university of Punjab	Central	3	3	8	9	53	49	104	130	120	152	214	845
Savithribaiphule Pune university	State	378	398	409	439	508	673	775	744	696	723	705	6448
Pandit RaviShankar Shukla university	State	61	46	57	73	74	105	131	109	96	83	114	949
Bharatiar university	State	222	230	297	342	427	467	570	684	701	639	607	5186
Kuvempu University	State	91	103	146	114	108	73	81	120	90	94	118	1138
Padmavati Mahila Vidhyalaya	Private Deemed	22	22	12	15	13	16	26	29	35	26	32	248
Chitkara University, Punjab	Private Deemed	14	12	16	26	27	66	37	47	68	116	255	684
Gitam Deemed to be university	Private Deemed	48	67	102	89	119	210	227	248	299	277	324	2010
Tezpur University	Central	133	169	232	297	375	348	348	406	354	351	321	3334
Yenepoya University	Private Deemed	29	24	28	28	21	41	64	55	82	79	139	590
The Gandhigram Rural Institute	Central	99	120	118	113	129	139	184	139	126	157	153	1477
Gujarat tech university	State	1	4	8	15	16	31	78	52	43	44	73	365
JSS Academy of Higher Education	Private Deemed	85	78	96	153	121	130	149	134	147	179	283	1555
NIPER-Hyderabad	Central	3	8	11	17	50	66	61	69	45	43	91	464
Bharatheedasan university	State	206	304	277	285	341	349	335	317	347	351	473	3585
UPES	Central	3	11	21	34	72	120	117	123	270	179	253	1203
Andhra university	State	222	224	304	233	249	278	340	292	364	307	303	3116

Annexure

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
JNU	Central	293	388	435	385	541	588	688	699	870	848	880	6615
BHU	Central	985	1146	1100	1239	1283	1307	1317	1310	1460	1558	1675	14380
University of Hyderabad	State	488	574	641	645	653	747	732	684	654	765	752	7335
Calcutta university	State	492	620	753	799	919	1000	958	970	911	925	1002	9349
Jadavpur university	State	822	909	1091	1113	1307	1349	1450	1422	1448	1326	1374	13611
Anna university	State	628	788	980	1256	1434	1347	1388	1402	1365	1601	1766	13955
Amrita Viswavidya peetam	Private Deemed	178	220	303	324	504	724	902	1305	1307	1025	891	7683
Manipal Academy of Higher Education	Private Deemed	456	513	516	602	673	770	1023	1128	1296	1501	1748	10226
Aligarh Muslim University		556	615	728	668	656	687	763	806	937	1041	1056	8513
Jamia Millia		281	264	354	326	416	525	468	542	681	807	863	5527
University of Delhi		1034	1218	1332	1376	1479	1446	1573	1533	1706	1633	1805	16135
Jamia Hamdard		214	264	297	313	314	279	319	275	290	397	506	3468
Homi Baba National Institute	Central	11	28	46	59	83	111	339	1199	1784	2049	2262	7971
Vellore Institute of Technology	Private Deemed	302	347	547	767	1042	1246	1393	1888	2019	2123	2461	14135
University of Madras	State	306	360	321	317	358	334	345	395	390	409	506	4041
Punjab university	State	570	688	719	732	845	956	1019	939	1069	1142	1178	9857
University of Kerala	State	116	145	138	149	143	177	164	222	218	208	292	1972
BITS Pilani	Private Deemed	177	242	300	398	535	682	756	720	863	994	1161	6828
Siksha O Anusandhan	Private Deemed	47	101	167	153	247	313	348	297	414	364	518	2969
Osmania university	State	229	276	288	280	357	370	442	367	372	334	352	3667
Thapar Institute of Engineering and Technology	Private Deemed	154	251	303	400	522	607	662	680	950	959	1051	6539
Alagappa university		106	164	169	218	191	204	246	240	289	358	504	2689
Mahatma Gandhi University		100	98	103	108	166	162	156	208	237	290	298	1926

Annexure

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Kalinga Institute of Industrial Technology	Private Deemed	49	52	77	117	241	329	358	429	573	496	579	3300
SRM Institute of Science and Technology	Private Deemed	104	164	238	422	387	489	481	743	1133	1239	1484	6884
JSS Academy of Higher Education	Private Deemed	85	78	96	153	121	130	149	134	147	179	283	1555
Tata Institute of Social Sciences	Private Deemed	19	38	26	37	29	58	64	50	56	73	85	535
Bharath Institute of Higher Education & Research	Private Deemed	14	14	22	41	39	53	71	79	98	115	122	668
Viswa Bharati	Central	164	231	267	299	306	337	370	380	449	405	409	3617
G. B. Pant Universtiy of Agriculture and Technology	State	138	156	157	143	142	154	161	162	178	180	187	1758
North Eastern Hill University	Central	100	109	130	162	144	183	167	194	216	220	218	1843
Shanmugha Arts Science Technology & Research Academy	Private Deemed	54	93	203	241	387	428	433	566	550	677	691	4323
Sathyabama Institute of Science and Technology	Private Deemed	44	60	115	176	260	388	392	454	280	474	566	3209
Gauhati University		102	100	152	193	208	232	245	233	248	300	285	2298
Saveetha Institute of Medical and Technical Sciences	Private Deemed	23	21	26	42	56	50	47	53	104	148	452	1022
Tamilnadu Agricultural University	State	109	101	82	96	124	147	142	139	125	128	192	1385
Madurai Kamraj University	State	137	222	214	225	266	272	252	287	272	235	245	2627
Dr. D. Y. Patil Vidyapeeth	Deemed	26	26	31	35	80	56	70	75	109	133	248	889

Annexure

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Pondicherry University	Central	147	228	249	325	387	450	396	501	499	455	448	4085
Sri Venkateswara University	State	183	263	297	359	318	325	314	277	255	253	221	3065
Koneru Lakshmaiah Education Foundation University	Private Deemed	22	32	65	70	93	140	163	187	316	347	493	1928
Punjab Agricultural University	State	149	168	186	181	203	251	236	241	278	352	469	2714
Shiv Nadar University	Private Deemed		3	13	50	73	123	124	146	179	196	245	1152
University of Kashmir	Central	56	89	126	181	211	235	242	258	262	237	300	2197
University of Mysore	State	299	339	238	244	268	280	286	279	267	220	251	2971
Guru Nanak Dev University	State	247	252	270	321	363	412	460	435	467	457	483	4167
Symbiosis International University	Private Deemed	1	6	29	21	144	63	99	105	95	140	134	837
SVKM`s Narsee Monjee Institute of Management Studies	Private Deemed	39	45	40	52	57	104	90	124	137	210	250	1148
Banasthali Vidyapith	State	42	80	91	157	202	184	219	165	211	252	228	1831
Bharati Vidyapeeth	Deemed	103	117	109	177	151	154	217	188	189	188	224	1817
CCS HAU	Central	100	85	81	87	75	59	54	66	91	143	183	1024
Calicut University	State	50	62	71	88	92	114	159	171	181	193	156	1337
Cochin University of Science and Technology	State	254	253	264	256	287	343	309	313	325	411	407	3422
Guru Gobind Singh Indraprastha University	State	92	107	121	133	176	213	221	198	230	235	246	1972
Anand Agricultural University		50	52	59	57	72	88	66	60	66	43	57	670
Periyar University	State	94	83	112	125	166	162	185	181	185	221	288	1802

Annexure

Institution	Affiliation	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
KLE Academy of Higher Education and Research	Private Deemed	83	116	123	103	84	89	105	87	88	94	113	1085
NITTE	Private Deemed	51	41	51	62	44	63	60	42	69	81	96	660
Kuvempu University	State	91	103	146	114	108	73	81	120	90	94	118	1138
University of Jammu	Central	84	111	135	138	145	177	193	190	191	266	247	1877
Dayalbagh Educational Institute	Deemed	43	50	65	69	67	55	72	54	60	39	54	628
Sri Venkateswara Institute of Medical Sciences	State												0
Dr. Babasaheb Ambedkar Marathwada University	State	125	145	106	93	83	92	139	168	150	131	140	1372
Dibrugarh University	State	58	76	68	68	95	86	98	99	103	121	137	1009
Mangalore University	State	265	333	113	90	145	152	156	155	230	232	227	2098
The University of Burdwan	State	157	182	211	242	265	267	202	238	215	253	299	2531
Maharshi Dayanand University	State	78	97	133	153	154	141	190	174	201	236	307	1864
Kalyani University	State	187	193	216	305	276	263	263	274	242	263	281	2763

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