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IS INDIA ON THE RIGHT TRACK OF BECOMING AN ACADEMIC RESEARCH INNOVATION HUB?

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Abstract

The pace and the quality of technological advancement is an important marker of a country's economic welfare and overall development. Reaching the heights of technological advancement is one of the DPSPs and a permanent fixture on most political parties' manifesto. A country like India with its huge youth population and a knack for 'jugaad' is in a great position to achieve the same. However, lack of infrastructural support and capital often results in innovators, especially student innovators to shelve their ideas even before they begin. In this paper, the authors have made an attempt at explaining how the practice of technology transfer and diffusion of innovation by these innovators, via their alma mater in collaboration with industrial firms, can help provide these innovators successfully transform their ideas into a marketable service/ product and commercialize the same with ease. The existing literature on the subject in Indian context is albeit limited, compared to other nations, therefore the authors have made an attempt at contributing to the literature in the Indian context – though this attempt will be one among many continuing efforts that need to be made to truly encompass the subject matter.

Keywords: student, innovation, technology transfer, diffusion of innovation, university-industry collaboration

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INTRODUCTION

Technology and innovation have become another source of economic health for nations. Businesses' ability to innovate and to commercialize these scientific and technological breakthroughs is important to stay relevant. Intellectual Property Rights [IPRs], such as patents and trademarks, are the legal instruments which have been used to promote industrial development and economic growth by giving the creator of an innovation exclusive monopoly over the use of and the revenue generated from the innovation unless transferred or infringed by a third party.[3] This cuts down on rapid imitation which could eat into the innovator's profits or decrease the incentive to innovate. However, this in turn restricts the availability of the technology by increasing its cost. This further acts as a barrier – companies are prevented from developing the original innovation or create newer technology by using the older innovation, since most of the times any developments or iterations to an existing IP are also granted protected.[4] The productivity enhancing utility is also lost in lieu of protecting the monopoly of the original innovator. Hence, IPR is an embodiment of policy conflict - conflict between the objective to encourage technological innovation by providing substantial perks and the need for rapid spread and diffusion of new technology to make newer and improved technological knowledge to become more accessible to the relevant market.[5] The people for whom this innovation was meant to act a solution are the biggest losers due to the aforesaid approach of in the existing IPR regime.

With science and technology evolving at an exponential rate across a plethora of subject matters, it is creating immense pressure on IP regimes across the globe. The intensive research and development [R&D] activities are resulting in a major hike in the cost of innovation and therefore, need substantial investment and protection.[6] Simultaneously, the innovation life cycle is shrinking at an equally short rate in IPR sensitive industries. This time crunch puts a heavy toll on rapid protection and commercialization of the innovation.[7] More often than not, innovations have gone beyond the old categories of protectable subject matter, which makes innovation a risky investment. This often leads to innovators abandoning their work – due to

[3] National Research Council. 1993. *Global Dimensions of Intellectual Property Rights in Science and Technology*. Washington, DC: The National Academies Press. https://doi.org/10.17226/2054
[4] *Id*
[5] *Id at 1*
[6] Ritesh Kumar Singh, *Innovate in India: The country cannot afford to wait any longer for a robust intellectual property rights regime*, Firstpost, May 03, 2018 Innovate in India: The country cannot afford to wait any longer for a robust intellectual property rights regime-Business News, Firstpost
[7] *Id*

lack of capital or tedious laws which make the innovation go obsolete even before it can be registered much before its actual commercialization.

An example of a country that falls prey to above mentioned issues is India – patent productivity in the country is considerably low compared to that of Japan, USA, China and South Korea. Though the number of patent filings in India have gained substantially owing to the programs like Startup India, however the quality of the patents have generally deteriorated. The relatively fragile IPR regime in our country coupled with under-staffed offices of IPR regulators results in long duration for an application to be accepted or rejected, sometimes long enough to make the innovation go obsolete. This runs against the objective of making India the hub for technology and innovation and the startup India campaign has in reality worsen the situation.

Every year numerous Indian students and researchers come up with innovations, however most take ages to get registered or come into use either due to lack of capital or because of lack of minimum infrastructure and effective ecosystem. Entrepreneurship is a process of developing, organizing and then [hopefully] earn profits from this organized development. Harnessing the power of imagination and innovation to reach the final result – a product, a company or a social movement – is at the core of entrepreneurial manifestation. However, more often than not, students and researchers have the ideas and but no infrastructure viz. funding, manufacturing facility, marketing, sales, etc. to support the transformation of this idea into the final reality. Across countries commercializing student innovations has been on the rise and is gaining attention from universities, politicians and industrialists alike. This idea of monetizing innovation produced by students is being embraced by most advanced economies of the world. So instead of struggling with such incapacities, University innovation particularly can instead be fast-tracked through a process called technology diffusion.

Through the course of this article the authors are going to discuss; i) what is technology diffusion; ii) how technology diffusion is used by countries successfully to increase the pace and quality of innovation; and iii) propose a model to be implemented in India and discuss how the same can save the untimely death of numerous innovations owing to the current approach. Universities, Governments and Industry are the primary stakeholders in this regard and if they endeavor to provide genuine and significant support to innovation, research and development and effectively allocate their resources then the chances of success of an innovation become manifold. A dynamic intellectual property-based strategy needs to be formulated where the original innovator is rewarded on *pro rata* basis based on the stage of the innovation or product

development. The fundamental objective in this has to be the safeguard of the innovation in a manner that its development and market entry is expedited through industry participation so that the innovation is able to reach the desired customer base on time.

In fact, as per Forbes report, out of the 2.1 million active US patents hardly 5% have reached the market. About 90% of the patents fail to be commercialized or find angel investors or licensees. These unlicensed patents include over 50,000 high-quality patented inventions belonging to universities. Similarly, in India, no more than 5% of patents reach the market.[8] There are several factors and variables for this dismal numbers but I have limited my focus on how an effective IP strategy at the ideation stage can help to avoid the Valley of Death thereby reducing the chance of failure and increasing the change of commercialization.

Whether an innovation should be developed in-house or with partners, or whether it will be licensed out. Essentially, it is a question of governance form dealing with ownership of innovation with three options: development and commercialization being in-house, commercializing the innovation with others either through an alliance or via licensing, or selling it to others for them to commercialize.[9] In other words, when a technological innovation has an estimated potential to earn high returns, but the firm does not have the capabilities to develop the assets necessary for bringing the innovation to market, the available options are to develop the innovation with partners or license it out .[10]This would be the best strategy for most technological innovations by students and researchers at University level owing to their lack of experience post product development stage. The timely decision in this regard can provide value to the invention through commercialization and prevent it from being a trophy in a laboratory.

TECHNOLOGY DIFFUSION – THE WHAT AND THE WHY

Adoption of new technology and innovation- whether costly R&D or opportune discovery- is a necessary ingredient for achieving sustainable long-term growth.[11] Steady innovation derives its importance from the fact that technology is used in a diverse manner across a spectrum of users, regions and purposes. Therefore, diffusion of technology across domestic and international borders is as critical as upgrading technology for long run growth. Diffusion in

[8] DPS Parmar, *Commercializing patents: Methods and challenges,* LexOrbis, https://www.vantageasia.com/commercializing-patents-methods-challenges/
[9] (Zahra, 1996)
[10] (Friedman, 2006).
[11] TECHNOLOGY DIFFUSION Nancy Stokey Working Paper 27466 http://www.nber.org/papers/w27466 july 2020

most cases is the opposite of protection and is an innovative approach to reach out commercialization. Technology diffusion encourages multiple firms to promote and distribute the technology and thereby, accelerate its development. Diffusion of technology is the process by which evolving technology is spread and used by the masses.[12] The rate of diffusion depends on several factors such as nature and quality of the development, the means of communicating the information and the demographics of the population in which the technology is introduced.[13] It is important to understand the process of diffusion to use it to commercialize IP to maximum extent without sacrificing much of the perks associated with protecting one's IP.

What is diffusion of innovation and technology transfer?

According to the 'Diffusion theory' by Everett M Rogers there are four elements that affect the diffusion process – innovation, communication channels, social system and time.[14]

Innovation- an innovation's characteristics influence the pace at which it will get adopted. The complexity, adaptability, compatibility and its visibility determine whether or not the innovation will be adopted and by what percentage of the population.[15]

Communication Channel – these channels are the means by which word reaches the masses. Greater the concentration of news and prolificity of the channel, greater will be the pace and rate at which the innovation will be adopted.[16]

Social System – Rogers defined social system as a set of inter-related units. A unit may be an individual, a group or organization. The cooperation in a social system can impede or facilitate adoption, a development's compatibility with the societal structure adds to the probability of its adoption. Human capital is necessary to make any innovation successful.[17]

Time – time is an important variable in the study of diffusion, the interval between first knowledge and opinion formation to final confirmation or rejection of the innovation affects the frequency of adoption.[18]

[12]https://sphweb.bumc.bu.edu/otlt/MPH-Modules/HPM/AmericanHealthCare_Technology-Drugs/AmericanHealthCare_Technology-Drugs2.html
[13]https://sphweb.bumc.bu.edu/otlt/MPH-Modules/HPM/AmericanHealthCare_Technology-Drugs/AmericanHealthCare_Technology-Drugs2.html
[14] https://crm.org/articles/diffusion-of-innovations
[15] https://crm.org/articles/diffusion-of-innovations
[16] https://crm.org/articles/diffusion-of-innovations
[17] https://crm.org/articles/diffusion-of-innovations
[18] https://crm.org/articles/diffusion-of-innovations

The Diffusion of Innovation has proved to be beneficial across various sectors. The most appropriate example to showcase that diffusion leads to development of the society as well, *inter alia,* is the technology used in X-ray scanning. Developing this kind of technology in the 1890s was no short of magic since it enabled non-invasive method of viewing what is inside the human body – providing the requisite 'relative advantage' that would make the society adopt this technology as soon as possible. The innovation was certainly not devoid of cons – the negative effects of radiation on health were evident. However, this didn't deter the social system since the technology had trialability and observability to its benefit. It was easy to try put an X-ray machine and see instant, tangible results which bulwarked its utility. These all factors combined to help X-ray technology get diffused rapidly across the globe and make it the biggest revenue generator in all of healthcare history.[19]

By defusing its innovation, the innovator can ensure that its version of the technology becomes the mainstream design, thereby assuring a competitive advantage for itself.[20] Microsoft hasn't always been the leader when it comes to web browsers. In 1995 Netscape Navigator had almost 80% of the market in its kitty. When finally, Microsoft created the Internet Explorer 1.0 and diffused its technology to PC and laptop manufacturers such as DELL, IMB, Toshiba, HP, etc. As per their agreement, these companies were to provide the Internet Explorer as the default browser in the Windows OS – which was also a Microsoft product. This put Microsoft in a dominant position in the market for web browsers with Internet Explorer capturing 96% of the usage share in 2001.[21]

Therefore, it is prudent that technology transfer through diffusion is promoted in economies to add to an economy's development. Research shows that universities are an important means of harnessing all possible sources of innovation, especially human capital.[22] Universities help leverage their assets, bridge the gap between funding for basic research, applied research and can provide the initial effort in commercializing this research.[23] Since technology is evolving at a rapid pace, universities have become a key stakeholder in the process of invention,

[19] https://crm.org/articles/diffusion-of-innovations
[20] Esteban Fernández, Sandra Valle, Battle for dominant design: A decision-making model, European Research on Management and Business Economics, Volume 25, Issue 2, 2019, Pages 72-78, ISSN 2444-8834, https://doi.org/10.1016/j.iedeen.2019.01.002.
[21] Esteban Fernández, Sandra Valle, Battle for dominant design: A decision-making model, European Research on Management and Business Economics, Volume 25, Issue 2, 2019, Pages 72-78, ISSN 2444-8834, https://doi.org/10.1016/j.iedeen.2019.01.002.
[22] W.F. Boh, U. De-Haan, R. Strom, University technology transfer through entrepreneurship: faculty and students in spinoffs, J Technol Transf (2015) doi: 10.2139/ssrn.2125203.
[23] W.F. Boh, U. De-Haan, R. Strom, University technology transfer through entrepreneurship: faculty and students in spinoffs, J Technol Transf (2015) doi: 10.2139/ssrn.2125203.

innovation and commercialization.[24] From the time Industrial Revolution set in, economic growth has been largely driven by the zeal for scientific understanding, application of solutions and continuous innovation.[25] For a profitable setting, the university setup should support all the steps of the process – from developing the idea to making sure the idea becomes a reality.[26]

A splendid example for proving the instrumentality of universities in the diffusion and technology transfer process would be the development of the process of irradiation. It is the process of infusing vitamin D in food and drugs. The developer of this process was speculative of the fact that his invention might be misused by unqualified individuals or organisations if not patented. He went on to create a university [of Wisconsin] affiliated entity that would accept patents and help license those and allocate the revenues to the innovator and the university without making them susceptible to any potential financial or legal liability. And thus 1924 witnessed the creation of one of the oldest technology transfer organization [TTO], the Wisconsin Alumni Research Foundation (WARF][27]. Thereafter it took another five decades, changing laws, trends in R&D investment, emergence of knowledge-intensive industries prioritization of technological innovation as a means of economic development, *inter alia,* to make TTO a stable system.[28] Technology transfer and diffusion of technology by universities help the industry to associate with potential innovators who in turn help them to connect to the market.[29] Industrialists and universities help students to develop the requisite entrepreneurial skills associated with maximizing commercial benefits the innovation can produce.[30] Through this collaboration, the industry based stakeholders help the student innovators navigate through the risks that emerge from the complex business ventures, while the university helps provide wider range of scientific skills and build the proper portfolio to engage in successful technological ventures.[31] Additionally, the increased data pool helps connect each student to a wide number of suitable avenues.

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[24] Commercializing University Innovations: A Better Way, Robert E. Litan, Lesa Mitchell, E.J. Reedy, AEI-BROOKINGS JOINT CENTER FOR REGULATORY STUDIES, May 2007 https://immagic.com/eLibrary/ARCHIVES/GENERAL/AEI_US/A070501L.pdf
[25] National Academy of Sciences and National Academy of Engineering 2006
[26] National Academy of Sciences and National Academy of Engineering 2006
[27] Sampat, Bhaven N. "Patenting and US Academic Research in the 20th Century: The World before and After Bayh-Dole." Research Policy 35, no. 6 (2006): 772-789.
[28] Id.
[29] Kenney, M., & Mowery, D. C. (2014). Public universities and regional growth: Insights from the University of California. Stanford, CA: Stanford University Press.
[30] D'Este, P., Mahdi, S. Neely, A., & Rentocchini, F. (2012). Inventors and entrepreneurs in academia: What types of skills and experience matter? Technovation, 32(5), 293–303
[31] Rasmussen, E., Mosey, S., & Wright, M.. (2014). The influence of university departments on the evolution of entrepreneurial competencies in spin-off ventures. Research Policy, 43(1), 92-106

Why do the stakeholders collaborate?

Companies getting involved with academic research has yielded concrete benefits, such as greater access to new ideas.[32] When a student innovates, the company is often the first entity to patent the same with the prospect of becoming a dominant entity in the industry. This collaboration bolsters the production of profitable ventures for innovations and increase the demand for external knowledge.[33] Universities seek collaborations with the industry to obtain funds and in return provide the years' worth of foundational research and work and tangible profits to these firms.[34] Research has found these collaborations help the industry stakeholders to stay ahead of the competition[35] and benefit their reputation.[36] Collaboration are an important component of technology transfer results for the industry.[37] Diffusion of innovation has had a positive impact on the society as well – these include development of energy efficient technology, improved medical applications and techniques, important electronic inventions like the computer, and several more. University-industry engagement leads to the creation of new firms, leading to industrial expansion and employment generation. Literature reveals university and student researchers engaging with companies have greater research performance.[38] Companies are at a better position to monitor societal needs and hence at a better position to channelize innovations to yield higher social impact.[39] On the other hand, the Universities are better suited for academic research and laboratory analysis. Comprehensive technology transfer results in a faster rate of diffusion which in turn leads to increased patenting.[40] Given the economic importance of intellectual property, the positive impact of technology transfer on diffusion of innovation and commercialization is evident.

GLOBAL SCENARIO

The authors believe that technology transfer and innovation diffusion are some of the most efficient ways of encouraging innovation and ensuring it earns its requisite monetary worth. We have discussed how beneficial the collaboration between universities and the industry for all the stakeholders involved – the student innovator, the university, the company facilitating

[32] Federica, Rosli and Yip 2014: 7
[33] Wunsch-Vincent (2012: 97)
[34] Chaguturu 2014: 8
[35] Datta 2011: 12
[36] Welsh et al. (2008: 8)
[37] 2012: 61
[38] Fabrizio and Di Minin 2008: 929
[39] Datta (2011: 13)
[40] Welsh et al. 2008: 1861

the technology diffusion and the society [or economy]. In this section the authors will be highlighting some of the most successful and prominent TTOs that account for a major portion of patents registered in their respective country. The IP and TTO regime of some countries has been discussed below:

1. The iVenture Accelerator instated at the University of Illinois is a year-long program wherein on-campus entrepreneurship units collaborate to provide expertise, facility to student innovators and connections to support promising ventures. The TTO has successfully contributed to the origination of more than a dozen of successful start-ups.
2. The Triton technology fund is a curative venture capital fund created specifically for supporting the students, staff, and alumni of the UC of San Diego who have created a licenced technology in the aegis of the university.[41]
3. Jacobs School of Engineering provides for a conducive system for university innovators through the von Liebig Entrepreneurism Centre wherein ideas are brought to the industry through training, mentorship, and funding. This TTO has helped establish more than 50 companies and supported over 200 start-ups.[42]
4. SPEAKall! is a enabling technology designed by Purdue University which is currently undergoing a licence-seeking process wherein the most efficient means of defusing the technology is being searched for. The technology is meant for helping autistic children communicate through speech therapy and remote learning. Students of Cornell University have devised the Combplex in collaboration with a start-up to help protect bees from the menace of Varroa mites. Geopipe is an AI based technology that creates immersive 3D models, created in furtherance of the NYU Summer Launchpad programme this technology is meant to be used to create 3D structures and models to be employed in medical and engineering processes.[43]
5. South Africa established the Technology Innovation Agency in 2008 with the aim of nurturing and increasing innovation to improve the standard of living in the country by commercializing novel technological developments. Various provincial offices were set up to facilitate the technology-entrepreneurs across the country by helping create proficiency focused markets for these entrepreneurs.[44]

[41] https://jacobsschool.ucsd.edu/vonliebig/ttf/
[42] https://ucsdnews.ucsd.edu/feature/supporting_student_innovation
[43] https://ip.com/blog/what-is-technology-transfer-with-examples/
[44] https://openscholar.dut.ac.za/bitstream/10321/1485/1/BANSI_2016.pdf

6. The University of Tokyo has Japan's biggest TTO which acts as a bridge between the university and the industry to diffuse innovation and acts as a one stop service provider for all IP based services needed by those associated with the University of Tokyo.
7. In Australia both university students and the staff can claim ownership of an innovation that has been created from publicly funded research subject to certain conditions. Students especially are entitled to claim ownership of any innovation created by them during the course of their education at the varsity – they are encouraged to make use of the university faculties which assist in commercialization of the innovation. The Australian IP regime gives an option to the students to hand over the rights of their intellectual property to the university in exchange of a portion of the revenue generated when the said innovation hits the markets.[45]
8. Universities in Canada increasingly indulge in collaboration with the industry for support and funds for research. The Ip regime of the country is not standardized therefore universities adopt different methods or models of collaboration which in turn goes to determine the willingness on the part of the student innovators to push for commercializing their innovation.[46]

Countries have fine-tuned their IP regime as per their developmental approach accordingly universities have devised their action plan for operating technology diffusion processes. However, the exercise of harmonizing and strengthening IPR protection is dynamic in nature.[47]

HOW WILL DIFFUSION HELP INDIA?

Education, especially higher education, has been an important part of India's socio-economic setup mainly due to its sheer population. Each year several students engage in innovation and technology based trades. Engaging universities in the reaping process for picking out the potential projects that can yield technological advancement can be the easiest way to tap into India's full potential. Historically, universities and educational institutions across the world have generated a range of innovations that have found their way to be commercialized.[48] University faculty not only have vast influence on the various aspects of the innovation and monetization, but also form the vital actors managing the knowledge transfer.[49] Several of the

[45] Christie et al. (2012: 18)
[46] (Kenney and Patton 2011: 112
[47] Breitwieser and Foster 2012: 51
[48] (Association of American Universities 1998 Bercovitz and Feldman 2006
[49] Markman et al. 2005a

these innovations are licensed by universities in their nascent stage of their development due to which a major chunk of the potential value of such developments lies in the tacit knowledge of the innovators and their alma mater.[50] University personnel are in a better position to gauge the potential of a research over time. Repeated engagement with consultation, advisory board service, industry sponsored research and commercialization process allows faculty members to have a mental vision board ready for each project – helping them confidently steer projects on the path of assured licensing and footing in the designated commercial market.[51] For India, technology transfer is mostly done by research organizations [mostly industry-based] that either have a designated cell or a cooperation with the industry[52] –

1. Technology Licensing Cell of Bhaba Atomic Research Centre[53]
2. Antrix of Indian Space Research Organisation[54]
3. Sponsored Research and Industrial Consultancy [SRIC] cell of IIT Kharagpur.[55]
4. C-Tech wing of the Defence Research and Development Organisation[56]
5. Foundation for Innovation and Technology Transfer [FITT] of IIT Delhi.[57]
6. Industrial Research and Consultancy Centre [IRCC] by IIT Bombay.[58]
7. Centre for Scientific and Industrial Consultancy [CSIC] at IISc Bangalore.[59]

These are the handful of the TTOs that are currently working in the country, however, these too help in research publications or obtaining a patent for an innovation, the part of marketing and commercializing is not done by these centres. More TTOs need to be set up in the country that will help cut down on the transactional costs associated with diffusing the scientific innovation into the market rapidly. Some of these transactional costs correspond to the tangible and intangible expenses linked with identification, protection, and modification of innovation and commercialization, as well as the administrative expenses and the opportunity costs for the time that would be required by researchers.[60] India has the advantage of having youth as the major portion of its population in terms of demographics. Adding to that is the Indians' knack

[50] (Jensen and Thursby 2001).
[51] Mansfield 1995
[52] https://www.nistads.res.in/all-html/Technology%20Transfer.html
[53] http://www.barc.gov.in/technologies/index.html
[54] https://www.isro.gov.in/about-isro/antrix-corporation-limited
[55] http://www.iitkgp.ac.in/sric/
[56] https://www.drdo.gov.in/technical-clusters
[57] http://www.fitt-iitd.org/
[58] https://www.ircc.iitb.ac.in/IRCC-Webpage/rnd/
[59] http://csic.iisc.ac.in/
[60] Phan and Siegel 2006

for upgrading or coming up with quick fixes for problems [.i.e. *jugaad*]. Keeping this in view there is an urgent need for creating more such institutions that will help diffuse technology and cater to the teeming number of inventive individuals in the country. Implementing a model that encourages universities to dis-unit its functions and assign them to specialists is seen as one of the most ideal models for any economy which intends to invest in TTOs and innovation diffusion.[61] IP Protection and its consequential commercialization is the traditional approach – this needs to be changed to bring in a legitimate change in the country and to make India a true hub for science and technology.

The Possible Business Models

There are several arrangements available that can be adopted for commercialising student innovations. The various options available have been discussed as under:

1. Direct Sale: when an innovation, product or service is offered by the university without incurring high capital costs and such a sale is guided by each institution's individual policy, it is known as direct sale. Herein, the product liability is a risk that is associated with the university and not the company/firm buying the said product or service.
2. Technology Transfer Broker: this is a convenient route for bringing the innovation to market. An agreement exists between the IPR owner [and innovator] and a broker for a royalty sharing model. The broker ensures that it will bear the costs of commercialisation in return for a share of the revenue generated by the said technology. Usually such a broker has an extensive network of potential patentees and expertise in the field of technology licensing.[62]
3. Research Collaboration: In this system, the research for innovation is collectively undertaken by the student innovator and the industrial firm that will finally help the innovation being developed into a product and then get commercialized. Specific intellectual property is exchanged for a research grant and a royalty-free licence is granted to the company. Student innovators become privy to share non-monetary benefits that emerge from the innovation which is decided by the stakeholders of the transfer process.[63]

[61] Phan and Siegel 2006
[62] Hedge 2010: 11
[63] https://immagic.com/eLibrary/ARCHIVES/GENERAL/AEI_US/A070501L.pdf

4. Open Source Route: this route puts in place a source code or a formula in public that can be used to for further innovation. The license for such open source codes is provided without any royalty, however an agreement is put in place between the owner of the source code and the person adapting providing for a revenue sharing system. This technique is widely used where an old technology has potential for development and this potential is monetised upon. Manuals and training is also provided by the creator of the older technology to quicken the pace at which this older technology can be built upon and commercialized. Usually, software based technology is diffused by using this method.[64]
5. Licensing: a licence agreement authorises a person to use the intellectual property created by its owner in exchange of an agreed amount of royalty fee. Such agreements help universities generate income from a company in exchange of the right to use the IP. The proceeds can be either in the form of an upfront fee charged at the time of agreement or be an annual royalty payment subject to the revenue or profit derived from its commercialization.[65] This model allows the innovator and the company to capitalize on the technology while simultaneously letting the innovator take care of potential business issues since the innovator retains the rights to his intellectual property.[66]

The Expected Result

Researchers in India are motivated by publication of their research and grant of patents rather than its commercialization.[67] Due to infrastructural and legal 'hazards' in the country the already risk averse society further cocoons in the comfort seeking satisfaction of journal publications as against proceeding to generate ideas and transform those to commercially viable products or services.[68] The Science, Technology and Innovation Policy was brought in 2013 to encourage innovation and research, transfer of technology and licensing but currently only a few institutions are funding research, and this too ends up in scientific journals.[69] Apart from filing and seeking IPR protection, the associated practices of IPR management [such as promotion] are equally necessary for an innovation's success and to increase the associated firm's value and decrease the connected costs in the long run.[70] Universities and TTOs can play

[64] (Southern African Research and Innovation Management Association 2013: 23
[65] Feldman et al. 2002: 113
[66] Lockett et al. 2005: 988
[67] Nandagopal (2013: 181),
[68] Sharma (2012: 2)
[69] Sharma 2012: 7
[70] Graham et al., 2008

this crucial rule of IP management for its student innovators which can help prevent any future IP related disputes [such as infringement and the subsequent litigation costs].[71] A conducive ecosystem for technological advancement not only consists of the legal regime of the country but also requires an infrastructure that will bolster the development by providing an institutional set up for business growth and collaboration.[72] The authors have explained through the scheme of this paper how university collaboration with industry leaders for diffusing of technology is the need of the hour. Therefore, it's high time that universities and industries push forth for and seek collaborations on their own accord to prevent losing any more disruptive innovations created by university students in light of lack of funds or infrastructural support.

CONCLUSION

The Indian IP regime has undergone significant developments over the years to encourage innovation and promulgate its protection and to ensure that innovations get produced on a commercial scale without undue delay. To be able to stand up in a global environment and to promote transformative ideas that lead into tangible development, India needs to realize that both protection and supporting the creation of IP is required.[73] Converting research from students into marketable forms need considerable and sustained efforts.[74] Dedicated TTOs and supportive infrastructure coupled with flexible commercial models with various industry-based partners is what can help further the nation's technology and scientific development goals.[75] There is an urgent need for improvement of systems and establishment of models that will help monetize the innovation created by students.[76]

This extent and scope of IPR in innovations is not only alien to most entrepreneurs but also to global universities and research institutes. The current IP ecosystem is overly infatuated with Patents and is further restricted to its commercialization only after the development stage. However, obtaining a patent is no guarantee of success. A majority of investors believe that patents are paper tigers and may turn out to be hollow after laboratory results are delivered. This is what happened to Theranos Inc., an American Unicorn which was once regarded as a revolutionary tech-startup and held as many as 2,700 patents from 2013 to 2018 before it was

[71] Jain, Akriti & Sodhi, Garima. (2019). Technology startups and IPR protection in India.
[72] Jain, Akriti & Sodhi, Garima. (2019). Technology startups and IPR protection in India.
[73] Verma 2011: 1
[74] Nandagopal (2013: 183)
[75] Chakraborti 2011: 93
[76] Sharma (2010: 257)

declared bankrupt.[77] This fall of a Unicorn startup from an IP point of view can be a learning curve for the mushrooming health-tech startups in India. Though the Indian government has introduced several capacity building and enforcement programmes for encouraging technology and innovation in the country, it still falls short due to lack of a conducive environment and limited number of resources. Therefore, increasing the number of efficient TTOs with substantial industrial and governmental support can help innovators counter the several roadblocks they face in their endeavour to create and maintain an innovation. This concept is not new; however, this is yet to be explored and implemented in India to the extent it is being done in other countries. Therefore, the exact results of the model cannot be predicted in the current piece – there is a necessity for a consistent research and the authors have made an attempt at the same.

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[77] Parmar 2019