Exploring the different aspects of academic research as per National Education Policy 2020

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Abstract

The National Education Policy 2020 has proposed some sweeping changes to reinvigorate the disintegrating Indian education system. It is a comprehensive framework that recommends complete overhaul of school education, undergraduate education and academic research. Since research is directly and positively related to development and is considered backbone of universities, therefore this paper aims to explore the diverse aspects of academic research as proposed in National Education Policy 2020. The thorough and careful analyses of policy lead to identification of four research themes where it aims major modification and reformation. The four themes are academia-industry collaboration, contribution to society and nation, research funds and infrastructure, and research ethics, transparency and credibility. Furthermore, deeper insights in form of constructive criticisms, perceptive suggestions and pragmatic outlook of initiatives, have been laid out on the basis of extensive review of literature, which may aid in better implementation of the policy.

   Keywords: Academia, institute, infrastructure, NEP 2020, university

1. Introduction

The long awaited structural reforms in the Indian education system have been finally approved and introduced by the government in the form of National Education policy 2020 (NEP 2020). This monumental, ambitious and futuristic education policy aims to revamp the dwindling education system of India. The great Greek philosopher Heraclitus (500 BCE) has rightly said that only change is constant (Graham, 2019). Therefore in this dynamic world, which is continuously evolving in terms of technology, sociology, ecology, and economy, the educational evolution and transformation becomes imperative.

The revised NEP 2020, which replaced the outdated NEP 1986, has given a clear road map to address contemporary issues in education sector. The new comprehensive and holistic framework of NEP 2020 is a full package of major reforms which includes restructuring of school education system, multidisciplinary education, digitalized pedagogy, flexible undergraduate courses, equity and inclusion, training and development of competent faculty, and quality innovation and research (NEP 2020). Such restructural and transformational changes aim to turn the rigid outmoded education system to flexible and progressive system of education. According to Quacquarelli Symonds (QS) world university ranking 2020, not even a single Indian university managed to place itself in the top 100 global universities .This needs immediate attention since universities represent the quality of teaching and research and are backbone of developing nations (QS World University & Business School Rankings, 2020).

NEP 2020 defines university as "a multidisciplinary institution of higher learning that offers undergraduate and graduate programmes, with high quality teaching, research, and community engagement". Thus research is very integral part of a university and therefore this paper aims to explore the research initiatives as proposed in NEP 2020. It is believed that quality of research determines the quality of teaching and learning in an institution,

which reflects in the development of nation as a whole. Thus research is not only limited to academia but has a high quotient of application to address the problems of society and industry.

Further, in present knowledge dominated era, industry-university collaboration is also of paramount importance to encourage the long due pragmatic research oriented innovations. The significance of knowledge economy is no longer concealed as a key to economic development (Cloete, Bailey & Maassen, 2011; Gurukkal, 2017; Patel, 2017) and therefore this needs attention of the researchers. Various scholars have advocated that partnerships and collaborations among different society stakeholders are a way to achieve societal well being (Bhattacharya, Deb, Nair, Shukla & Yadav, 2017; Centre for International Mobility CIMO & University of Tampere, 2015; Gurukkal, 2017; Sheel & Vohra, 2014) which ultimately reflects in growth of

society and nation; research funding and infrastructure; and research ethics, transparency and credibility (figure 1); which seek attention of the research policy makers, industry and academia.

2. Academia-industry research collaboration

Academia and industry are two foundational pillars of emerging economies and the push towards collaboration between the two is much appreciated in the National Education Policy, 2020. To encourage quality research, the policy envisages the establishment of National Research Foundation (NRF) and one of the four primary activities of NRF as mentioned in the policy is to "act as a liaison between researchers and relevant branches of government as well as industry"(NEP 2020). Since knowledge creation and innovation have now become major parameters to determine the development of a nation, therefore it becomes an absolute necessity to
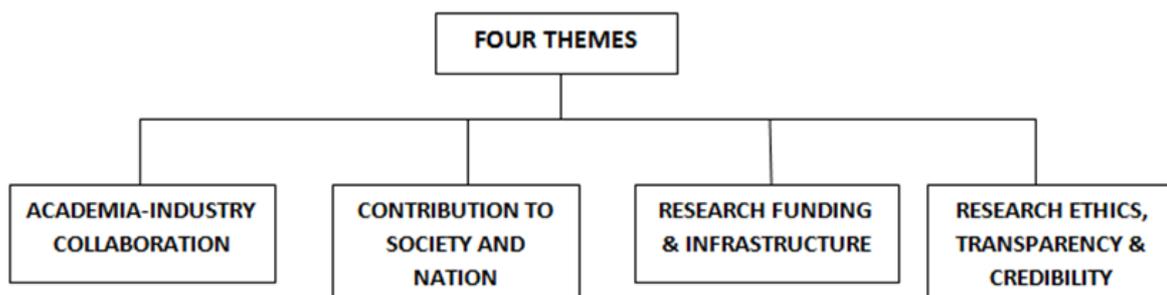

Figure 1: Themes

a nation since society is a sub-set of nation. However, the lack of research credibility and transparency along with insufficient research infrastructure and funding hinders the growth of a nation and this calls for immediate attention (Bhattacharya et al., 2017; Gurukkal, 2017; Tilak, 2019; Varughese, 2017). To address such issues, NEP 2020 has proposed the establishment of National Research Foundation (NRF) which aims to support and encourage quality and credible research.

Thus there arises a need to understand the present state of Indian research, the benefits of robust research to nation, and challenges and loopholes embedded in the Indian research set up. To present such elaborative and critical insights of academic research, thorough analysis of NEP 2020 and extensive review of literature has been done which resulted in identification of four major themes i.e. academia-industry research collaboration; contribution of research to

promote alliance between academia and industry. This will make the academic researchers aware about the emergent issues in the industry and thus their findings would be more practical and useful to industry and policy makers. Therefore the higher education institutions are expected to encourage quality research and innovation by establishing significant linkages between industry and universities (NEP 2020).

The literature suggests that various governments have supported such significant partnerships to foster innovations across nations (Rast, Khabiri & Senin, 2012). For example the Malaysian government launched the Malaysian Technology Development Corporation (MTDC) which encouraged research and innovation via university-industry liaisons (Rasiah & Govindaraju, 2009). The government has also undertaken transformation task for various Malaysian universities that aims to transform them

from mere research transmitting universities to the ones that contribute towards development and revenue generation via active university-industry collaboration (Yaakub et al., 2011). Knowledge Transfer Program (KTP) is another initiative of Ministry of Education of Malaysian government that encourages university faculty to collaborate with industry managers and promotes sharing of knowledge, innovative ideas and research findings among them (Salleh & Omar, 2013). This new alliance of academia and industry has also been the foundation of research and development in OECD (Organization for Economic Co-operation and Development) countries (Geisler and Rubenstein, 1989; Etzkowitz, 1998). For instance the Business-Higher Education Forum in USA extends membership to Fortune 500 CEOs along with college and university presidents and it aims to encourage innovation via strategic partnership between business and higher education (Business-Higher Education Forum, 2001). On similar lines, University of Warwick in England has also been involved in collaborative research projects with

industry since its inception (Barnes, Pashby, & Gibbons, 2002). Thus learning from these world class examples of academia-industry research integration and collaboration can help India in developing high impact research as recommended in National Education Policy, 2020.

The learning in this context is imperative since strong and intense learning leads to robust and impeccable implementation. Such learning can further be augmented by understanding the different academia-industry-government collaborative models which have been successful in delivering results in foreign countries. One such model is Knowledge Integration Community (KIC) model formulated by Cambridge-MIT institute in UK with support from British government in year 2000 (Acworth, 2008). The model ties all the four essential stakeholders together i.e. government, industry, education and research and instils Knowledge Exchange (KE) among them. Study of innovation in knowledge exchange (SIKE) form the central theme of this model that promotes sharing of research and innovative
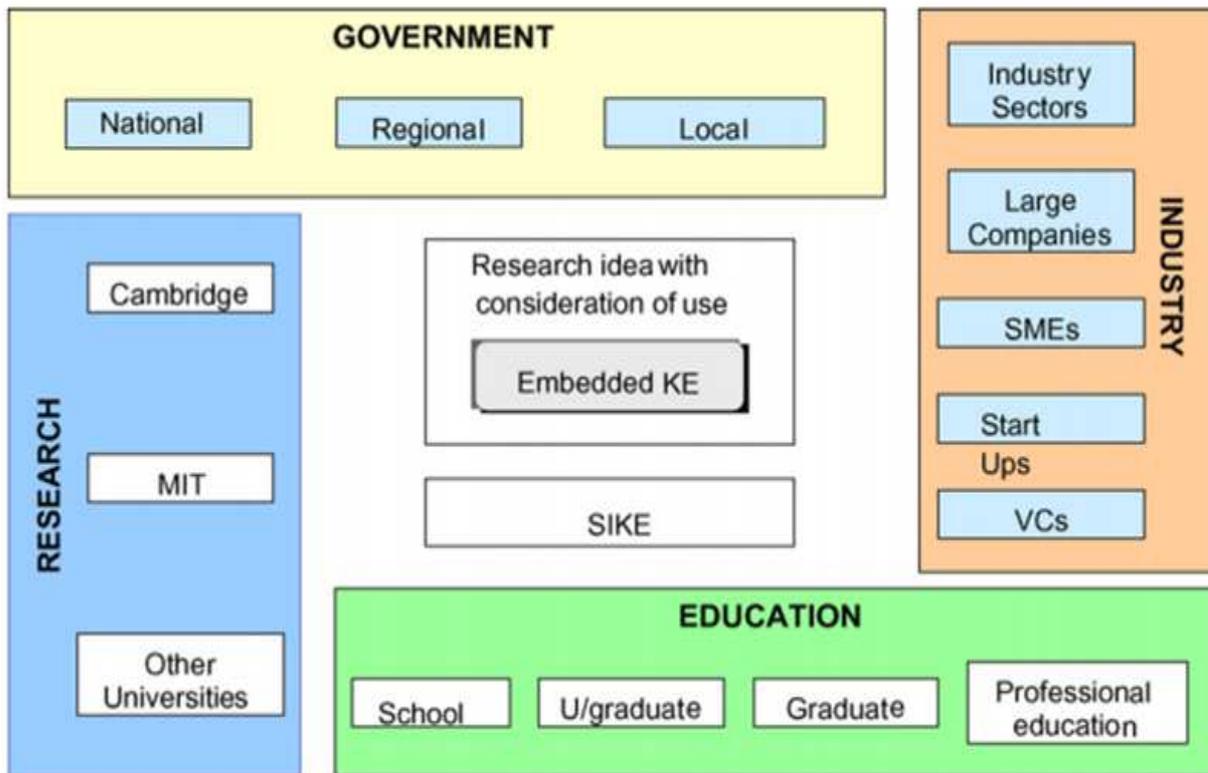

Figure 2: Knowledge Integration Community model
Source: Acworth, 2008

ideas and encourage uninterrupted flow of knowledge among the four key components of the model (Figure 2).

Thus it is clearly evident that foreign countries have adopted various collaboration models and strategies in this regard wherein India lags much behind. In western countries like US, the corporates generally reach out to higher education institutes/universities for bringing out innovation whereas this is not true for India where industries rely on their in-house research rather than reaching out to academia (Kannan, 2017). This is primarily because of the substandard academic research quality and unawareness of academia about practical emergent industrial and societal issues. However, the National Education Policy 2020 endeavours to bring an end to academic research crisis in India by introducing various reforms, one of them being the above-mentioned academia-industry collaboration. It is important to

of GERD i.e. gross expenditure on research and development, by the higher education sector in India, is quite low i.e. only 7% and the maximum contribution in GERD is by government i.e. 52% (Figure 3). This is in stark contrast to most other developed and emerging economies wherein the contribution by higher education sector is more and by government is less as compared to India. Therefore it is clear that India needs to boost research especially in the higher education sector where it is presently lacking.

The National Education Policy 2020 advocates that research and knowledge creation are foundational bricks in the growth of nation and economy and are major contributors in upliftment of the society. The Policy further emphasizes that if India aims to become leading knowledge society across the globe, then, it primarily requires the expansion of

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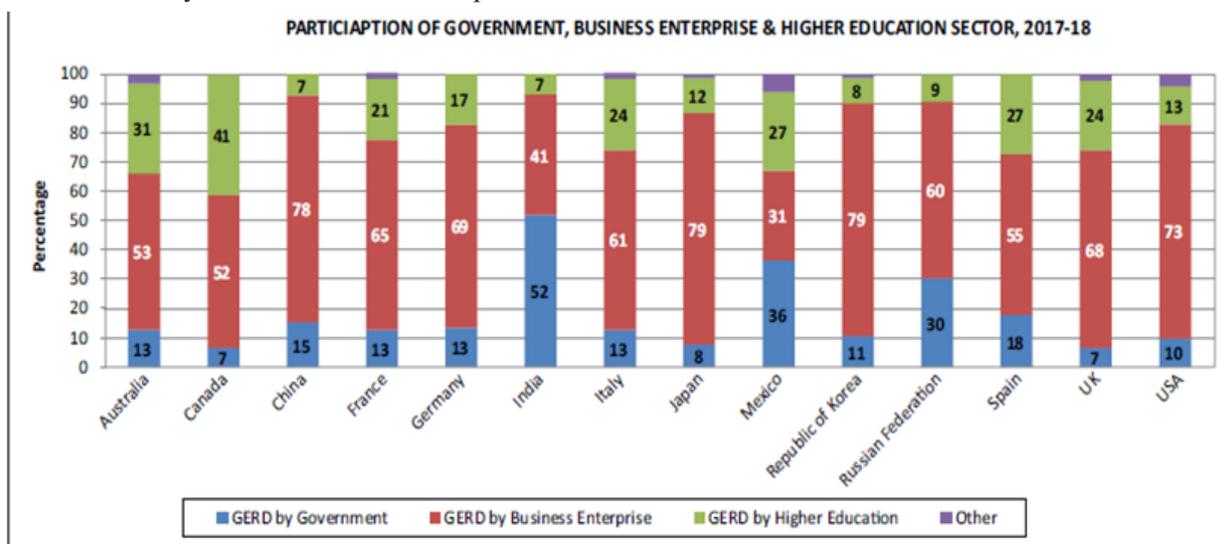
Source: NSTMIS, Department of Science & Technology, Government of India.

Figure 3: Contribution to research
Source: Research and Development Statistics 2019-2020, Department of Science and Technology, Government of India.

note that such collaborations not only result in quality research but also leads to overall societal and national development which has been elaborated in the next theme.

3. Contribution of research to society and nation

As per the Research and Development Statistics 2019-2020 released by the Department of Science and Technology, the contribution to research in terms

national research capabilities (NEP 2020). The significant role of research towards societal and national development has also been emphasized by numerous scholars in the past (Chen & Kenney, 2007; Patel, 2017; Solga, 2014). The policy thus views academic research as a solution to various societal problems such as bad air quality and drinking water, improper sanitation, debilitated healthcare, and environmental degradation (NEP 2020). For addressing these challenges, it is important to encourage high quality

multi-disciplinary and inter-disciplinary research in the fields of social sciences and humanities along with sciences. Numerous researchers have also highlighted the mutual benefits of synergistic collaboration between universities and social policy developers (Cloete et el., 2011; Solga, 2014;). Thus, the insistence of this policy is on encouraging and supporting higher education institutions in undertaking research to address social predicaments and to celebrate critical thinking in such subjective social science fields. The NEP 2020 also encourages universities to undertake research in fields of infectious diseases, virology, vaccinology etc that will greatly help mankind in sustaining the pandemics.

The universities and higher education institutions can act as agencies for governmental policies by providing scientific perspective to social problems (Centre for International Mobility CIMO & University of Tampere, 2015). Thus the policy upholds that to solve Indian social problems, solutions to these problems should emerge from Indian universities' research and not from foreign research (NEP 2020). Therefore the policy aims to make India self-reliant in the field of academic and social research. To achieve such broader objectives of research, a structured curriculum is needed at higher education level and the problems need to be first identified via active community engagement though social projects (Bhattacharya et al., 2017). The concept of community based learning and service-learning is also well received and appreciated in which universities collaborate with local communities and organizations to get deeper insights of the local societal issues and contextual problems associated with them (Ryder, 2011). The Anacostia Watershed Society (AWS) is an organization in United States of America that collaborates with universities and students to research and find solutions to restore the safe and clean Anacostia River (Ryder, 2011). Such examples can greatly help in understanding the vision of National Education Policy 2020 with regard to research objectives. NEP 2020 in this regard, also mentions about Global Citizenship Education (GCED) which would make researchers and learners aware about the global contemporary challenges and thus it would lead to promotion of sustainable societies.

Apart from identifying the social problems, it is also imperative to make the research data and findings accessible to other researchers so that they become aware of the recent developments in the field and can spare themselves from duplication of work. This also gives researchers the opportunity to develop their work further based on critical analysis of the data sets and findings of previous research. For example the Zika Experimental Science Team (ZEST) published their research and data on online portal and it greatly helped the academicians and researchers in updation of their data on daily basis which significantly expedited the research process of exploring the nature and cause of Zika virus (Butler, 2016).

The contribution of research towards nation as a whole also cannot be undermined wherein it has been witnessed how the research in science and technology has empowered the mankind to move from animal driven handcarts to speedy race cars which not only helps in improved standard of living but also contributes towards overall development (Doren, 1991). Empirical evidence from various OECD countries also corroborate that research leads to new knowledge which further contributes towards increased productivity and development (Griffith, Redding & Reenen, 2004; Hall, Lotti & Mairesse, 2009). According to Bresnahan & Gambardella (2004), the role of universities and research institutes is also significant in the development of nation as has been witnessed in cases of various developed countries (e.g. USA). The research conducted at university level is considered as a seed which blossoms and instils a new innovative and entrepreneurial spirit in the nation, thus leading to economic and national development (Shane, 2004). China has set an example in this regard, wherein the start-ups have been supported by the universities and research institutes which undoubtedly lead to national development. The Chinese Academy of Sciences (CAS) formed a venture capital firm i.e. China Science and Technology Promotion and Economic Investment Company to encourage and support the CAS staff in start-ups establishment (Kondo, 2003). The Information Technology Research Institute in Taiwan also played a significant role in the development of Hsinchu Technology Park (Noble, 1999) which has largely contributed towards development of the country. Such strategic and pioneering models may be adopted in India as well wherein university and research institutes would have a larger role to play.

4. Research funding and infrastructure

To reap the benefits of quality research in terms

of societal and national development it is important to ensure that sufficient funds are allocated to research and researchers have access to good infrastructure and resources. This has been given due significance in the National Education Policy, 2020 that aims to establish a National Research Foundation (NRF) whose primary objective would be to provide research funding and to undertake various initiatives in order to develop research culture in the country (NEP 2020).

According to Research and Development statistics, Department of Science and Technology, Government of India (2019-2020), India spent 0.7% of GDP on research in 2017-2018, whereas other BRICS nations i.e. China (2.1%), Russia (1.1%), Brazil (1.3%) and South Africa (0.8%) spent higher on R&D. Such scanty and insufficient research spending in India makes it lag much behind the developed countries which spend more than 2% of their GDP on R&D. The National Education Policy, 2020 also highlights that the research and innovation investment, presently in India is meagre 0.69% of GDP which is quite low as compared to developed countries like USA (2.8%). Such inadequate research funding and investment is major cause of appalling Indian research infrastructure which includes deficient repositories, restricted databases, inaccessible journals, and substandard libraries and academic laboratories (Kumar & Gupta, 2017; Patel, 2016; Sheel & Vohra, 2014).

Research infrastructure, which primarily includes access to research databases and analysis software (Sheel & Vohra, 2014) is severely lacking in developing countries like India and therefore is major hindrance in research development. Despite being supported by MHRD (now Ministry of Education), complete access to reputed journals is still a distant dream for most Indian researchers (Sheel & Vohra, 2014). However, on the other hand, it is worth noting that various developed nations have undertaken measures to provide free unrestricted access to their researchers e.g. the Competitiveness Council of the European Union in May 2016 announced to provide open access to all scientific research articles by year 2020 (Enserink, 2016).

With regard to libraries, apart from funding, the journal subscription fee also needs to be regulated specially for developing and underdeveloped countries to give them wider access to research journals. It has been witnessed that libraries struggle with very high license fee of journals whereas on the other hand the big publishing houses such as Springer, Elsevier are highly profitable (Monbiot, 2011). Further, for adequate allocation of research funds to laboratories, India may adopt and learn from countries like Japan, wherein funds are distributed through a rigorous and transparent competitive process in which researchers from public and private laboratories are encouraged to make exceptional research proposals (Kumar & Gupta, 2017). Although NEP 2020 highlights big initiatives with regard to research funding, still such examples from developed countries may be borrowed to build an effective roadmap for its implementation.
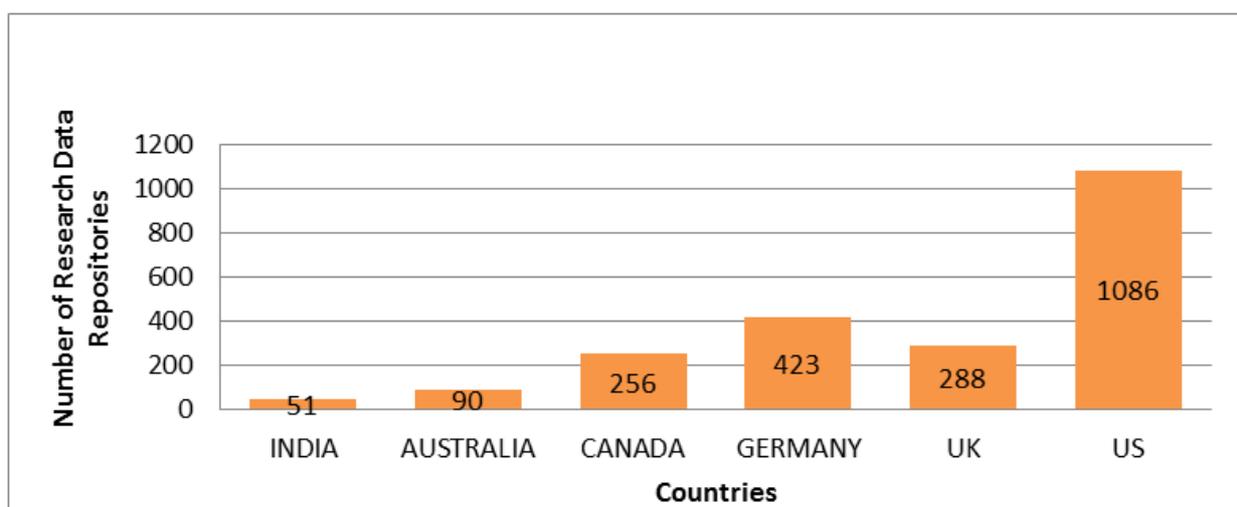

Figure 4: Number of registered research data repositories
Data source: https://www.re3data.org/browse/by-country/

Furthermore, to systematically organize and store the datasets and research articles, it is important to maintain research repositories. As per recent data from Registry of Research Data Repositories, the number of registered repositories in India is 51 which are quite less as compared to developed nations (Figure 4). Although it has been advocated that every institution should develop a repository to increase its visibility and access (Wolski & Richardson, 2011), still Indian educational institutes lag much behind in repository establishment (Figure 5), primarily because of lack of research funding and support. Moreover, few datasets and research articles in already established Indian repositories are not freely accessible to researchers (Figure 6), which become a major hindrance and thus affect the quality of research. Although India has undertaken few appreciable initiatives in this field e.g. the establishment of Shodhganga repository, still lot more effort is needed to make research freely accessible to all. In this regard, the National Research Foundation as per NEP 2020 aims to flourish research in India and
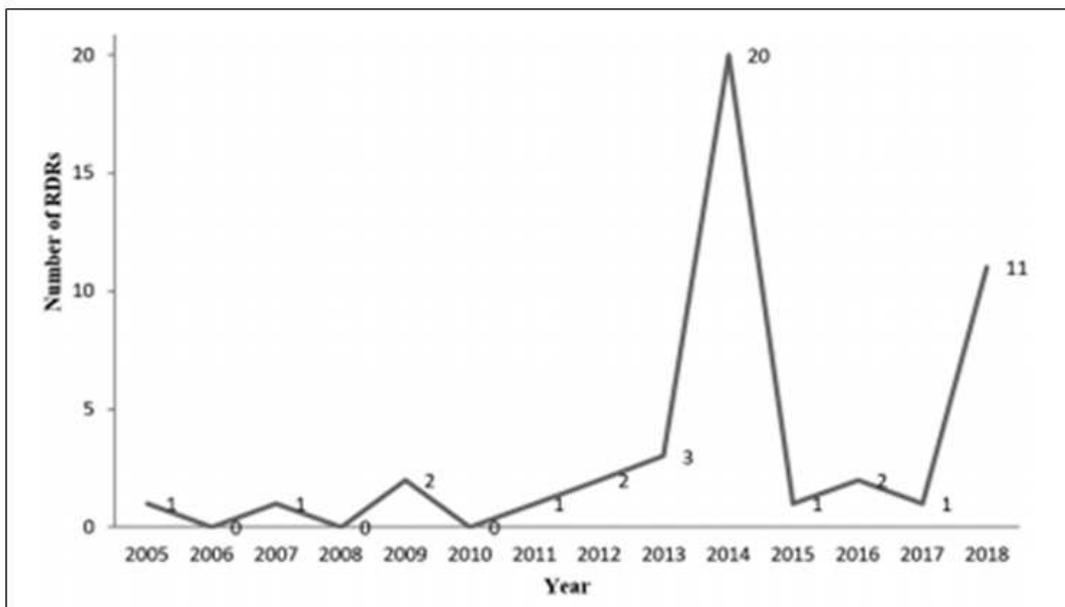

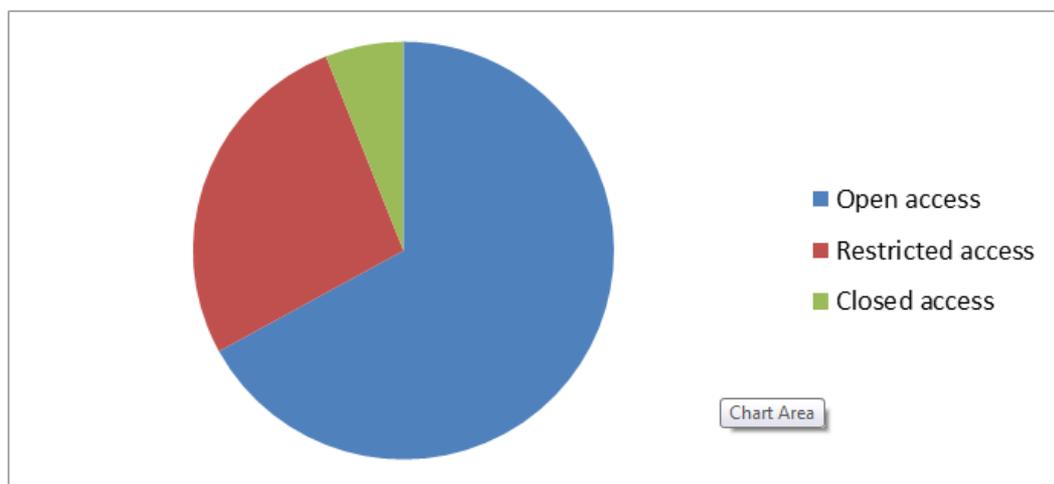Figure 5: Year wise growth of research data repositories in India

Source: Bhardwaj, 2019

Figure 6: Database access of data repositories India
Source: Bhardwaj, 2019

remove major research hurdles by providing adequate funds that will improve research accessibility and infrastructure.

Lastly, it is worth noting that research infrastructure cannot be improved by solely relying on government funding. The private industry can also play a bigger role in research infrastructure development and universities may seek funds from industrial players in the form of advance payment for research (Kumar & Gupta, 2017; Kailas, 2008). Therefore universities should be encouraged to explore all funding options to immediately resolve research infrastructure crisis in the country. However, apart from funding and infrastructure problems, research credibility is another important aspect which needs due attention from Indian scholars and policy makers.

5. Research ethics, transparency and credibility

One of the primary objectives of National Education Policy 2020 is to grow the research culture in India and set academic research standards. This can be achieved via transparency in research funding, ethics in research conduct and credibility in research outcomes. The Higher Education Commission of India (HECI) and its four independent verticals are entrusted with the responsibility of bringing transparency in research funding procedures and to publicly make self disclosures with regard to finances, audits and infrastructure (NEP 2020). Such transparency would eliminate all grey shaded research areas and would make research credible. Further, to encourage more credible research, it is imperative to have a separate governing body as in case of most developed nations such as AERA (American Educational Research Association) in America, BERA (British Educational Research Association) in Britain, SERA (Scottish Educational Research Association) in Scotland etc (Govil, 2013).

The past three decades have witnessed rising cases of breach of the ethical code of conduct in research. This includes unscrupulous use of Government grants (Wysocki, 2005), inadequate protection of research participants (Argetsinger, 2001), data fabrication (Kintisch, 2005), intentional misrepresentation of facts (Wade, 2002), improper acknowledgement of research partners, plagiarism (Chubin, 1985), uninformed consent and confidential data breach (Frankel, 1989). This calls for an urgent scrutiny because unethical research will not only deteriorate research culture but will also bring bad name to the country. Also, the non ethical practices of participatory research in various developed and developing countries need strict regulation and governance. For example, a research study received huge criticism wherein more than 400 African Americans infected with syphilis were left untreated to study the disease (Shamoo & Resnik, 2009). Such dark events in the research history make it necessary to have an ethical code of conduct in research, especially, to protect the participants' interest. This should primarily include participants' right to full disclosure of material information (Stalker et al., 2004), right to informed consent, and right to privacy and anonymity (Frankel, 1989). The American Sociological Association lists six principles in Code of Ethics which are professional competence, integrity, respect for people's rights, dignity and diversity, professional and scientific responsibility, social responsibility and human rights. The World Health Organization also mentions five ethical principles for conducting research. These are integrity, accountability, independence and impartiality, respect for persons and communities, and professional commitment (World Health Organization, 2017). Such principles and code of ethics in research also needs to be established in India and strict adherence needs to be mandated.

It is high time to raise the voice against prevailing non-transparent and unethical research practices. The NEP 2020 thus brings a ray of hope in this regard, since it aims to govern and restrict the use of such abovementioned unscrupulous research practices via HECI and NRF which intends to promote transparency and credibility in research. The implementation of such proposed changes would not only result in utilitarian research, but will also improve the country's global research reputation.

6. Discussion

The extant literature advocates that concerns like lack of academia-industry collaboration, inadequate research infrastructure, lack of funds and grants, non viable and unreliable research results etc. have largely contributed towards deterioration of research and has placed India on low ranks on global competitive indices. To rectify these conundrums, the changes proposed in NEP 2020 are appreciable and Indian government's envision of establishing National Research Foundation (NRF) is need of the

hour. Although the policy has highlighted various crucial aspects, yet literature suggests certain loopholes inherent in the research system that need to be addressed for smooth implementation of NEP and unruffled functioning of NRF.

The NEP 2020 advocates that research has a noteworthy role to play in addressing the critical societal challenges related to water, air, health etc since it facilitates deeper understanding of such issues and hence would result in reliable solutions. Though the rationale is well thought and articulated but there are certain integrals which need to be properly assessed. Firstly, it is a strenuous task to devise objective and well grounded measures to evaluate the societal impact of research (Bornmann, 2012). Martin (2007) specified various problems associated with assessment of the societal impacts. First problem mentioned is the causality problem which states that there is obscurity regarding which research variable/factor directly attributes to the particular impact. Second problem is attribution problem which cites unclarity as to whether research or any other factor led to the impact caused. Third is evaluation timescale problem which states that premature evaluation of impact can result in policies overstressing research bringing short term results. The draft NEP 2019 suggests the explicit mention of societal impact of research in the proposal. However practically there is high probability of deviation since in most cases the output of research turns out to be different from initial objectives. For example, the research on apoptosis was initially perceived to be of high calibre but eventually after 30 years it was found that it did not contribute much to health industry (Smith, 2001). Therefore there is an emergent need to devise some robust and objective measures with the help of experienced social researchers to assess the quality and impact of research.

Another objective of NRF is to act as liaison between researchers, industry as well as government to deliver pragmatic and relevant research to the society (NEP 2020). This commercialisation of knowledge for societal benefit through industry-academia collaboration is much more convoluted than it seems. It has been witnessed that university research is supported by industry through gifts and donations rather than specific contracts (Geuna & Muscio, 2009). In absence of such legally valid contracts, the complications of abstruse intellectual property right claims over the research output increases.

In situations where industry sponsors the research, university provides infrastructure and researchers toil to achieve desired research output, the conflict occurs in form of triangular claims over intellectual property rights (Kumar & Gupta, 2017). Friction further intensifies when the objectives of academia and industry do not align. Feldman & Desrochers (2003) notes that both have conflicting rationales for undertaking research wherein the primary objective of research for university is to create and disseminate new knowledge whereas industry aims at commercializing the research output. Thus it is important to mention the objectives of research project in the research proposal so that academia and industry collaborate only when their goals align and valid contracts need to be materialised to solve the issues of intellectual property right claims.

Further, to reach the pinnacle of research standards, it is envisioned that NRF would fund the research across all disciplines through competitive and peer reviewed approach (NEP, 2020). The literature upholds that when limited resources are available, the approach of competitive funding can be advantageous (Butler, 2003) especially for country like India where resources are scarce and competition is more. Another competitive approach advocated is that grants should be allocated to the top researchers with an impressive past track record (Hicks & Katz, 2011). This would mean that funds reach recognized researchers who have already peaked in their research domain and therefore would be of less use. Thus the role of government and NRF in this regard is very critical and significant since funding is an important and integral part of the overall policy. On one hand, such competitive funding would make universities dependent and the administrative and bureaucratic interference might affect the research efficiency, on other hand NEP 2020 aims to give more autonomy to universities. Thus the equilibrium between dependency and autonomy needs to be maintained for better research culture. Further, to improve the research outcomes, initiatives need to be undertaken to provide unrestricted access to high quality journals and to establish open access repositories which would result in more credible and quality research. Therefore although establishment of NRF is an appreciable initiative, still there are numerous other abovementioned research aspects which seek due attention, in order to achieve the ultimate aim of improving research culture as envisioned in NEP 2020.

7. Conclusion

The National Education Policy 2020 brought out with the hard efforts of MHRD holds major significance in refurbishing the dwindling Indian education system. Although this instrumental and revolutionary policy deserves huge applause and admiration, yet few critical viewpoints and multifaceted insights would ensure its smooth implementation. The research paper highlights various aspects of academic research mentioned in NEP 2020 and explores the untrodden potential that research holds in our present lives. The immense contribution of research towards society has been emphasized and the nuances of much needed academia-industry collaboration have been discussed. Numerous other constructive and critical aspects related to research funding, infrastructure, accessibility and ethics also find mention. Thus after thorough analysis of policy and the extant literature, it can be concluded that due attention to the aforementioned hitches would further contribute towards the aim of establishing healthier and superior research culture in India as envisioned in National Education Policy 2020.

8. Declaration

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References :

• Acworth, E. B. (2008). University–industry engagement: The formation of the Knowledge Integration Community (KIC) model at the Cambridge-MIT Institute. *Research policy*, *37*(8), 1241-1254.

• Argetsinger, A. (2001). Panel blames Hopkins in research death. *The Washington Post*, *30*, B03.

• Barnes, T., Pashby, I., & Gibbons, A. (2002). Effective university–industry interaction:: A multi-case evaluation of collaborative r&d projects. *European Management Journal*, *20*(3), 272-285.

• Bhardwaj, R. K. (2019). Content Analysis of Indian Research Data Repositories: Prospects and Possibilities. DESIDOC Journal of Library & Information Technology, 39(6).

• Bhattacharya, S., Deb, S., Nair, H., Shukla, T., & Yadav, A. (2017). Critical Perspectives on the National Policy on Education 2016. *Higher Education for the Future*, *4*(2), 129–146.

• Bornmann, L. (2012). Measuring the societal impact of research: research is less and less assessed on scientific impact alone—we should aim to quantify the increasingly important contributions of science to society. *EMBO reports*, *13*(8), 673-676.

• Bresnahan, T., & Gambardella, A. (Eds.) (2004). Building high-tech regions. Cambridge: Cambridge University Press.

• Business-Higher Education Forum, Washington, Dc. (2001). *Working together, creating knowledge: The university-industry research collaboration initiative*. ACE Fulfillment Service.

• Butler, D. (2016). Zika researchers release real-time data on viral infection study in monkeys. *Nature*, *530*(5).

• Butler, L. (2003). Explaining Australia's increased share of ISI publications—the effects of a funding formula based on publication counts. *Research policy*, *32*(1), 143-155.

• Centre for International Mobility CIMO & University of Tampere. (2015). *Higher Education Institutions Partnering for Development and Change*. Finnish Ministry of Education and Culture. Retrieved August 22, 2020, from www.oph.fi: https://www.oph.fi/sites/default/files/documents/hei_ici_book_1_2.pdf

• Chen, K., & Kenney, M. (2007). Universities/research institutes and regional innovation systems: the cases of Beijing and Shenzhen. *World development*, *35*(6), 1056-1074.

• Chubin, D. E. (1985). Research malpractice. *BioScience*, *35*(2), 80-89.

• Cloete, N., & Bailey, T., & Maassen, P. (2011). Universities and economic development in Africa: Pact, academic core and coordination. 1-82.

• Doren, C. V. (1991). *A history of knowledge: Past, present and future*. New York: Ballantine Books.

• Draft National Education Policy (2019), Ministry of Human Resource Development, Government of India, Retrieved from: https://www.mhrd.gov.in/sites/upload_files/mhrd/files/Draft_NEP_2019_EN_Revised.pdf

• Enserink, M. (2016). In dramatic statement, European leaders call for 'immediate' open access to all scientific papers by 2020. *Science*, *27*.

• Etzkowitz, H. (1998). The norms of entrepreneurial science: cognitive effects of the new university–industry linkages. *Research policy*, *27*(8), 823-833

• Feldman, M., & Desrochers, P. (2003). Research universities and local economic development: Lessons from the history of the Johns Hopkins University. *Industry and Innovation*, *10*(1), 5-24.

• Frankel, M. S. (1989). Professional codes: Why, how, and with what impact?. *Journal of business ethics*, *8*(2-3), 109-115.

• Geisler, E., & Rubenstein, A. H. (1989). University—industry relations: A review of major issues. In *Cooperative research and development: The industry—university—government relationship* (pp. 43-62). Springer, Dordrecht.

• Geuna, A., & Muscio, A. (2009). The governance of university knowledge transfer: A critical review of the literature. *Minerva*, *47*(1), 93-114.

• Govil, P. (2013). Ethical considerations in educational research. *International journal of advancement in education and social sciences*, *1*(2), 17-22.

- Graham, D. W. (2019). Heraclitus. In E. N. (ed.), *The Stanford Encyclopedia of Philosophy.* Metaphysics Research Lab, Stanford University.
- Griffith, R., Redding, S., & Reenen, J. V. (2004). Mapping the two faces of R&D: Productivity growth in a panel of OECD industries. *Review of economics and statistics*, *86*(4), 883-895.
- Gurukkal, R. (2017). Introduction: A Critique of Draft NEP, 2016. *Higher Education for the Future*, *4*(2), 101–116.
- Hall, B. H., Lotti, F., & Mairesse, J. (2009). Innovation and productivity in SMEs: empirical evidence for Italy. *Small business economics*, *33*(1), 13-33.
- Hicks, D., & Katz, J. S. (2011). Equity and excellence in research funding. *Minerva*, *49*(2), 137-151.
- Kailas, S. V. (2008). The lack of quality research in India. *Current Science*, *94*(8), 979-980.
- Kannan, I. (2017, November 30). India moving towards innovation through academia-industry partnerships. *Hindustan Times*, Retrieved from http://www.hindustantimes.com
- Kintisch, E. (2005). Researcher faces prison for fraud in NIH grant applications and papers. *Science*, *307*(5717), 1851-1852.
- Kondo, M. (2003). Chinese model to create high-tech start-ups from universities and research institutes. *Management of technology: Growth through business, innovation and entrepreneurship*, 77-92.
- Kumar, P., & Gupta, R. (2017). The roadmap for enhancing university–industry research collaboration in India. *Indian Journal of Public Administration*, *63*(2), 196-227.
- Martin, B. R. (2007, May). Assessing the impact of basic research on society and the economy. In *Rethinking the impact of basic research on society and the economy (WFEST International Conference, 11 May 2007), Vienna, Austria*.
- Monbiot, G. (2011). Academic publishers make Murdoch look like a socialist. *The Guardian*, *29*, 8.
- NEP (2020). National Education Policy 2020. Ministry of Human Resource Development, Government of India. 1-66.
- Noble, G. W. (1999). Conspicuous failures and hidden strengths of the ITRI model: Taiwan's technology policy toward hard disk drives and CD-ROMs.
- Patel, P. J. (2016). Research culture in Indian universities. *Social Change*, *46*(2), 238-259.
- Patel, P. J. (2017). Research Culture in Indian Universities: The Debate Continues. *Social Change*, *47*(1), 94–100.
- QS World University & Business School Rankings,2021. (2020). Retrieved August 22, 2020, from https://www.qs.com/portfolio-items/qs-world-university-rankings-2021-result-tables-excel/
- Rasiah, R., & Govindaraju, C. V. (2009, October). University-industry R&D collaboration in the automotive, biotechnology and electronics firms in Malaysia. Georgia Institute of Technology.
- Rast, S., Khabiri, N., & Senin, A. A. (2012). Evaluation framework for assessing university-industry collaborative research and technological initiative. *Procedia-Social and Behavioral Sciences*, *40*, 410-416.
- Research and Development statistics at a glance 2019-2020. (March, 2020). Department of Science and Technology, Government of India. Retrieved from www.dst.gov.in
- Ryder, P. M. (2011). Preparing" academic citizens:" Service-learning in Research Universities. *Journal of the Washington Academy of Sciences*, 17-31.
- Salleh, M. S., & Omar, M. Z. (2013). University-industry collaboration models in Malaysia. *Procedia-Social and Behavioral Sciences*, *102*, 654-664.
- Shamoo, A. E., & Resnik, D. B. (2009). *Responsible conduct of research*. Oxford University Press.
- Shane, S. A. (2004). *Academic entrepreneurship: University spinoffs and wealth creation*. Edward Elgar Publishing.
- Sheel, R., & Vohra, N. (2014). Fostering Academic Research among Management Scholars in India: An Introduction to the Special Issue. *Vikalpa*, *39*(2), v–xi.
- Smith, R. (2001). Measuring the social impact of research: difficult but necessary.
- Solga, H. (2014). Education, economic inequality and the promises of the social investment state. *Socio-Economic Review*, *12*(2), 269-297.
- Stalker, K., Carpenter, J., Connors, C., & Phillips, R. (2004). Ethical issues in social research: difficulties encountered gaining access to children in hospital for research. *Child: Care, Health and Development*, *30*(4), 377-383.
- Tilak, J. B. G. (2019). Promising but Perplexing Solutions: A Critique of the Draft National Education Policy 2019. *Social Change*, *49*(4), 686–712.
- Varughese, R. (2017). National Policy on Education and Higher Education. *Higher Education for the Future*, *4*(2), 158–165.
- Wade, N. (2002). A new look at old data may discredit a theory on race. *New York Times*, *8*.
- Wolski, M., & Richardson, J. (2011). A Framework for University Research Data Management. *CCA-EDUCAUSE Australasia Conference, Sydney, Australia*. http://www98.griffith.edu.au/dspace/bitstream/handle/10072/39672/69936_1.pdf
- World Health Organization (WHO). (2017). Code of conduct for responsible research. *WHO: Geneva, Switzerland*.
- Wysocki, B. (2005). As universities get billions in grants, some see abuses: Cornell doctor blows whistle over use of federal funds, alleging phantom studies. *The Wall Street Journal*, *16*, A1.
- Yaakub, N. I., Hussain, W. M. H. W., Rahman, M. N. A., Zainol, Z. A., Mujani, W. K., Jamsari, E. A., ... & Jusoff, K. (2011). Challenges for commercialization of university research for agricultural based invention. *World Applied Sciences Journal*, *12*(2), 132-138.