



ROLE OF HIGHER EDUCATION INSTITUTIONS IN RESEARCH AND DEVELOPMENT

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Abstract

In a globalised world, the role of an academic institution is very important for its innovation led growth, development and sustainability. The pursuance for knowledge is the motivator or basic idea behind research and higher education is an effective medium to generate this knowledge and innovation. Higher education institutions can play an important role in nation building, they can bring change in economic, social, scientific as well as political sphere of life.

The objective of this study is to identify the position of India in the global scenario of basic research, to evaluate the challenges faced by higher education institutions in R & D. It also describes how universities perform vital functions both as generators of new knowledge through their leading-edge research activities and as trainers of highly qualified labour.

Keywords: Innovation, R&D, Higher Education Institutions

Introduction

In the recent era of globalisation, enhancement of knowledge is the key factor in the process of growth and development of an economy. Knowledge that can be defined as knowhow and know why, is the breeding ground of innovation. Innovation is universally regarded as an engine of economic growth in developing as well as developed countries. Innovation has been a driving force behind advancements in society. It is an innovation that triggers another innovation and thus the never-ending long-term process of development goes on. The innovative practices can be achieved only through research and development as it is one of the important components in fostering innovation. Research and development (R&D) is an important component of a country's national innovation system (NIS) and R&D statistics are among the most widely used indicators to monitor the NIS. Research and development activities includes knowledge generation and transfer, the purchase of technologies, product commercialization etc. Industry- i.e., private firms- and higher education institutes are the major performers of R&D in an economy. It is well established in the literature that both higher educational institutions and industry R&D have a positive effect on innovation output (Karlsson and Andersson, 2005). With the rise of the knowledge intensive economy, the contribution of university research to economic performance becomes more vital. Higher education institutions act both as a primary source of 'knowledge workers', as well as the key factor of production - knowledge itself. By imparting higher education, conducting research and interacting with individuals and institutions at different levels within and outside India, our education institutions have been major contributors to the generation and dissemination of knowledge. Through their teaching, universities disseminate knowledge and improve the stock of human capital; through the research they perform, universities extend the horizons of knowledge; and by their third-

mission activities, they transfer their knowledge to the rest of society, work with industry and create the seeds that lead to new companies.

Definition of Research and Development

Research is essential to advancing society, strengthening the economy, driving innovation, and addressing the vexing and challenging problems we face as a people, place, and planet. R&D activities include one or more of the categories of research such as basic research, applied research and experimental development (UNESCO 1984 and OECD, 2015). The term 'research' usually refers to uncovering or generating new knowledge, or solving particular practical or theoretical problems. Research is classified as either basic or applied. The OECD (2002) defines pure basic research as experimental and theoretical work undertaken to acquire knowledge without looking for long-term benefits; applied research refers to original work undertaken to acquire knowledge with a specific application in view; and development is defined as systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design development, and improvement of prototypes and new processes to meet specific requirements. Hence, Research and development activities are aimed at making scientific discoveries and inventions that are commercially attractive.

Need of the Study

This is a time of renewed enthusiasm for higher education and research as the way forward to world development. Through research, universities can maintain a strong academic connection with industry, national and international organizations. Research works of the university have a substantial impact on government policies and environmental politics; the world has owed to the researches and achievements of researchers in the various fields of the environment such as water, waste, sanitation, and many more. (Mumtaz et'al 2021). Higher education institutions can play an important role in nation building, they can bring change in economic, social, scientific as well as political sphere of life.

Objectives of study

The objectives of the present study are:

1. To know the importance of R&D activities in higher education institutions.
2. To analyse the contribution and position of India in R&D in world scenario.
3. To examine various challenges for research in India.

Role of Higher Education Institutions

In a globalised world, the role of an academic institution is very important for its innovation led growth, development and sustainability. The pursuance for knowledge is the motivator or basic idea behind research and higher education is an effective medium to generate this knowledge and innovation. One of the core functions of a higher education system is to contribute in knowledge production through research. The variables that capture contributions in this regard are: patent filing, research publications and citations by higher education institutions. As per the UGC report (2023) the Indian research and development (R&D) system consists of various organizations, such as universities, Government research laboratories, autonomous organizations, private research laboratories and centres, etc. Recent information from the University Grants Commission (UGC), New Delhi, suggested that there are 1074 universities in the country (as on 25 Jan, 2023) Currently, this system consists of 56 central, 460 state, 128 deemed and 430 private universities and more than 150 institutes of National Importance. These cater to activities related to various disciplines (such as arts, languages, sciences, social sciences, humanities, etc.) and receive financial support from different sources. In addition, there are well-established institutional systems with significant contributions to the national R&D output.

With the fast pace of change and due to the impact of globalization, the role of the higher education institutions in furthering research and development is becoming important. It is recognised worldwide that investing in higher education is a good thing for the economy and society. Academic research through universities forms an important component of the technological base of a country. The economically important "outputs" of university research have come in different forms, varying over time and across industries. They

include, among others: scientific and technological information (which can increase the efficiency of applied R&D in industry by guiding research towards more fruitful departures), equipment and instrumentation (used by firms in their production processes or their research), skills or human capital (embodied in students and faculty members), networks of scientific and technological capabilities (which facilitate the diffusion of new knowledge) and prototypes for new products and processes. Assessing the impact of university research on GDP and jobs, researchers begins with measuring the impact of research on the Total Factor Productivity (TFP) of an economy. TFP is the economic growth that results from increases in the efficiency and productivity of labour and capital.

In short, University research helps to: meet the grand challenges of the 21st century, such as overcoming resource scarcity, ensuring global food security and tackling global warming; shape policies in areas like international relations, health and education; discover and develop the technological advancements that will create new opportunities for how we live our lives; cure diseases and innovate models of service and care; enrich lives through culture and the arts support overseas development. Universities are primarily the nodal centres for academic Research in India. However, the need for and awareness of quality research are not understood clearly among the academia leading to a wide disparity in research activity and output across the country, both in quality as well as quantity. It is widely felt that the academicians from higher education Institutions of National and International repute, do not justify the role of researchers and many of them do not confirm to the International academic standards of research. The understanding and contribution to quality research in their specific area of study seem to be an imminent challenge faced by the academicians in India (Kanduri & Suripeddi 2018). To study the university research spill over to industry, Mansfield (1991) found, by studying the selected sample firms in information processing, electrical equipment, chemicals, instruments, drugs, metals and oil industries, that about one tenth of the new products and processes commercialised from 1975 to 1985 could not have been developed (without substantial delay) if no recent academic research undertaken within the last 15 years.

Position of India in Research- Global Scenario

The performance of higher education sector was quite significant in recent years. In OECD countries, research from academic institutions accounts for about 15-35 per cent of the overall R & D effort of the Country. Patenting, which is an important measure of innovative R&D activity, is on increasing trend in India. High tech hubs such as Bengaluru, Chennai, Delhi, Hyderabad, Mumbai and Pune have seen the maximum patenting activity. The share of patents filed by Indians at the Indian Patent Office has been rising marginally over the years. Statistics from **World Intellectual Property Organisation (WIPO) in 2022** showed that in 2021, around 3.4 million patent applications were filed across the world. This is a 3.6 per cent increase from the previous year. The top two countries with highest number of patent filings are India and China. India received 61,573 patent applications last year, an increase from 56,771 in 2020. Almost 43 per cent of the Indian patent applications were local and filed by resident applicants. It was found that 18.5 per cent of total published applications in the country are related to pharmaceuticals. According to this report, 57.3 per cent of the patent applications filed in India were by non-residents. The share of non-resident applications is very high in countries like Australia (90.8%), Canada (87.3%), the EPO (55.6%), the United States (55.7%), Brazil (80.7%), Indonesia (84.1%), Mexico (93.1%) and Singapore (86.1%). India even recorded a 16.5 per cent growth in patent grants in 2021. Besides this, India also witnessed a 6.7 per cent increase in the filing of the number of trademark applications. About 42.4 per cent of non-resident trademark filing in Indian offices were from the US, China and Germany.

India boasts 16 entries in the top 100 of the new **QS University Rankings: BRICS (2022)**, a ranking of leading universities in the five BRICS countries (Brazil, Russia, India, China and South Africa). Unsurprisingly, the top universities in India are largely comprised of Institutes of Technology (IITs) – the elite group of colleges specializing in engineering, technology and science disciplines which have so far provided the main success story of Indian higher education. Of the 16 IITs in operation, half are ranked within the BRICS top 100, and the first seven of these also constitute the seven top universities in India. Also performing well are a number of large multidisciplinary public universities, based in India's major cities: the final three places in the Indian top 10 are taken by the Universities of Calcutta, Delhi and Mumbai, and the BRICS top 100 also includes the University of Hyderabad, University of Madras, Banaras Hindu University, University of Pune and Manipal University.

Recently, India has improved its overall International Intellectual Property (IIP) score from 38.4% to 38.6%, and the country is ranked 43rd out of 55 countries on the **International Intellectual Property Index.(2022)**

QS World University Rankings (2022) reported that Indian Institute of Science (IISc) Bangalore is the top university in India, followed by IITs in Mumbai and Delhi in second and third places. Forty-one (41) Indian universities have featured in this highly regarded university ranking system this year.

As per **OECD report (2022)** India ranks 4th among the countries by the number of Ph.D degrees awarded. It is preceded by the US, Germany and Great Britain. India awards nearly 24000 doctoral degrees annually.

Technology innovation is gaining pace in India with Indian companies having filed 1,38,000 tech patents in India from 2015 to 2021, according to the India Patents report launched by the **National Association of Software and Services Companies (Nasscom 2022)**. Over 9,500 patents were filed by India domiciled companies in the US between 2015-2021, an increase of 47 per cent over 2015 and 2019 and overall, more than 400 technology patents were filed by Indian start-ups during 2015-2021, an increase of 45 per cent from 280 patents in the 2015-2019 period.

As per Latest **NIRF Report (2023)** Indian share of the overall world publications is about 4.81%. In the Management discipline, the publications share of India is 5.32%. In fact, In Engineering discipline, India's contribution to the World publications is 7.10% In case of Pharmacy, India's contribution to the World publications is 6.58% IT Madras has topped in overall NIRF Rankings, followed by IISc (Bangalore) in 2nd position and IIT Delhi stood third.

Some notable examples of innovative products such as the Tata Nano, GE's portable electrocardiography (ECG) device etc. The drivers for these innovations are local needs, user preferences and most often the paying capacity of the customer.

Challenges for Research in India

It is seen that the researchers in India emulate topics of the developed economies often to the neglect of local need and national priorities, in order to get published and gain respectability. Doctoral theses in social sciences often apply a descriptive approach to specific limited topics without really relating it to a wider socio-political and economic context. There is a need for a more analytical and comparative approach in doctoral research and relating it to society, policy and economy. The university administration is not research friendly and there are no incentive structures - either financial or professional - to encourage teachers to undertake research. It is seen that despite a very large system of higher education and a significant number of science and engineering graduates, research output of India in terms of publications, particularly its quality, patenting, high technology exports are poor. There is a lack of adequate linkages between higher education institutions and research laboratories on the one hand and universities and businesses on the other. With very little being spent on research through higher education institutions, the required infrastructure and experimental facilities for research does not exist; whatever exists is not being optimally utilised due to lack of collaborative work and absence of the culture of sharing of facilities. While there are several issues that affect India's global performance in filing patents-from researchers lacking finances to lack of knowledge about processes.

Conclusion

The role of higher education institutions in the innovation process has increased continuously over time because the development of new products or technologies depends increasingly on the findings of university (scientific) research (Martin and Nightingale 2000; Tijssen 2002). This is closely related to the growing importance of multi- and interdisciplinary R&D and the strengthened interrelation of basic research and industrial application. The way new knowledge is created, protected and managed requires new ways of collaboration between academia, research laboratories and industry. The need for their working together is no more an option, but an imperative. The consortia approach has been adopted to enhance access to expensive e-journals and e-resources in a cost-effective manner. There should be more liberal funding of selected institutions. A major handicap faced by doctoral research in India is its poor visibility and the 'unseen' factor. There is an international trend to preserve and centrally maintain repositories of electronic thesis and dissertations and make them generally accessible and improve their visibility. Electronic theses and dissertations (ETDs) are highly valuable resources for research and development in the academic institutions.

In nutshell, higher educational institutions played a very special role in each country- not as drivers of innovation, as commonly viewed in the West, but as shapers of human capital formation.

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