

## LIBERALIZATION AND GLOBALIZATION IN SCIENTIFIC RESEARCH\*

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Liberalization and globalization go hand in hand. If we Google the word ‘liberalization’, the number of hits is more than 3,460,000 (about 3.5 million) while the corresponding number for ‘globalization’ is 24,800,000 (about 25 million). Globalization is thus discussed more than liberalization. If we trust the definitions in Wikipedia, we find that “globalization in its literal sense is the process of transformation of local or regional phenomena into global ones. It can be described as a process by which the people of the world are unified into a single society and function together. This process is a combination of economic, technological, socio-cultural and political forces.” The term ‘liberalization’ on the other hand, “refers to a relaxation of previous government restrictions, usually in areas of social or economic policy”. In the arena of social policy it may refer to a relaxation of laws restricting human actions like travel, marriage, or importing equipment, among others. Legalising anything does not necessarily lead to its implementation immediately. Liberalization, in a true sense, is coming out of an orthodox setup, to accept changes for the benefit of humanity. Acceptance and implementation of any change requires a liberal attitude in the receiver. For example, in recent years inter-faith marriages are being accepted much more willingly than, say, fifty years ago, because we are now more progressive in our understanding and attitude.

From these definitions it is clear that liberalization and globalization are intimately connected. Liberalization is the first step in the process of globalization. In social life also, we could embrace the whole world as one, as

‘*basudhaiba kutumbakam*’ (entire world is your own people), if we are liberal in our attitude.

Neither liberalization nor globalization is anyone’s invention; it is a law of history. Liberalization is a process which gets invoked automatically as science advances. Historically, scientific research has been characterized by individual work. And liberalization (or even globalization) is an indispensable process required to march forward in science and technology. Europe, for example, procured intellectual traditions from other parts of the world, specifically from China, India and the Middle East<sup>1</sup>. The windmill had come into Europe from Persia, the compass had come from China, many fundamental mathematical concepts (including the notion of zero) had come from India and the idea of an organized social space for learning had been an Arabic innovation.

Excellence in research in science and technology depends on the policy of the country. The policymakers hold the future of a country in their hands. The more liberal the science policy is and the more knowledgeable, pragmatic and liberal in attitude the policy holders are, the more likely is it to achieve excellence in science and technology. Liberalization is important not only for the advancement of science and technology, but also for the upliftment of society which results in a better economy as measured by the GDP. Here is an example from ‘Nation Building through Science and Technology’, an article by R.A. Mashelkar<sup>2</sup>. “I remember the legendary Indian Industry leader JRD Tata saying in desperation in February 1978 that Telco, which was his company, was not allowed to develop a car. It was only in July 1991 that India liberalized its industrial policy and opened up. It was in 1993 that Ratan Tata who succeeded JRD Tata, was allowed to make a car. He gave this challenge to 700 engineers who had never designed a car before in their life. Spending only

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one tenth of what major auto manufacturers would have invested; he and his team designed and developed a new Indian car, Indica, that was world class. The creative ability of his 700 engineers from Telco was always there for all to see, but it got “expressed” only when the government policy changed through opening up and liberalization”.

The liberalization of India’s science policy is a relatively recent phenomenon. After independence, Jawaharlal Nehru was focused on building science and technology institutions to create scientific spirit within the country which would ultimately help overall development, even not immediately. Indira Gandhi believed that self-reliance in technology will help India to take an independent position in the world. It was during her time that an attempt to link S&T with economic planning was made for the first time, and was never repeated. Her tight control over the import of equipment and foreign technology impeded the development of science and technology. In India liberalization started in the eighties, although its actual implementation occurred in the nineties. In scientific research it was Rajiv Gandhi who lifted import restrictions and introduced more liberal policy for importing scientific equipment and technology. He realized that in order to compete with the advancement of science and technology worldwide, it is imperative that modern equipment be made available to scientists instead of investing time to build it indigenously. There is no denying that this liberalization helped the country in building up a scientific infrastructure and attitude comparable to many advanced countries, and thus helped advancement of scientific and technological research enormously in certain areas. However, building up of scientific infrastructure and modern laboratories does not automatically benefit the economy of the country or elevate the status of the poor although that should be the ultimate objective of science and technology. In 1927 Mahatma Gandhi visited the Indian Institute of Science and remarked, “Unless all the discoveries that you make have the welfare of the poor as the end in view, all your workshops will be really no better than Satan’s workshops.”

One of the major objectives of liberalization is to reduce the gap between developed and developing nations in areas like economy, facilities, infrastructure and knowledge. Here, I shall only be concerned with the creation of knowledge and its dissemination. The purpose of the present paper is both ‘inward looking’ and ‘outward looking’. In the first category we suggest policy recommendations so as to improve the quality of human resources which is the vital ingredient for improvements in scientific and technological research, and to keep open

the space for challenging research activities, while in the second category we suggest methods to obtain an equitable academic environment through international collaboration and agreement. The creation and dissemination of knowledge is a prime constituent factor for creating an appropriate academic environment.

It will be relevant here to deliberate how Latin America, particularly Brazil, has changed its education and science policy in the last few years not only to avoid the catastrophe it was heading to but also to appear as one of the emerging developing countries in economy, education and science and technology. Till mid eighties to all universities in Latin America the model aspired to be one of the best US or European research universities. But at that time most of the higher education institutions in Brazil were just teaching institutions and it was ridiculous to aspire to be like Harvard or Cambridge without strong research base in universities. Brazil through its new constitution under the civilian rule insisted that in higher education teaching and research are inseparable which implied that good education as such was an unworthy goal for the country’s higher education establishments<sup>3</sup>.

During the military government in Brazil in the seventies, ambitious projects like nuclear programme, rocket and satellites, nuclear submarine, etc. were undertaken on one hand and on the other hand American-style graduate programmes, research programs and fellowships were undertaken. As reported<sup>3</sup> “this alliance between the military and academics was a notable feature of those years, particularly because of the opposite political ideologies usually held by leading figures of the two sectors. Nowhere was this alliance as strong as in the failed attempt to develop an indigenous computer industry in Brazil, in the same very years that the microcomputer revolution was starting to sweep the world”. The ambition to make Brazil a world power started fading away in the early eighties when the military regime started to crumble and disappeared when the power was handed over to the civilians in 1985. But this short-lived alliance was enough to produce a significant number of researchers and research institutions claiming for public support. In the early eighties Brazil had about one thousand graduate programmes in all fields of knowledge, about fifty thousand people were living on research money distributed in the form of fellowships, grants, and salaries etc. But the quality of scientific environment produced due to this rapid growth in the seventies was very uneven except at some universities which had scientific and technical traditions for many years. Brazil, like India, tried to protect the industry from the competition from foreign firms and

introduction of foreign technology under the guise of import-substitution policy with the assumption that national industry may not be efficient at the beginning but would mature and eventually compete internationally in an equal basis. As a result industrial products became too expensive and could not compete internationally and economy failed.

The policy for science was similar in many respects, the assumption was that even if a research group is not very good, provide them support and eventually it will improve. The policy was soft without discriminating the good and the bad, because if the projects were evaluated by stricter criteria by funding agencies, very few research institutions will finally qualify. Consequently the resources for research started to be meagre and the number of people requesting funds for science kept increasing. The situation became worst in 1986-87, when inflation was at its peak and it was impossible to allocate resources for science and technology because most of the funds spent in paying salaries to the employees in the form of fellowships. This might have been an appropriate strategy to combat the situation at that time, but later when the currency is stable and the situation more favourable, 70% of the resources allocated to the National Research Council went towards paying salaries only. The change in policy started with the recommendation that the country should maintain and protect whatever capability it has and also in trying to improve on that. At the same time, mechanisms should be created to stimulate closer links and association with users of scientific knowledge and competence, both in the private and in the public sector. There should two mechanisms for science support, one based on strict criteria of quality, the other strongly influenced by criteria of social and economic relevance and one should influence the other. Brazil followed these recommendations and the results are imminent.

The first task in this kind of study is to understand what are the assumptions and what is the real situation, only then one can challenge it for a change. The standard model is based on the so called “endless frontier” model of science which assumed that scientists are free to pursue any kind of research they feel like and if you can support the interests of individual scientists with enough funds, everything else will follow: good education, good training, technology and economic development, as was assumed in Brazilian science policy in seventies. This assumption is at the centre of belief in many countries including India and our scientists are long clamoring for this. However, this is just an ideology (ideally science should be like that) and it has many pitfalls. Unless there is some sort of

realistic monitoring and scope to take corrective measures it will ever remain unproductive.

This ideology of providing scientists enough money for pursuing science, giving them freedom on the assumption that they will always do good things, is enjoyed more by those who pursue pure science than those who do applied science. If we look at the international scenario today, what is changing is not that science is becoming more linked with the applied science. Scientists sometimes interpret this challenge to pure science as a threat to their independence and autonomy. In order to accept this change we need liberalization of our attitude towards science.

When I said monitoring of the works within the frame work of independence, obviously the word that came into your mind is the accountability which is *lingua franca* among the policy makers and bureaucrats. This term was introduced politically in all spheres of English public life by Margaret Thatcher—as daughter of a small-town grocer it was natural for her to quantify any process of evaluation—and crossed over to Indian shores in the early days of economic liberalization. Accountability has different meanings in different contexts—outside the world of economics, its intention is to make one responsible and answerable to someone or to an authority. Accountability in terms of economic return is relevant to industries and businesses because they follow a linear model: maximum economic output is expected to be delivered by a given direct input of resources used in production<sup>4</sup>. However, this linear model might not be true for general research, particularly in the case of fundamental research. The general perception of science is to see a tangible result, and hence applied research tends to receive more public support in terms of funding compared to fundamental research.

Now the question is how can one make the money given to research and higher education more relevant and meaningful to society? Obviously there are two opposing views. One view insists that the amount of money spent in science research is much less than expected and needs to be increased and giving the size of the country the number of research students and scientists are small and some wastage is unavoidable. The opposite view is that the whole system is a waste of resources and government should stop supporting basic science research and only support industrial and applied research. One may cite the example of Japan who developed modern technological capabilities without significant system of basic research.

'Basic science research' and 'fundamental science research' is not the same thing although scientists use them interchangeably according to their convenience. It is hard to distinguish between basic and fundamental research. Fundamental research is the research which leads to a fundamental discovery or produces an entirely new knowledge or concept. All basic researches are not fundamental but all fundamental researches are basic research. Basic research may lead to a fundamental discovery, and one can appreciate its significance only after it is discovered.

Scientific research is a process of discovering knowledge. With globalization, scientific research is becoming more and more challenging. With the tremendous improvement in communication system and liberalization, scientists are forced to play in a level field competing with other countries, not only with scientific discoveries but also to handle complex issues such as pollution of the air and water, global warming, etc. These issues will remain an important agenda for all scientists to address. The days of traditional individualized research to achieve personal fulfilment are no more, and the need of the hour is to work collectively to promote interdisciplinary programmes and institutes. I do not agree with the blanket remarks made in the World Bank's World Development Report<sup>5</sup> that developing countries differ from developed ones not only because they have less capital but because they have less knowledge. This might be true for some nations, but should not be mistaken as a generalization. It is true that creating knowledge in the form of books, journals and other materials is more difficult in developing countries than in developed ones due to disparity of economic circumstances. With the availability of digital technologies and the Internet, it is not impossible to move far beyond the physical boundaries of a library to access journals and books from any other library in the world. The agencies like DST, CSIR etc. which support science and technology research pay subscriptions for electronic version of all relevant journals and create a portal accessible to all scientists of institutions supported by them and thus save the cost of subscription of journals to individual institution separately. This also prevents stocking of every journal or book in each individual library thus conserving scarce financial resources. The policy of creating regional library like regional instrumentation facility set up in the country to avoid duplicate set of equipments will not be a good idea considering the dismal experience scientists have generated from complex many-body problems.

Scholarly journals have been the traditional outlet for disseminating knowledge, and affording such journals in developing nations is becoming increasingly difficult. In order to reduce this disparity in creating knowledge, it is imperative that efforts are made so that knowledge will be available to everyone everywhere irrespective of geographic and political boundaries. The libraries of tomorrow will be different from those of today. This can be achieved by international negotiations and collaborations. Similar access to laboratories and classrooms are possible through virtual visits without significant investments in developing countries (assuming a reliable Internet backbone is available). These means of communication will open up a new form of intellectual discourse, and clearly the process of discovering knowledge will be enhanced when scholars of different disciplines are linked and communicate rapidly.

In order to understand the factors affecting science research, one has to understand the framework within which research and institutes of higher education operate. In India, basic research is mostly funded by public money through funding agencies like Department of Science and Technology (DST) and Council of Scientific Research (CSIR). Ironically however, the Indian public is largely unconcerned about science and its effect on human life. For the most part, Indian scientists still prefer working for their own satisfaction, rather than working collectively to attack and solve national issues. In order to excel in scientific research, the most crucial element is human capital, i.e. people who are inspired to work towards achieving these goals. Simply increasing fellowships and salaries cannot be the only method of attracting such talents.

The creation of knowledge not only requires proper environment and infrastructure, but more importantly, human resources. Knowledge is created from ideas and ideas come from creative people and knowledge comes from education. For good education, a significant portion of government money invested in science research should be invested in universities. Science research should run through public-private partnership. Instead of building more research institutes, which is the current trend in this country, more universities and educational institutions need to be built up. Although many ideas may remain latent in the creative minds of people, their extraction and utilization require the implementation of proper policy and creation of a suitable environment as well as an appropriate infrastructure. In order to attract the best students in research, research needs to be more challenging in the areas of public utilization. The problems of acid rain, ozone

depletion, greenhouse effect, waste disposal, and other matters of public concern should be an important agenda for research and public policy. We have found almost all research institutes lamenting the lack of good research students, despite substantial increase of research funds. In order to attract quality students and for sustainable research, it is necessary to make research more challenging, and to transform the results of research to all who can use it, to benefit society, and to serve the economic and national interests of the country. Present generation wants to perform, wants to face challenges, wants to see the result, wants to achieve and so it is the opportune time to set challenges before them to solve. Laboratories without aspirations, projects full of quirks of scientists no longer attract bright students. It is the duty of the policymakers to identify national issues and societal problems, prioritize them and open up those challenges to the scientific community to come up with solutions. “Thrust areas” or “Frontiers” of science needs to be categorized on the basis of the need and capabilities of the country and not following the trends of science research in West Europe or USA. Unless such an environment is created, talents will continue to be siphoned off to other sectors and countries. Many of our scientists are ensconced in the narrow professional interests of their discipline, completely oblivious to the broader mission of serving the public for which the institute is funded. The reward should not come merely from the number of publications or the number of patents acquired, but from the originality of ideas, so that the methods of solving emerging issues are rewarded. Provide them good salary comparable to the corporate sector, if possible, but assess them properly to plug the wastage of resources and also to inculcate value-based culture in the system. Increment and tenure needs to be performance-based. I am happy to note the trend has started in recruiting faculty in the newly formed Indian Institute of Space Sciences and this is liberalization from orthodox ideas and concepts.

A system to register the ideas similar to the National Innovation Foundation<sup>6,7</sup> needs to be created. This would allow any individual to freely register an idea in a public database. As long as the depositor is affiliated to an organization, no permission would be needed from the institution to register the idea. This open access system would then be accessible to any individual, organization or agency to review and comment. Ideas would remain in the public domain for enough time to give a chance to be criticized, improved upon and for further development by any interested party. In addition, these ideas would be evaluated by a board of experts from time to time to assess their feasibility and suitability for further application. If an

idea is found to be novel and practical, the originator would be rewarded. If the idea is used commercially, the party or parties responsible for generating and nourishing the idea would get a monetary benefit based on mutual negotiation. The entire system could be conducted and managed by an independent non-government board without interference from politicians or bureaucrats, either in terms of functioning or funding. By communicating directly with the public through their website, the board could increase general awareness of challenging national issues including security and health, as well as matters of commercial importance that would develop the national economy. Similarly, an open access portal describing national issues and problems regarding societal issues can be hosted by the government inviting scientific community to participate and come up with solutions. Besides ‘big’ issues like pollution, garbage disposal etc., it should contain problems and issues of regional and of local demand, problems that may not fall under ‘fashionable’ research, but will benefit the society. Scientifically correct and feasible solution to a given problem after debate among the scientists and experts will be given all sorts of support to achieve the goal. It will be an ‘open’ dialogue between the scientists, the common people and the policy makers, a connection between the solution seekers and solution providers. This will act as a window in its true sense. A window is not merely a hole in the wall, but a relationship between the outside and the inside, between darkness and light, between warmth and cold. A window is not a thing—it is a connection.

Research institutes and universities in India are, in general, ineffective in packaging and delivering the goods (knowledge) necessary to make research interesting. The link between universities and research institutes and between research institutes with industries is required to be more interactive. In order to compete with other nations and to be an effective player in the field of science, a science policy needs to be formulated to strengthen human resources as well as generating an atmosphere conducive to the creation and dissemination of knowledge.

The economic model of funding scientific research by the public exchequer through government agencies like the Department of Science and Technology, etc. is not very sustainable, and investment in research by private players should be encouraged in applied research. At the same time, the number of patents granted or the number of published papers should not be the criterion for funding. As Terence Kealey<sup>8</sup>, a researcher and professor in clinical biochemistry at the University of Cambridge, remarked in his book *The Economic Laws of Scientific Research*, “The

Market Place does not worship false Idols, it makes empirically correct judgements. It is the government funding of science that is an Idol of the Tribe". Fundamental research needs to be fully supported by the Government, while 'routine' research should be supported by private-public partnership. According to him eventually science runs up against the limits of taxpayer generosity, and even if funding keeps growing, but at a slower rate, there is much pain and frustration as anticipated career paths do not materialize. Kealey contends that not only would the free market have provided amply for basic research, it would have treated scientists themselves better. Liberalization should not be taken in a narrow context of relaxing the regulations of the existing laws but requires coming out of the orthodox set up as a whole. Time has come to rearticulate the need and demand for a public funded research. □

#### References

1. Mikael Hard and Andrew Jamison, *Hubris and Hybrids: A Cultural History of Technology and Science*, (2005) Routledge.
2. R.A. Mashelkar, *Innovation strategy today*, Vol.1, pp. 16-32 (2005).
3. Simon Schwartzman, "Science and Technology: Old Assumptions and New Challenges", Lecture presented at the Seminar on Higher Education, Science and Technology in Latin America on November 8 1996.
4. S.C. Roy, 'Accountability for Scientific Research' *Science and Culture* **73**, 261-263 (2007).
5. World Bank (1999), *World Development Report 1998/1999: Knowledge for Development: summary*, The World Bank, Washington, DC.
6. J.D. Livingston, *Proc. of the International Conference on Innovation and Technology Management*, pp.54-70 (2008).
7. <http://www.nifindia.org/>
8. Terence Kealey, *The Economic Laws of Scientific Research*, (1997) Palgrave McMillan.