GLOBAL STRATEGY FOR HIGHER EDUCATION IN THE 21ST CENTURY

Indo-US Consortium of Universities

Obama-Singh 21st Century Knowledge Initiative

A Proposal for Training Science-Technology-Engineering-Mathematics (STEM) Faculty through Inter-Institutional Partnerships between U.S. and Indian Universities

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EXECUTIVE SUMMARY: **This proposal describes a plan to establish STEM Education and Research (ER) Centers at Indian universities in collaboration with U.S. universities. The goal is to train the next generation of STEM faculty in India in teaching and advanced research at the level of world-class institutions. Owing to the urgency and immensity of the needs for higher education in India, this plan differs from existing degree or exchange programs. It envisages an accelerated time-frame within two years of an intensive ER program for prospective students that would impart basic knowledge and begin an ongoing process, to continue in later years as they embark on careers as STEM faculty. Based on a standardized and accredited platform, the training program would be carried out both at host institutions in the U.S. and at the STEM-ER centers in India. Research and innovation at the STEM-ER centers would be aimed at laying general scientific infrastructure, as well as to meet specific needs of industry. This proposal based on a U.S. India Education Foundation pilot project between the Ohio State University and the Aligarh Muslim University launched under the Obama-Singh 21st Century Knowledge Initiative. One of its aims is inter-university cooperation between U.S. universities, and central and private universities in India. Public-private partnerships could significantly contribute to the proposed endeavor.**

1. INTRODUCTION

Rapidly emerging countries have an unparalleled need for higher education. Great human and material resources exist not only in big countries such as China, India and Brazil, but around the globe in Asia, Africa, and South America. The potential is literally limitless. The governmental and non-governmental agencies are acutely aware of the need to develop this immense potential. Plans are being unveiled, or are already being implemented, on an unprecedented scale in many countries.

Despite this immense potential, the educational infrastructure in these emerging countries currently lacks the capacity of meeting the need: **to train those who would teach**. Indeed, it is

the faculty in the newly established or expanding universities that must acquire state-of-the-art knowledge and skills to teach the vast multitude of students waiting to be educated. The young and bright students are eager to learn. Thanks to the internet and its derivatives they are already aware of the most advanced developments in each field, from the smallest scales in nanotechnology to the largest in the Universe. Therefore, the training of STEM faculty must include not only all that is basic and essential in each area, but also the latest developments. Their students deserve and would be satisfied with nothing less. At the same time, the symbiosis between higher education and research must be recognized and addressed.

American universities have a unique role to play, and indeed, a historic obligation to fulfill. The largest number of world-class universities exists in the U.S. While carrying out the most advanced scientific and technological research in the world, they also specialize in teaching large number of students in the widest possible array of disciplines. Perhaps the best exemplar of such symbiosis is the Consortium for Inter-University Cooperation (CIC) in the United States (see Appendix). An equal partnership between educational institutions from emerging nations such as India, and their American counterparts, is both a vital necessity and a great opportunity.

Moreover, the need for training STEM faculty is urgent; conventional graduate programs and timeframes are impractical for prospective faculty members in the new universities in emerging nations. They are already "in the trenches," teaching while keeping abreast of rapidly advancing knowledge. Traditional doctorate programs that require up to 5-6 years of study and research in STEM subjects are prohibitively expensive and time-consuming. On the other hand, a traditional Master's program in one subject provides insufficient advanced training or research exposure to STEM subjects. Also, many current faculty members may already possess these degrees from institutions in their home countries. As a result, he world-class and state-of-the-art advanced training is the necessity.

We propose a standardized and streamlined approach with the following salient features.

- Unified proposal from the U.S. Universities for optimal efficiency avoiding duplication
- Develop new and intensive 2-year graduate degree programs intermediate between a Master's and a Doctorate
- Combine multi-disciplinary curricula for advanced research and teaching
- Formulate uniform standards across the participating institutions
- Define appropriate metrics for the success of each program
- Implement distance learning internet-based audio-visual interaction mechanisms
- Ensure continuity and follow-through subsequent to the formal degree program
- Establish joint centers of instruction and research at participating universities in emerging countries
- Focus on innovation and research on global problems: energy, environment, healthcare
- Form a Steering Committee to oversee the implementation of the STEM initiative.

2. INDIA-SPECIFIC PROGRAMS

The needs of each country are different. While the general requirements, standards, and pathways outlined above may be the same, partner universities and educational institutions in each country would have specific priorities. At the same time, participating universities from the U.S. would also desire **country-specific flexibility** in designing their programs according to existing resources and future plans. For example, environmental problems, healthcare issues, alternate energy generation, basic scientific research, etc. may find different focus, emphasis, and level of activity at each institution in each country. At the same time, common global imperatives also need to be considered since they affect each country.

One solution to the issue of diversity is to identify and form **bi-lateral institutional arrangements** under joint partnerships between a U.S. university and a university or institute in other countries for the training of STEM faculty and related programs with strengths in different areas. While such programs may involve only two or a few institutions, they would still attempt to adhere to the general guidelines to maintain quality control, avoid duplication, share resources, foster collaborations, and approach potential funding sources, as envisaged in the general criteria outlined earlier.

Therefore, bi-lateral arrangements need not be in conflict with the general aim of this US-INDIA STEM initiative. Rather, they should strengthen the overall proposal vis-à-vis potential funding sources by exemplifying programs that would contribute to the goal of STEM education and research. All universities have their areas of strength, usually manifest in centers of excellence or specialized institutes. Since STEM education and research are both emphasized under this proposal, prospective students could choose to pursue STEM-ER degree programs at the most appropriate U.S. and Indian universities. This should correlate with students' area of specialization, and one in which they would remain engaged following the completion of formal requirements, presumably towards a full-fledged doctorate.

The link between education and research under the STEM-ER program should be flexible. This may also reflect national priorities such as education in rural areas, as opposed to urban areas which tend to have more than sufficient concentration and opportunities for higher education. Students may select an emphasis on teaching over research by enrolling in coursework that teaches skills necessary for undergraduate classes. Graduate level research may be less of a priority.

In the next sections, as an example, we sketch out a possible framework for a US-India program. Similar programs may be drawn up with respect to other emerging countries.

3. US-INDIA INITIATIVE

The existing situation with respect to higher education in India presents a great challenge, with dimensions of supply, demand, resource, and quality. On the one hand, the established universities are over-burdened with exceedingly heavy demand and lack the resources to meet it. On the other hand, a multitude of small for-profit colleges and universities have sprung up with extremely narrow and commercially oriented curricula without adequate quality control. Indeed, the numbers tell the story: there now exist over 20,000 colleges and universities in India, about ten times the number in the U.S. The uneven standards are detrimental to future prospects of the vast majority of young students seeking higher education in most of these institutions. In addition, a number of profit-motivated business organizations from foreign countries have moved into the higher education arena. Finally, and despite the dearth of qualified world-class faculty, some private Indian universities have begun opening campuses in other countries outside India, in the Mid-east, Asia, and Africa .This then is a global issue as manifest in the Indian environment. **A major combined effort on the part of U.S. universities can help tremendously. Whereas the resources of a member university of the consortia in the U.S. or India may be inadequate, a well-coordinated program should be able to address the problematic issues outlined herein**. There is, indeed, an illustrious example of the connection between U.S. institutions and the genesis of the highly prestigious Indian Institutes of Technology. The Kanpur Indo American Program (KIAP) was instituted in 1962 by President Kennedy and Pandit Jawaharlal Nehru. A consortium of nine premier American universities and institutes, led by MIT and including the Ohio State University, was formed to assist the formation and development of the Institute of Technology Kanpur. Since then, "IIT-K" has flourished by leaps and bounds, with many alumni as members of faculty at U.S. universities.

Driven by similar motivations and intended on a much larger scale, following the general criteria outlined earlier, the Ohio State University would like to suggest the preparation of first such proposal from CIC Universities to the **University Grants Commission (UGC) and the Department of Science and Technology (DST) of the Ministry of Human Resources and Development of India**. This would be in response to solicitations by the Government of India, specifying a timeframe concordant with the implementation of the 12th 5-year Plan in 2012.

The agenda is to address these issues through coordination with a consortium or organization of Indian educational institutions, similar to the CIC, under the aegis of governmental agencies such as the UGC and DST. To wit: As this proposal focuses on STEM-ER, DST could sponsor such an association of Indian Universities under guidelines drawn in consultation with UGC and the Indo-US consortium of universities. The organizational structure could be built up in stages, with the first tier comprising of the major central universities in India (see Section 9 for a list and locations). Subsequently, other universities could be brought into the framework in an order deemed suitable by the Indian and U.S. governmental agencies and participating organizations. The U.S. universities would then follow with the groundwork necessary to establish a framework of collaboration with individual Indian universities.

A few outstanding features of this initiative are outlined below.

4. STEM EDUCATION AND RESEARCH IN INDIA

The two main and inter-related components of this initiative are as follows.

I. **STEM education and training:** Utilizing rapid advances in electronic transmission of virtually all forms of knowledge enables highly efficient routes to be implemented. One is remote learning, and the other is flexible schedules. STEM faculty trainees should find it particularly attractive to access all course materials, as well as avail themselves of faculty interactions, on-line. A well organized "virtual environment" is the key to the success of this endeavor. Fortunately, that is not only feasible but also foreseeable. For example, equipped with state-of-the-art visualization and communication capabilities, the Ohio Supercomputer Center in Columbus, Ohio has expressed its support for undertaking such ventures. Flexibility of schedule that would suit prospective trainees in the STEM-ER program is also critical. Formal course requirements or examinations need not be time-bound, partially owing to distance learning facilities. The faculty and staff at participating universities on the one hand, and the prospective STEM faculty trainees on the other hand, can develop the most efficient schedule on an individualized or collective basis.

II. **Research Infrastructure:** While India has attained astonishing growth in certain areas of science and technology, the extent of many of these areas in STEM research is still narrowly confined and does not, as yet, constitute the world-class research infrastructure that India needs for growth in all major fields of science and technology. At the same time, with the exception of the relatively few institutions mentioned above, there is extreme dearth of science and technology facilities at most universities in India. While research is not the primary focus of the Indo-US STEM – ER initiative, joint research and innovation centers would be established at not only major universities, but eventually at all participating institutions. **A symbiotic relationship between STEM education and research could be the driving engine for the growth of basic scientific infrastructures and superstructures throughout the country.**

Implementing these two items in the Indian environments must take several factors in consideration, including regions and the locations of central universities. Regional and geographical locations would play a role and should be carefully taken into account. On the one hand the Indo-US STEM initiative must connect with Indian institutions that possess the necessary resources, likely to be located in metropolitan areas. On the other hand, it must reach out extensively into other populated areas where the need is greatest.

One may illustrate the need and the solution embedded in the proposed concept by considering the universities in the capital area, and in reasonably close proximity to Delhi. For example, among the major Delhi universities are the University of Delhi, Jawaharlal Nehru University, and Jamia Millia Islamia. They are all classified as Central Universities (Section 9 for a list) under the administration of the central government. Owing to their location in the capital, they have relatively far greater access to resources than most other Indian institutions. Not far away (approximately two hours by road), the Aligarh central university is located in the most populous state in the Indian Union, Uttar Pradesh (U.P., population 200 million). The Aligarh University, founded in 1875, aims to provide higher education in U.P., with perhaps the most acute needs in terms of the number of current and potential students. Thus, a part of the proposed initiative could focus on a regional formation linking these few universities, in Delhi and in U.P., as part of the overall Indo-US STEM program.

The modalities for the Indo-US STEM-ER initiative could comprise of the following elements.

- Concordance with the 12th 5-year Plan: Follow the contours of the Concept Note on Innovation Universities Aiming at World Class Universities (Source: DST report, Indian Embassy, Washington, DC)
- Form an equitable partnership with a consortium of Indian universities with similar aims, involving major central universities first and state universities later
- Build upon existing connections between U.S. member universities and Indian universities
- Standardize accreditation system for joint or dual STEM-ER degree program
- Enable interested faculty members in each Indo-US university partnership to develop common curricula
- Provide administrative oversight of common education and research programs by partner universities
- Constitute an Indo-US STEM-ER Board to oversee the implementation of the above elements

5. DUAL OR JOINT DEGREE STEM-ER PROGRAMS

One of the important issues to be addressed is the nature of the two-year degree program to be offered by the U.S. and Indian universities. A dual-degree program might entail a degree awarded by each partner institution on the basis of their existing standard requirements for a Master's or Doctorate course. A joint degree would require a more comprehensive coordination and standardization of course and research work by both partner universities, as well as between the respective consortia of universities in the U.S. and India.

We suggest an initial phase based on the dual-degree alternative. The joint-degree option can be explored as the program develops, with crucial input from the practical experience gained from

the first phase. The joint-degree program would be different from the existing framework, and would require approval at various levels at each institution and taking account of programmatic considerations of the envisaged consortia of institutions.

It is of crucial importance to design the degree(s) and courses to be offered appropriately to meet this general framework. A possible outline may be considered as below. The novel degree program would entail the following:

1. Bear the **imprimatur of participating universities** in the U.S. and India.
2. Fundamentally different from traditional Master's or Doctorate program in content
    - Maximum 2-year duration
    - Flexible course schedule and timetable
    - Continuation beyond the required degree phase
    - Joint mentoring and research collaboration
3. Degree requirements would be commensurate with those of the particular university where a given student pursues the coursework.
4. Emphasis on both educational coursework and research project
5. Prospects for continuing research under chosen advisors
6. STEM-ER curricula would be designed in coordination with Colleges of Education and individual colleges and departments in STEM subjects at participating universities

6. THE USIEF OBAMA-SINGH OSU-AMU PILOT PROJECT

An important point concerning the nature of the STEM education and research proposal, and potential partnerships, is that it is very timely. It falls under several recently launched education and research initiatives. For instance, it is ideally suited to the goals of the agreement instituted by President Obama and Prime Minister Manmohan Singh, the **Obama-Singh 21st Century Knowledge Initiative, administered by the US-India Education Foundation (USIEF).**

Consistent with outline presented hitherto, and under the Obama-Singh 21st Century Education Initiative, the U.S.-India Education Foundation has awarded a grant to a joint partnership between the Ohio State University (OSU) and the Aligarh Muslim University (AMU) in 2013 to establish a Center of Excellence for STEM Education and Research faculty training in Aligarh. The three-year pilot project seeks to train a limited number of senior graduate students from AMU, already near completion of a doctorate degree in a STEM subject, under a dual-degree two-year MEd (STEM) program at OSU, complementing and enhancing the graduate degree program at AMU. Eventually, the goal is to expand the program at AMU to a larger number of students, as well as to other public and private universities in India.

7. PRIVATE INDIAN UNIVERSITIES AND INDUSTRY

Most of the new universities in India that have emerged in recent years are private. Their need for new faculty may well be the prime focus of the proposed endeavor. At the present time most private colleges and universities have fairly narrow curricula, usually restricted to elementary business and computer courses. Research is generally not a priority, and in any case would require considerable effort, expertise, and timeframe for the development of requisite research infrastructure.

However, large private universities with huge enrollments have embarked upon comprehensive plans not only to expand the reach of their curricula, but also to engage in frontline research. For example, the Manipal University and the Jain University, have several campuses within India. But in order to bring those up to world-class standards, STEM education and research should be front and center.

At the same time there is growing urgency concerning the needs of private industries. Major business enterprises, whose commercial interests are critically important to Indian economy, are often unable to function well due to lack of adequately trained recruits in basic science and technology. That, in turn, also inhibits the capability of private industries to expand as rapidly as the Indian economy demands. Organizations such as the Confederation of Indian Industry (CII) are cognizant of the vast need for training not only large number of STEM faculty, but also that their training needs to be world-class in order to compete with advanced countries and other emerging nations such as China and Brazil.

U.S. universities may also act as catalyst to the establishment of STEM Education and Research Centers of Excellence at private universities in India.

8. SCOPE AND FINANCIAL PLAN

Owing to the extensive nature of the proposed program addressing a vital national need, it is necessary for the consortia of U.S. and Indian universities to prepare a comprehensive proposal to be submitted for consideration by governmental and inter-governmental ministries and departments.

While the first phase of pilot projects may be undertaken with support from sources and funding programs already in existence, such as the USIEF and the IUSSTF, the primary request for support would need to be made to the Indian and U.S. governments. The full scope of the challenge is evident from the current need to train at least 300,000 faculty members for existing and upcoming institutions of higher education in India.

Assuming that the universities in the U.S. and partner universities in India agree to meet this need under this program by considering a number between 1% and 10% of the figure mentioned by Mr. Sibal, amounts to between 3000 to 30,000 students. Divided among the ten or so

partnering institutions that is still a large number, if we embark on a five-year plan concurrent with the 12th Five Year Plan of the Government of India, or even a ten-year plan.

Private-public partnerships are vital. Resources commensurate with the scope of this problem are probably beyond the capacity of most universities, and therefore a new program supported by the U.S. and Indian governments would be proposed as an outcome of the initial phase, and as outlined in the next section.

9. ACTION PLAN FOR A JOINT INDIA-US PROGRAM

- Seek administrative input and approval from U.S. universities, associated colleges, and STEM faculty
- Focus on selected universities in India as initial members of the **Joint Indo-US STEM-ER Consortium**
- Prepare a list of prospective partner universities in India and database of existing education-research programs.
- Organize a symposium in India to discuss the proposal to UGC and DST
- Approach organizations such as the US-India Educational Foundation (USIEF) and the Indo-US Science and Technology Forum (IUSSTF) for support and guidance
- Involve other governmental agencies in the U.S. and India , via the U.S. embassy in India
- and the Indian embassy in Washington, DC
- Inculcate private-public collaborations with organizations such as the Chambers of Commerce, Confederation of Indian Industry, and a selected variety of private enterprises including multi-national corporations
- Establish joint centers for Innovation and Research at Indian institutions with multi-lateral participants: Indian universities, U.S. universities, Indian government agencies, U.S. government agencies, and Indo-US business groups
- Develop a joint proposal for submission to the Indian and U.S. governments to support the establishment of the STEM-ER centers at Indian universities

10. APPENDIX

The CIC Consortium of U.S. Universities:

Headquartered in the Midwest, the Committee on Institutional Cooperation (CIC) is a consortium of the Big Ten member universities plus the University of Chicago. For more than half a century, these world-class research institutions have advanced their academic missions, generated unique opportunities for students and faculty, and served the common good by sharing expertise, leveraging campus resources, and collaborating on innovative programs. Governed and funded by the Provosts of the member universities, CIC mandates are coordinated by a staff from its Champaign, Illinois headquarters.

CIC Member Universities:

- University of Chicago
- University of Illinois
- Indiana University
- University of Iowa
- University of Michigan
- Michigan State University
- University of Minnesota
- University of Nebraska-Lincoln
- Northwestern University
- Ohio State University
- Pennsylvania State University
- Purdue University
- University of Wisconsin-Madison

A comprehensive description of the resources and capabilities of CIC universities will be provided in ancillary material highlighting the strengths of individual member institutions pertaining to this proposal. A brief outline for the Ohio State University .

The Ohio State University: Founded under the Land Grant Act signed by President Abraham Lincoln, The Ohio State University is one of the leading universities in the world. For more than a century, OSU has successfully advanced the goal of bringing higher education to generations of students on a large scale while maintaining high standards. Continuing to meet that goal here in the U.S., OSU is particularly cognizant of the magnitude of the challenge facing higher education entities in emerging countries. That forms the basis of globalization efforts launched by OSU under its country-specific Gateway programs related to the following general items.

- Size, quality, and diversity of education and research programs at OSU
- Globalization plans under OSU Gateways
- Connections with Indo-US business enterprises in Ohio

Central Indian Universities:

A partial list of universities under administration by the Central Government of India

a. University of Hyderabad, Central Univesity P.O. Hyderabad - 500 046 Andhra Pradesh
b. Maulana Azad National Urdu Univesity, Gochibowli Hyderabad - 500 032 Andhra Pradesh
c. Assam University, Silchar - 788 011 Assam
d. Tezpur University, Napaam, Tezpur - 784 028 Distt. Sonitpur Assam
e. University of Delhi, Delhi - 110 007 Delhi
f. Indira Gandhi National Open University, Maidan Garhi New Delhi - 110 06 Delhi

g. Jamia Millia Islamia, Jamia Nagar New Delhi - 110 025 Delhi
h. Jawaharlal Nehru University, New Mehrauli Road New Delhi - 110 067 Delhi
i. Mahatma Gandhi Antarrashtriya Hindi Vishwavidyalaya, Post Box No.16, Panchtila, Umri Village, Arvi Road Wardha-442 001 Maharashtra
j. Central Agricultural University, Iroisemba Imphal - 795 001 Manipur
k. North Eastern Hill University, P.O. NEHU Campus Mawkynroh Umshing, Shillong - 793 022 Meghalaya
l. Mizoram University, Aizwal - 796 012 Post Box No.910 Mizoram
m. Nagaland University, P.B. 341, H.Q. Lumami Kohima - 797 001 Nagaland
n. Pondicherry University, R Venkataraman Nagar, Kalapet Pondicherry - 605 014 Pondicherry
o. Aligarh Muslim University, Aligarh - 202 002 Uttar Pradesh
p. Babasaheb Bhimrao Ambedkar University, Vidya Vihar Rae Bareli Road Lucknow - 226 025 Uttar Pradesh
q. Banaras Hindu University, Varanasi - 221 005 Uttar Pradesh
r. Visva Bharti, Santiniketan - 731 235 West Bengal

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