Detailed Project Report

Of the Project entitled,

"Setting up of Indian Institutes of Science Education & Research (IISER) at Bhopal and Trivandrum"

Submitted to

Planning Commission
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By

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Section 1

Summary

Setting up of two Indian Institutes of Science for Education and Research (IISER) at Pune and Kolkata is a path-breaking decision of Government of India. It is based on the strong recommendation of Scientific Advisory Council to Prime Minister. Several other bodies have also emphasized the need to attract young, meritorious students to career in sciences. Internationally, India is becoming a leading nation in the emerging knowledge economy scenario. In order to gain a competitive advantage, it is necessary to train young students in the emerging fields of sciences. There is a need to establish a set of high-quality education and research institutions in the field of basic and natural sciences.

The academic model of the proposed institutions is unique and different from either the traditional university system or the technical educational institutions. The proposed institutions will foster education and research in interdisciplinary areas without any boundaries or constraints of academic departments. These institutions will offer Integrated Master's level programmes as well as Doctoral programmes. The academic programmes will emphasize the spirit of research at an early stage of education. The research infrastructure of these institutions will be at such an international level that it will attract the best talents within the country, as well as successful Indian scientists from abroad to return and take up faculty positions in the proposed institutions.

The proposed institutions will be established as the national centres of excellence. These institutions will be able to award Master's and Doctoral degrees. Each Institute will have an approximate strength of 1000 students in the Integrated Master's programme and an additional strength of nearly 1000 students in the parallel streams of Post B.Sc and Post M. Sc. Inputs into the Ph.

D. programme. Each batch of Integrated Master's level students will be admitted through a national-level entrance test. Students will have an option of selecting a major and a minor area of specialization not at the entry level but during the course of their education. Students will need to earn research credits for their Master's level degree programme. The intake for the doctoral programme will be in all areas such as Physical Sciences, Chemical Sciences, Material Sciences, Mathematical and Computational Sciences and Biological Sciences. The Institutes will also have a strong post-doctoral programme to encourage research beyond the doctoral level. About 200 post-doctoral fellows will be on the roll of an Institute. The faculty strength is earmarked at 200. The support staff of technical and ministerial level will be 300, including outsourced personnel.

Each Institute will have a residential campus of approximately 300 acres. Besides a Director as the chief academic and executive officer of the Institute, each Institute will have a governing board with its associated academic senate, finance committee and building & works committee. Many support services, it is envisaged, will be outsourced. The fee structure will be along the lines of IITs. A large number of fellowships to meritorious and needy students would be made available.

The present proposal is submitted for approval of IISERs at Bhopal and Trivandrum. It is expected that this new institute will focus on biological sciences along with other sciences such as physical, chemical and material sciences. The total project cost is estimated at Rs. 600 crores spread over a period of seven years. The non-recurring component is estimated at Rs. 341 crores. The recurring component is estimated at Rs. 259 crores.

Section 2

Introduction

Education is a key element of infrastructure for the growth of a society. The educational infrastructure has several layers such as primary education, secondary education, technical education and higher education. The economic strength of a society depends on the standard of educational infrastructure, in general, and the quality of higher education, in particular. Any society must ensure a free, creative and high-caliber university environment so as to produce successful captains of that society. The higher education system consists of three major components – (i) liberal arts and social sciences, (ii) technical and professional fields and (iii) basic and natural sciences. In India, a unique situation has arisen after 50 years of Independence. The growth in the field of technical and professional education is phenomenal. However, this development has taken place at the cost of education for liberal arts and social sciences as well as education and research for basic and natural sciences.

Many experts have expressed serious concern about the state of education and research in basic and natural sciences in India. The country could boast of a set of fine institutions for science education and research in the pre-Independence era. Even eminent world-class scientists emerged during that period. However, the state of affairs has declined. In spite of the fact that scientific establishments in space, nuclear and defense areas have come up in the past fifty years, the quality and quantity of scientists produced has deteriorated considerably. The Scientific Advisory Council to the Prime Minister (SAC – PM) has strongly recommended establishing two peer institutions for science education and research. It is further recommended that these institutions be established in Pune and Kolkata respectively. For a country like India, it is necessary to have more than two such institutions. However, taking into account the financial constraints and taking into account the enormity of the task, it is suggested that based on the experience of these two institutions, the

Government of India should consider the issue of establishing additional institutions in future.

It must be acknowledged that higher education system in India has grown considerably, without concern for quality. There is also a paucity of any institution that integrates research-based, under-graduate as well as post-graduate educational programmes of high standard in basic and natural sciences. The IITs serve well for technical education. Some IITs do have Integrated Master's programmes in sciences which need to be strengthened further. The IIMs have been able to train young men and women for managerial careers. The Indian Institute of Science caters to post-graduate education in sciences in a unique and admirable way. However, young minds are eager to excel in sciences even at the under-graduate level. The success of Indian students at the science Olympiads is a shining example of India's strength and potential. However, all such bright minds are lost due to the pull of a strong technical education system as well as societal pressure on students. It is clear that there exists a void in the higher education spectrum for science education and research of high quality.

It is interesting to note that during last decade of 20th century and the first five years of the present century, a dramatics rise in science education has taken place in countries like China, Korea, Singapore and Japan. These developments are important for India's global competitiveness. For example, during the period from 1995 till 2003, the number of Ph. D. admissions in China grew from 8,139 to 48,740. During the same period of 1995 to 2003, the Ph. D. admissions in India grew from 3000 to approximately 5000. For the year 2004, the number of scientific publications from China is reported to be 57,378. While for the year 2004, the number of publications from Korea happens to be 24,464 and for India, the corresponding number is 23,338. It is interesting to note that the registration of new doctoral students in science and engineering in the year 2003 from China is 9000, while the corresponding number for India is 4000.

The present report examines the feasibility of setting up of Indian Institutes of Sciences for Education and Research. The present situation is analyzed in detail. The need analysis has been carried out and presented in this report. Several points of justification have been mentioned. The description of the project along with the preliminary cost estimates has been given. The charter of these institutions was prepared by a committee constituted by Ministry of Human Resource Development, Government of India. Subsequently, the charter document was endorsed by Scientific Advisory Council to the Prime Minister. A copy of this charter is also appended to the report. For detailing the specific projects at Pune and Kolkata, MHRD has constituted two committees. The necessary notifications have been enclosed in the report for reference.

Section 3

Analysis of Existing Situation

Despite the explosive growth of the number of universities in India during the past fifty years, there has been a decline in the quality of science education and research. The secondary education system expanded during 50's and 60's. The direct result of this expansion was the growth of the university system. The concept of affiliated colleges permitted such an expansion. In fact, this expansion was so explosive that the universities in the big cities of Chennai, Mumbai, Delhi and Kolkata were unable to cope with it. In many states, several new universities came up. All these universities have many affiliated colleges. The administration and coordination of such a system has become the main task of a university. Those universities which have their own colleges and departments as well as affiliated colleges could not maintain the on-campus infrastructure. This was primarily due to highly subsidized fee structure. Most of the on-campus education was at the post-graduate level. The on-campus departments could not carry out any research activities due to lack of funds, enormous pressure of administrative work such as examinations, admissions, recruitment, promotions and teaching large classes.

The lack of opportunities along with the uncontrolled growth in numbers made the situation from bad to worse. The science graduates could not seek successful avenues of career. Many bright science graduates went abroad for higher studies. After completing their post-graduate education from some of the best universities in the world, they could not come back because of lack of opportunities. The university system was entangled in its own clumsy bureaucracy. The academic world was not pursuing research that these young people would like to continue as their profession. The research establishments of the Government have several constraints and restraints. Since the faculty

recruitment was pursued at the national level, in-breeding and mediocre quality standards set in. The lack of research environment and in-breeding culture has resulted in the declining quality of science education and research.

The university system is the main torch bearer of science education and research. It is necessary to invest at the appropriate level for cultivating on a sustainable basis the ethos of science education and research. The Government of India has invested heavily in research establishments in the field of nuclear, defense, space as well as ocean, environment, biotechnology, as well as applied industrial areas. All these establishments require quality manpower. Many establishments are in need of scientists. On the other hand, the graduates of the universities are either not up to the mark or are not interested in pursuing career in such establishments. The faculty positions in many universities are not filled up. Once again, the question of quality comes forth. It is clear that some quality institutions are needed to develop a cadre of manpower of good standard for carrying out scientific research.

Lack of research infrastructure for science education and research is a serious concern. Consider the example of Argonne National Laboratory. It is a fine facility at the international level. It is under the realm of University of Chicago. One is not able to find such examples in India. Unless some such facilities are available with the universities or institutions in India, the system will not get a fillip that is required for sustainable growth of science education and research. The proposed Indian Institutes of Science for Education and Research (IISER) will attract the talented scientists from all over the country and the world to these academic institutions and these institutions will house some unique research facilities. The Integrated Master's programmes of these institutions will attract the young minds of India. These programmes will foster an environment of an academic learning through research. The academic organization will not have rigid walls of groups, departments etc. These institutions will encourage interdisciplinary learning and research. In short, the spirit of boundary-less academics will be encouraged in these institutions.

Section 4

Nature of Science Education & Research

India has a large university system. The number of students enrolled in each university is also large. However, the research output from this system is very low. The quality of the research is also average to poor. Each university has many affiliated colleges. The primary work of the system is to grant degrees in science, arts, commerce and other applied areas to a large number of students. This work is so huge that by and large the research activities are carried out in a perfunctory manner. During the past two decades, countries like China have made substantial progress in terms of upgrading research activities at the university level. Even countries like Korea, Singapore and Japan have a strong research base in their university system. In India, the research base in the university system has eroded significantly. It is, therefore, necessary to establish some new role models of education and research institutions in sciences.

Research quality in science is measured by parameters like the citation index and the impact factor. Once again, the quality of research coming out from India needs an improvement on these counts. One can also see that recognition to Indian academicians at the international level is piecemeal and scanty. For a country which boasts of a very large university system, the accolades are too few. The situation was not as serious in 50's and 60's. However, a steady decline has occurred over the last few decades. Many Indian scientists who migrated to Europe and America have earned high acclaim. However, these individuals achieved their recognition for their work abroad. There are some fine institutions for post-graduate education and research. However, it is difficult to cite an institution providing quality undergraduate as well as postgraduate education and carrying out high-quality research in sciences.

Research in sciences is crucial for development of economy. Many areas of basic science evolve eventually as applied sciences. Take the example of lasers. The original research in Physics gave rise to the developments in the field of laser technology. Other fields such as superconductivity, semiconductors, NMR imaging and nanomaterial can be cited as areas which are at the interface of science and technology. In fact, one can say that basic and applied sciences are two sides of a coin. Research in different areas of science can generate significant intellectual properties. The rights of such intellectual properties become the proud assets of a university. Some of the best institutions in the world are able to generate sizable revenues from such IPRs. In India, one is not able to cite the example of any university in this category. The proposed IISERs should be able to generate IPRs in the areas their specializations.

Scientific research requires analytical, experimental and computational approaches. In India, a culture of slotting scientists as theorists or experimentalists has evolved over the years. However, research efforts around the world are increasingly becoming team efforts. Such teams work on all the three approaches. Developing such teams and moving them dynamically around is essential for emerging areas of research. A pool of science faculty with a strong commitment of team efforts is required in Indian universities. IISER will lead the way in establishing such a culture of research organization.

Section 5

Need and Justification

Education system in any country is linked with the pressure of the job or career market. The dismal state of science education has resulted due to limited number of career options for science graduates. The supply of science graduates increased enormously and the demand did not rise proportionately. This situation has occurred in other professions also. The subsequent quality deterioration compounded the situation further. Now, even the supply of quality science graduates has gone down considerably. One can arrest this spiraling turn of events by establishing some high quality science education and research institutions. This will produce quality manpower. The graduates will get the limited jobs available in space, nuclear, defense, pharmaceutical and space research besides the academic jobs available in India.

It is strongly felt that setting up of IISER will not be an end in itself. The Government of India will have to review the entire supply chain of science education from school education to job market in science. The Quality Improvement Programme has successfully trained a large number of teachers from engineering colleges. Similarly, once IISERs are established, it is necessary to initiate a new kind of quality improvement programme for science teachers from present university system. It will complement the initiative of improving the quality of manpower in science education and research. IISERs, IISc, TIFR, IITs will serve as nodal points for the quality improvement programmes.

India will be preferred destination for scientific research in years to come. The cost of research in basic and applied areas of science will be less in India. If the quality of research is assured, it is certain that India can become a hub of science research. It is already happening in engineering sciences, information sciences and biological sciences. Several national and international R&D organizations will set up shops in India. These organizations will demand quality

manpower comparable to world standards. It is hoped that IISER will play a pivotal role in crystallizing the development of India as a hub of scientific education and research.

Retention of research manpower in scientific laboratories is a major problem in India. The exodus of scientists from R&D establishments in Bangalore, Hyderabad, Pune and other cities is a matter of worry. There needs to be a more synchronous environment between university or educational institutions, Government R&D laboratories, research Institutes and research establishments of private corporations. However, the administrative structures, the compensation packages and career options vary considerably. It will be essential to bridge the gaps and bring all the constituents together.

Science education and research is becoming increasingly interdisciplinary in nature. The present structure of departments in the university system has become so rigid that it is difficult to have faculty members with joint appointments to form an interdisciplinary group. Students are not allowed to credit courses in a flexible manner. Research projects with joint supervision from different departments are not carried out easily. This results in stifling the growth of new ideas. The proposed academic model of IISER will showcase a new way of science education and research. Once established, it can be spread around to other institutions and universities as well. Besides interdisciplinary research in an institution, it is also essential to promote linkages between national research laboratories and national universities. It is difficult to establish such linkages in the existing structure. However, a new institution like IISER can develop right from its inception a new model of university – laboratory relationship. Students and faculty of IISER should be able to interact closely with the national laboratories. Similarly, scientists of national laboratories should be able to interact with the faculty and students of IISER.

Section 6

Project Description in Brief

In this section, a description of the project is given in brief. The overall goals, vision and mission is described in the section – Charter. The description of the Master's level and Doctoral level academic programmes is given in the section – Academic Programmes. A brief outline of the research activities envisaged in the proposed Institute is given in the next section. The Institute is expected to develop linkages with national laboratories and existing universities through a Quality Improvement Programme. A description of this programme is also given. IISER will give emphasis on quality rather than quantity. The staff structure, student strength and faculty strength as proposed is described in the subsequent section. The proposed Institute is a residential Institute. The infrastructure will however be minimal with lesser load on the Institute administration. The governance structure of the Institute will be along the lines of other national institutions of excellence in India. The proposed governance structure is described next.

The Charter

(a) Objectives

- To create world-class institutions for under-graduate and post-graduate education in sciences with an intellectually alive atmosphere of research

- To create a unique research university in the country in which education will be totally integrated with state-of-the-art research

- To create, therefore, an Integrated Master's programme in sciences following ten-plus-two curriculum

- To create a cadre of high-caliber, internationally well-known faculty members which will be devoted to teaching as well as research activities in sciences.

(b) Goals

- To strive to arrest the declining trend of young people in joining basic sciences

- To match the quality and brand equity, extant in engineering (IITs) and management (IIMs), also in basic sciences

- To impart science education that will nurture creativity

- To provide education and training in order to charter new grounds and break compartmentalization of traditional disciplines of biology, chemistry, computer sciences, mathematics and physics

- To make possible a flexible, border-less curriculum in which a student, say interested primarily in biology, should have no difficulty in taking courses in, say mathematics

- To strengthen the base of the pyramid of basic sciences and gradually build up its apex of inter-disciplinarity

- To create awareness in career opportunities for well-rounded Master's degrees in all aspects of basic sciences, followed by specialized training during the final year of the curriculum

- To expect that about 20% of the graduates of the Master's programme will carry-on in pursuit of a doctoral stream in focused sectors, while the rest will leave with a quality stamp to join other organizations

- To plan to provide such preparatory training to about 80% of the final year class such that the graduates will be ready to join a plethora of career opportunities that exist for scientists in government organizations such as the Department of Atomic Energy (DAE), Council of Scientific and Industrial Research (CSIR), Indian Space Research Organization (ISRO), Defense Research & Development Organization (DRDO), teaching profession in colleges and universities and other sectors of the society at large

- To network IISER with the existing institutions, laboratories, universities and colleges in the neighborhood in order to make optimal utilization of resources, both in terms of expensive laboratory facilities as well as teaching talents

- To develop a doctoral programme which will admit students with Batchelor's degrees making possible a parallel entry of select group of students who have had their undergraduate science education elsewhere

- To develop a doctoral programme that will also admit student with Master's degrees either from IISER or from elsewhere

- To build a strong core faculty that will be able to synergize research with teaching and education

- To develop first-class teaching and research laboratories in order to emphasize the point that science is 'experimental'; the focus on experimental research would be to charter uniquely novel areas, not found elsewhere, applicable to technology and industry; the development of research programme should be such that theorists would be naturally inclined to carry out collaborative research in conjunction with experimentalists

Academic Programmes

The academic programmes of an educational institution determine the character of that institution. The proposed IISERs will have two main academic programmes – (i) an Integrated Master's level programme and (ii) a doctoral programme.

The Integrated Master's level programme will take students after 10+2 years of school training. Brilliant students will be selected based on their performance in a suitable national test. The issue of whether this test should be JEE or a new test will be decided at a later stage. Students will be provided a menu of courses. Each student will be required to accumulate certain number of credits in mathematical sciences, physical sciences, biological sciences and chemical sciences. However, beyond this minimum coverage, a student can specialize in a major area as well as a minor area. A student will be able to design his or her specialization in a unique manner. The Institute will ensure that courses covering all areas of specialization are offered every semester in sufficient number.

The spirit of education in the proposed institution is "research-based learning". Students will be exposed to laboratory work in an intensive manner.

Besides formal lecture hours, each student will be required to undergo some training in laboratories. After this training, each student or a group of students will undertake some research activity so as to explore their ideas, suggestions, and proposals. Such an approach will provide in every course a window of activities for research. Unfortunately, the present structure of learning where research is considered an exclusive domain of students who have gone through a huge number of courses is a myth. In some cases, a person with less formal knowledge may come up with a brilliant idea provided the person has been confronted with a situation in a creative manner. Doing research is a way of thinking. One needs to learn it. If one learns it earlier, it is better.

The doctoral programme will establish a new icon of research in the country. It will involve course work, qualifying examination, state of the art seminar, thesis work, open seminar and thesis examination. Besides a thesis supervisor, a committee will be constituted for each candidate so as to oversee the progress of research work. The quantum of course work will vary depending on the background of a student. The doctoral students will be encouraged to work in a group. It is essential to understand that ambitious research activities need to cultivate a team spirit of research. Besides a research project of an individual, students will be involved in several professional activities such as seminars, workshops, presentations and review meetings. In other words, a part of the training on research organization and research management will be embedded in the academic programme. All doctoral students will be asked to assist faculty members in some teaching assistance during the course of the doctoral programme. This will develop linkages between undergraduate and postgraduate students. As already mentioned, in addition to the undergraduate students in the Integrated Master's programme postgraduate students with Bachelor's degree and Master's degree from other universities will be admitted to the doctoral programme.

The academic activities of the Institute will be interdisciplinary in nature. However, the Institute shall have following major areas.

Physical Science
Chemical Sciences
Mathematics
Material Science
Environment & Earth System Sciences
Computer Science

Students and faculty will be encouraged to form groups involving more than one area. The thrust areas of research will require fostering an environment of interdisciplinary nature.

Programme	sCHEDULE
Integrated M. Sc.	July 2007 (Academic Year 07-08)
Int. M. Sc. – Ph. D.	July 2008 (Academic Year 08-09)
Ph. D.	July 2009 (Academic Year 09-10)
Post-doc Fellows.	July 2010 (Academic Year 10-11)

Table 1 Introduction of Different Academic Programs

Research Activities

Indian research activities suffer from many maladies. Countries like Korea, Israel, and Taiwan have shown successfully how research programmes can be used effectively to transform the economy of a nation. It is now possible to develop a chain of activities from knowledge generation to wealth creation. Vision of research with such characteristics needs to be developed in Indian universities. It is hoped that IISERs will be successful in ushering such a vision in Indian academic environment.

Many leading universities in the world nurture ambitious research programmes and facilities, for example, JPL at Caltech, Lawrence Livermore at Berkeley and Argonne National at University of Chicago. Establishment of such facilities propels the university research environment at a different level. In India, even though large research establishments have been established by Government, an academic university is not able to set up such national or international research facilities. Once again, IISER will have a strong sponsored research activity. The Institute will endeavor to develop a research atmosphere with sizable infrastructure.

Group activity is a key element of any modern research environment. Many research activities require expertise of experimental, computational and analytical abilities. Such a requirement can be fulfilled by forming a group of post-doctoral fellows, doctoral students, summer trainees, and undergraduate students. The work environment of such a group requires excellent interpersonal relations and complimentary skill sets. In many cases, one needs to learn as to how to share the resources and facilities in a group. IISER will encourage as a policy an environment of group research.

Research activities require large funding. Funds of such a magnitude need to be raised through sponsored research activities. IISER, being a research institution, will strive to develop a strong sponsored research programme right from its inception. In order to develop such a programme of research successfully, the Institute will establish an apex body such as Research Council. It will develop the agenda of research at the Institute level. It will initiate and champion mega-research projects. Research policy framework will be developed by such a council. Besides faculty members of Institute, the membership of the research council will include eminent scientists from India as well as abroad. Representatives from industry and funding agencies are also expected to be members of the research council.

IISER will establish a strong reputation of research through the publication record of its faculty and students. Strong emphasis will be placed on publishing the results of research activities in international and national journals. India is loosing its position in publication record vis-à-vis China, Japan, Korea, Europe and America. It is essential for Indian academic community to understand that academic research is an index of performance at the international level. The degree of excellence will depend on the publication record of students and faculty. The Institute should explicitly strive to maintain a high standard in terms of its publication record. The agenda of the research programme as well as the quality of resources and infrastructure will determine the performance of IISER.

Quality Improvement Programme

IISER is conceived to be a national Institute. It shall have a stature of a centre of excellence in basic and natural sciences. It is expected that Government and other funding agencies will invest significantly in such an institution. IISER will serve as a trigger to boost the quality of science research and education in India. IISER will serve as a catalytic agent for other Indian universities to change the overall situation of science education and research in the country. This can be accomplished in an evolutionary manner. Once the Institute is well established, it will provide opportunities to faculty and students of other universities as well.

There are many ways to improve the quality of science education and research in other institutions. IISER can admit some talented young teachers of other institutions in its doctoral as well as post-doctoral programmes. Such persons will be provided full financial assistance as well as modest housing on the campus of IISER. After completing their academic programmes of IISER, these QIP scientists will be under an obligation to serve their parent institution for

a specific period of time. In order to carry out some research at their parent institution, such scientists will be provided some research funding.

Science is an ever-happening field. New discoveries and fields emerge on a continual basis. Students and faculty of universities need to be need to be exposed such fields. By organizing a series of continuing education courses of one or two week duration at IISER, it will be possible to sensitize the academic community at large. Speakers for continuing education programmes could be the faculty of IISER as well as experts from India and abroad specializing in the sunrise areas of science. Such programmes can be delivered using the satellite and distance education technology. It is, therefore, necessary to develop the infrastructure of technology enhanced learning at IISER.

Scientists and faculty members of other universities can be invited to participate in the activities of IISER as visiting scientists or adjunct faculty members. During their visits, such scientists can participate in the research programmes of IISER.

The quality improvement programme will form an interface division of IISER with other universities and institutions. It will require appropriate infrastructure as well as organization. It is expected that an apex committee of IISER will set out the policies, approve the programmes and monitor the quality of all activities. The apex committee will have representation from other universities, laboratories and industries from the region where the Institute is located. A national Institute such as IISER will evolve a cooperative and collaborative spirit with other institutions. The quality improvement programme will be the wing of the Institute for such a purpose.

Student, Faculty and Staff Strength

IISER shall be a centre of excellence for science education in India. The undergraduate programme shall be an Integrated Master's level programme. When fully established, the Institute will admit 200 students per year. To begin with the batch will be of 50 students and it will be gradually increased to full strength in a period of four years. So the Institute will have the strength of 1000 students assuming the programme to be of five year duration. If it is decided to develop a four year programme, the Institute can consider having a batch of 250 when fully established. In short, the total strength of the undergraduate programme shall be 1000.

The doctoral programme is an important element of the Institute. IISER will have a strong doctoral programme. In order to develop such a programme, IISER will admit students after Batchelor's degrees as well as after Master's degree. It is expected that about 120 students will be admitted in the first category and about 100 students will be admitted in the second category. Considering that a student takes about four or five years to complete a doctoral programme, it is expected that the total student strength of the doctoral programme, when it is fully established, shall be about 1000.

Science education and research is now increasingly dependent on the research being carried out by the post-doctoral fellows. At present, the strength and quality of a post-doctoral programme is not satisfactory in India. It is hoped that IISER will strive to establish a strong post-doctoral fellowship programme. When fully established, this programme will have the strength of 200. A post-doctoral fellow will be in the programme for a period of maximum three years and minimum six months. The research agenda for each fellow will be well articulated. Each fellow will be provided a monthly stipend and housing on the campus. The post-doctoral fellows will carry out the research as well as assist in running the laboratories and carrying out laboratory instructions.

The Institute will have a sanctioned strength of 200 faculty members. To begin with, the Institute will start with a group of 20 faculty members and build up the full strength over a period of five to six years. The selection will be on a highly critical basis. The applications will be invited from all over the world. The faculty members will be provided incentives in the form of initiation grants, travel subsidies, joint appointments etc. People of Indian origin and holding dual citizenship may also be considered for visiting or sabbatical positions. In fact, it is recommended that people from SAARC region, who wish to join and who have outstanding academic record, may also be considered. The Institute shall strive to build excellence and the cornerstone of this quality will be based on the quality of faculty.

The support staff is a crucial element of Institute manpower. Indian institutions in general suffer from an overburdened strength of this category of manpower. It is strongly suggested that IISER will keep the support staff strength to a minimum. As per the norms of Government of India, the support staff strength is recommended to be 300. The Institute should outsource many services and avoid employing staff on a permanent basis for all functions. To begin with the strength of 30 would suffice. The full sanctioned strength of 300 can be reached in a period of five years.

Title	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6
B. Tech.	75	100	150	200	250	250
M. Tech.	-	50	100	150	200	250
Ph. D.	-	-	20	40	60	80
Post-doc Fellows.	-	-	-	20	40	60
Total Strength	75	200	410	730	1120	1565

Table 2 Year-wise Student Intake and Student Strength

Title	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7
Students	75	200	410	730	1120	1565	2055
Faculty	10	20	40	73	112	155	205
Staff	15	30	60	108	168	255	306

Table 3 Year-wise Strength of Students, Faculty and Staff

Institute Infrastructure

The Indian Institute of Science for Education and Research shall be a residential Institute. It is proposed that an Institute of such a stature shall require an area of 200 to 250 acres. The campus will house the academic area, the residential area for students and the residential area for faculty and staff. The campus will be developed and maintained by outsourcing the services of security, maintenance, mess services, horticulture, local transport etc. The post-doctoral fellows will be provided studio apartments. A guest house will be essential for visitors, and visiting faculty members. The guest house will have two sections. One section will cater to the guests who are visiting for a couple of days. The other section will cater to those visitors who are likely to stay for a month or two. The housing for such guests will include more facilities of cooking and storage. The Institutes will endeavor to provide appropriate facilities of health care at the level of a primary health clinic. The Institutes will also provide elementary as well as secondary schooling facilities to the children of faculty, staff and married students.

Sr. No.	Item	Plinth Area (in sq.m.)
1	Academic Complex	
1.1	Academic-cum-Administrative Building	8,000
1.2	Lecture Hall Complex (includes some Class Rooms)	6,000
1.3	Laboratory Complex (includes some Tutorial Rooms)	10,000
1.4	Common Instrumentation, Testing and Fabrication Facilities	3,000
1.5	Computer Centre	2,500
1.6	Conference Complex / Auditorium	4,000
1.7	Student Activities Centre / Cafeteria	2,500
1.8	Library	4,000
	Sub-total	40,000

Table 4-a Space Requirement – Academic Complex

Sr. No.	Item	Plinth Area (in sq.m.)
2	Residential Complex	
2.1	Student Hostels with common facilities	55,000
2.2	Faculty Housing	26,000
2.3	Guest House	4,000
2.4	Community Center	2,500
2.5	Commercial Center, Health Center, Campus School	2,500
	Sub-total	90,000

Table 4-b Space Requirement – Residential Complex

The academic area of the Institute will consist of lecture and tutorial rooms, faculty offices, laboratory spaces, cafeteria, meeting rooms, spaces for administrative support services, library, computer centre, mechanical and electronic fabrication laboratory, offices for Director and other officials, senate hall, auditorium and space for continuing education programmes. The Institute will provide expansion in both vertical and horizontal directions. The campus will be provided sufficient green cover. The campus will be developed taking into account the measures of energy conservation, rainwater harvesting, waste water treatments etc. A primary health care centre as well as a small shopping centre along with banking and postal facilities will be provided on the campus.

The Institute will need laboratory equipment as well as computing equipment. The list of such equipment will be based on the academic curriculum of the Institute as well as the research programme to be developed by the faculty of the Institute. It is expected that the inventory of such equipment will grow as the Institute grows in terms of number of faculty and the academic programmes. It is expected that all laboratories and buildings will be fully developed over a period of eight years. The financial support for such planned activities will be provided partially by MHRD.

Sr. No.	Item	Amount (in Rs. Lacs)	Amount (in Rs. Lacs)
1	**Academic Laboratory Equipment**		
1.1	Physical Sciences	30,00.00	
1.2	Chemical & Material Science	25,00.00	
1.3	Biological Sciences	20,00.00	
1.4	Earth & Environment Sciences	14,00.00	
1.5	Computer Science	15,00.00	
1.6	Mathematics	7,00.00	
	Sub-total		**111,00.00**
2	**Central Facilities**		

2.1	Computer Centre	20,00.00	
2.2	Central Workshop	8,00.00	
2.3	Library	27,00.00	
	Sub-total		**55,00.00**
3	**Miscellaneous**		
3.1	**Furniture**	3,00.00	
3.2	**Audio-visual Equipment**	2,00.00	
	Sub-total		**5,00.00**
	Total		**171,00.00**

Table 5 Assessment of Equipment Requirements

Institute Governance

The Indian Institute of Science for Education and Research will be governed by a Board of Governors. The institute will be formed by establishing a registered society as per the Society Registration Act. The Board will be constituted by Government of India. The society will also be formed by Government of India. At a later stage, the Institutes would be brought under an Act of Parliament as Institutes of National Importance. The Ministry of Human Resource Development will provide the necessary financial support for plan as well as non-plan expenditure of the institute.

The Board of Governors will be headed by a Chairman. The Chairman will be appointed by Government of India. The Board will consist of representatives from academia, scientific laboratories, Government agencies such as space, defense research, atomic energy, environment science, information science etc. It will also have representation from respective state governments. The Director of the Institute will be a member of the Board. The secretary of the Board will be an appropriate official of the institute.

The Director of the Institute will be the chief academic as well as executive officer of the Institute. The Director will be an eminent educationist with proven academic and leadership qualities. The Director will be appointed by the Board on the recommendation of Government of India. The Director will have the tenure of five years which can be extended by the Board. The Director can serve the institute up to the age of 65.

The Board will have a Finance Committee which will be chaired by the Chairman of Board of Governors. The Building and Works Committee will be a standing committee of the Board. It will be chaired by the Director of the Institute. The academic senate of the institute will also be a standing committee of the Board. It will be chaired by the Director of the Institute. The Institute will have a set of Deans such as Dean of Students, Dean of Academics, Dean of Research. All other functions such as administration, accounts, purchase, library, computer center etc. will be managed by a group of officials.

The Institute will be governed by norms set up by the Board. On matters where policies are not explicitly defined by the Board, the Institute will follow the norms set out by MHRD, Government of India, from time to time.

Section 7

Cost Estimates

The proposed Institute will be developed in two phases. For the first seven years, the Institute will be funded in project mode. After this phase is over, it will be funded as per the modified block grant scheme of Government of India.

The overall cost of the project for the period of first five years is estimated to be Rupees Three Hundred crores. This funding will cover the cost of buildings, the cost of equipment, books, the cost of development of infrastructure such as roads, water, electricity, waste disposal etc. It will also cover the recurring expenditure of salary, consumables, journal subscriptions etc. A tentative table of these cost estimates is given below.

Sr. No.	Item	Amount (in Rs. Lacs)
1	Buildings in Academic Complex Area (40,000 sq. m. @ Rs. 15,000 per sq.m. average)	60,00.00
2	Buildings in Residential Complex Area (90,000 sq. m. @ Rs. 10,000 per sq. m. average)	90,00.00
3	Internal roads and paths, Storm water drains, Landscaping and horticulture operations	8,00.00
4	Electric supply, Generating Sets, External Lighting and Data Networking	8,00.00
5	Water supply with water tanks and distribution network, Waste water treatment systems	4,00.00
6	Boundary wall	2,00.00
	Total	170,00.00

Table 6 Cost Estimates of Different Infrastructure Items

Item	1	2	3	4	5	6	7	Total
Equipment	700	2500	3900	3500	2900	1800	1800	17100
Infrastructure	1500	2500	2700	3000	2500	2400	2400	17000
Total	2200	5000	6600	6500	5400	4200	4200	34100

Table 7 Year-wise Capital Investment (Amount in Rs. Lacs)

Item	1	2	3	4	5	6	7	Total
Pay and Allowance	500	1000	1600	2200	2300	2500	2600	12700
Outsourcing Expenses	250	500	750	1100	1100	1200	1200	6100
Estate Maintenance	-	200	200	300	300	450	450	1900
Equipment Maintenance	-	-	100	400	450	550	550	2050
Utility Charges	150	150	200	300	300	350	350	1800
Miscellaneous	100	150	150	200	250	250	250	1350
Total	1000	2000	3000	4500	4700	5300	5400	25900

Table 8 Year-wise Recurring Costs (Amount in Rs. Lacs)

Item	1	2	3	4	5	6	7	Total
Capital Costs	2200	5000	6600	6500	5400	4200	4200	34100
Recurring Costs	1000	2000	3000	4500	4700	5300	5400	25900
Total	3200	7000	9600	11000	10100	9500	9600	60000

Table 9 Year-wise Total Investment (Amount in Rs. Lacs)

Item	1	2	3	4	5	6	7
Class Rooms	-	20%	50%	80%	100%	-	-
Laboratories Construction	-	15%	45%	65%	85%	100%	-
Hostels	-	30%	60%	80%	100%	-	-
Residences	-	10%	25%	45%	65%	85%	100%
Estate Development	10%	50%	90%	100%	-	-	-
Equipment Purchase	10%	25%	35%	55%	75%	85%	100%

Table 10 Year-wise Progress of Project Expected

It is expected that the block grant of the Institute will be fixed on the overall requirements as well as the expenditure during the sixth and seventh year of the Institute.

Section 8

Closure Observations

Indian society and Government invested significantly in education sector after Independence. Establishment of IITs, IIMs, RECs (which are now NITs), new central universities, TTIs, and many other national establishments came up to meet the demand of high quality manpower. The IITs and IIMs have earned a reputation of excellence all over the world. The emerging scenario of globalization demands new strategies to be adapted for development of manpower. The emphasis on quality will be necessary. Even though India boasts of a large size of higher education system, it is difficult to make any claims of quality in higher education. It is, therefore, necessary to establish some role models of higher education, in general and in basic sciences, in particular.

The proposal to establish two institutions dedicated for education and research in sciences is a strategic decision for emerging global competition. The Indian Institutes of Science for Education and Research to be established at Pune and Kolkata will herald a new culture of higher education. The decision has been taken after extensive discussions in the academic community. The issue has been fully endorsed by the Scientific Advisory Council to Prime Minister. Many academic societies have been suggesting that such institutions be established to improve the status of science education and research. The change will bring in many benefits to Indian society. It will generate manpower for science departments and laboratories. These institutions will attract talented scientists from abroad back to their homeland. It will generate more avenues of assured quality career for young students. For those who do not wish to pursue engineering or medicine and who would like seek an admission to a national level institution, these institutions will offer an excellent option.

Each institution will have a total student strength of 2000 and faculty strength of 200. The post-doctoral fellowships will be 200 and the support staff

will be 300. Each institution will require a budget of Rs. 300 crores in project mode for a period of seven years. Each institution will then be covered by the block grant scheme for further funding.

It is suggested that the first batch of students be admitted starting July 2006.

Appendix – I

Decision of SAC – PM (4/3/2005) and MHRD Notification (18/3/2005)

The Scientific Advisory Council to the Prime Minister (SAC-PM) in its first meeting held on 04.03.2005 at New Delhi under the Chairmanship of Prof. C. N. R. Rao recommended creation of two new Institutions devoted to Science Education and Research to be named "Indian Institute of Science for Education & Research (IISER)" likely to be located at Pune and Kolkata. The financial requirement for these Institutions was recommended at a level of Rs. 500 crores for each Institution over a period of five years. It was also agreed that more such institutions at different locations would be considered subsequently.

For the purpose of writing the Charter of IISER to ensure that objectives, goals and modalities are properly defined, Hon'ble Minister of Human Resource Development has approved constitution of a Committee of Experts consisting of the following :-

1. Dr. S. Sivaram, Director
   National Chemical Laboratory, Pune — Member

2. Dr. P. Balaram, Director,
   Indian Institute of Science, Bangalore. — Member

3. Shri. Sudeep Banerjee,
   Secretary, Ministry of Human Resource Development,
   New Delhi. — Member

4. Prof. Sanjay G Dhande, Director, IIT, Kanpur — Member

5. Dr. S. Dattagupta,
   S. N. Bose National Centre for Basic Sciences, Kolkata — Convener

Appendix - II

CHARTER document of IISER

I. VISION

The basic idea of IISER is to create research Universities of the highest caliber in which teaching and education will be totally integrated with the state of the art research. These Universities will be devoted to undergraduate and post-graduate teaching in sciences in an intellectually vibrant atmosphere of research. One of the important objectives of creating these Universities is to make education and careers in basic sciences more attractive by providing opportunities in integrative teaching and learning of sciences and break the barriers of traditional disciplines.

II. GOALS

1. To establish two IISER's in Pune and Kolkata.

2. To create quality education and research in basic sciences that will nurture curiosity and creativity.

3. To attract and nurture high quality academic faculty selected from across India committed to undergraduate and postgraduate teaching in addition to carrying out cutting edge research in frontier areas.

4. To create an Integrated Master's programme in sciences, following the plus two curricula, in order to provide entry into research at a younger age. This programme will include a major research component and a thesis. In addition IISER will offer an integrated programme leading to a Ph.D. to those who hold a Bachelor's degree in science. Those integrated Ph.D. students who do no wish to continue to Ph.D. will be given a Master's degree after three years. The others will be expected to complete the Ph.D. degree in two more years. Further, IISER will admit post M.Sc. students from outside for a direct Ph.D. programme.

5. To build a strong core faculty capable of synergizing quality research with education, teaching and mentoring. IISER will offer adjunct faculty/joint faculty appointments and postdoctoral fellowships, especially, in emerging frontier areas of sciences, through creation of select interdisciplinary research groups, with a view to foster collaborations and sharing of research facilities.

6. To make possible a flexible borderless curriculum in which a student, say interested primarily in biology, should have no difficulty in taking courses in chemistry, mathematics or physics. The curriculum design shall also strive to avoid overspecialization too early in the student's academic career.

7. To help create career opportunities for well rounded Master's degrees in all aspects of basic sciences and core engineering sciences such as fluid mechanics, materials science, engineering design and technical arts.

8. To provide education at the Ph.D. level to students completing the Master's programme in frontline areas.

9. To provide preparatory education such that the students completing the Master's programme will have acquired necessary competencies to enable them to seek careers in various scientific agencies, teaching professions in colleges and Universities, R & D industries and other sectors of the society at large.

10. To actively forge strong relationships with existing universities and colleges and network with laboratories and institutions, in the neighborhood of each IISER, in order to share faculty resources as well as research, library and computational facilities. The liaison and networking with various institutions in the region where IISER is located is an important concept of the proposed IISER.

11. To build up first class teaching and research laboratories wherein the focus will be to charter uniquely novel areas of research of relevance to industry and society.

12. To establish advanced research laboratories and central facilities under the same roof in order to encourage interdisciplinary and collaborative research across disciplines, through appropriate design of laboratory, office and meeting spaces and adapting the best of global practices in this regard.

13. To promote academic freedom, efficient, responsive and non-bureaucratic support administrative systems and enlightened management practices that respect merit and peer reviewed excellence as the sole criterion in all decision making processes relating to academic and educational matters.

III. MODALITIES

1. In the Master's programme, admit one hundred students in the first year to begin with, increasing eventually to four hundred.

2. Admissions to the initial years could be from amongst those qualifying the joint entrance examination of the IIT's.

3. Have a credit based flexible system such that a student can take courses in all core subjects, namely, chemistry, biology, physics, mathematics, engineering and computational sciences, in the first three years. In

addition the students will be required to take a few courses in humanities, languages and communication skills, which can be taken for credit, with input from neighboring institutions.

4. Subsequent to the first three years curricula will be devoted to specialized, interdisciplinary and research methodology based courses.

5. Have a semester system with intervening summer recesses, which can be utilized for short-term research projects or courses. Necessary flexibility will be available for the students to pursue areas of their interest.

6. IISER will strive to have a student to teacher ratio of 10:1.

7. In the parallel, a post Bachelor's programme may be introduced, initially with upto twenty students, in each of the basic disciplines of chemistry, biology, physics and mathematics.

8. IISER will be an autonomous institution. The necessary modalities for establishing such an institution will be worked out by MHRD.

9. An integrated campus comprising housing for students, faculty, laboratories, offices, sports and recreational facilities will be built up in spacious and environmentally friendly ambience. Most of the on and off campus services should be outsourced with a view to minimize the permanent non-teaching staff.

10. IISER will be governed by a management council chaired by an eminent scientist. It will be headed by a reputed scientist Director who will also be a Professor of the Institute. It will have an academic advisory body comprising scientists from outside and inside the Institute. In academic and administrative matters the existing rules and procedures prevailing in the IITs / IISc may be followed till such time that IISER formulates its own independent rules and regulations.

11. Most of the students will be provided with fellowships out of which hostel and meal charges will have to be borne by the students.

12. Entry to the doctoral programme will be based on nationally administered eligibility tests. Fellowships will be provided through IISER and other existing schemes.

13. In order to launch IISER and do a more detailed planning of activities leading upto the commencement of the academic session in 2006, a Planning Committee with local and national membership may be constituted for each of the two locations as early as possible.

Appendix – III

Notifications of MHRD, Dated 30th June, 2005

For the purpose of writing the Charter of IISER to ensure that objectives, goals and modalities are properly defined, a Committee of Experts was earlier constituted by Hon'ble Minister of Human Resource Development (as mentioned earlier in Appendix I). The Committee has since submitted the "Charter" of IISER.

As per item 13 of the modalities worked out by the Expert Group in the Charter of Indian Institute of Science for Education & Research (IISER) "In order to launch IISER and do a more detailed planning of activities leading upto the commencement of the academic session in 2006, a Planning Committee with local and national membership may be constituted for each of the two locations as early as possible". Accordingly, Hon'ble Minister of Human Resource Development has approved constitution of the Local Committee for implementation of IISER in Pune and Kolkata.

The Local Committee for implementation of the Charter of IISER in Pune will consist of the following : -

1. Dr. Sivaram, Director, National Chemical Laboratory, Pune	Chairman
2. Prof. Govind Swarup, (Physics and Astrophysics), Former Director NCRA, Pune.	Member
3. Prof. V. G. Bhide, (Physics), Former Vice Chancellor, Pune University, Pune.	Member
4. Prof. M. S. Raghunathan, (Mathematics), TIFR, Mumbai	Member
5. Dr. R. Nityananda, (Astronomy and Astrophysics), Director, NCRA, (TIFR) Pune	Member
6. Prof. J. B. Joshi, (Engineering Sciences), UICT, Mumbai	Member
7. Prof. A. Kolaskar, (Biological Sciences), Vice Chancellor, Pune University, Pune.	Member
8. Prof. Dipankar Chatterji, (Molecular Biology), IISc, Bangalore	Member
9. Prof. D. Balasubramanian, (Physical Sciences), L. V. Prasad Eye Institute, Hyderabad	Member
10. Dr. Javed Iqbal, (Chemical Sciences), Dr. Reddy's Laboratories, Hyderabad	Member
11. Dr. S. Pal, Head, Physical and Materials Chemistry, NCL, Pune	Member
12. Dr. K. N. Ganesh, Head, Organic Chemistry, NCL, Pune	Convener

Similarly, the Local Committee for implementation of the Charter of IISER in Kolkata will consist of the following:-

1. Prof. Bikash Sinha, Director, Saha Institute of Nuclear Physics, Kolkata	Chairman
2. Prof. Debashish Mukherjee, Director, Indian Institute for Cultivation of Science, Kolkata	Member
3. Prof. Shankar Pal, Indian Statistical Institute, Kolkata	Member
4. Prof. S. Chandrasekhar, Director, ISI, Kolkata	Member
5. Prof. R. Balasubramanyam, Director, Institute of Mathematical Science, Chennai	Member
6. Prof. C. Bhattacharya, Director, TIFR, Mumbai	Member
7. Prof. S. C. Lakotia, BHU, Varanasi	Member
8. Prof. Raghavendra Gadagkar, IISc, Bangalore	Member
9. Prof. Sanjay Dhande, Director, IIT, Kanpur	Member
10. Prof. S. Dattagupta, S. N. Bose National Centre for Basic Sciences, Kolkata	Convener

Corrigendum
(Dated 20th July, 2005)

Subject: Constitution of Local Committee for implementation of the Charter of "Indian Institute of Science for Education & Research (IISER)" at Pune and Kolkata.

In partial modification in para 5 of this Department's OM of even number dated 30th June, 2005 on the abovementioned subject, the composition of the local Committee for implementation of the Charter of IISER in Kolkata is revised as follows :-

1. Prof. Bikash Sinha, Director, Saha Institute of Nuclear Physics, Kolkata	Chairman
2. Prof. Debashish Mukherjee, Director, Indian Association for Cultivation of Science, Kolkata	Member
3. Prof. Shankar Pal, Indian Statistical Institute, Kolkata	Member
4. Prof. S. Chandrasekharan, IISc, Bangalore	Member
5. Prof. R. Balasubramanian, Director, Institute of Mathematical Sciences, Chennai	Member
6. Prof. S. Bhattacharya, Director, TIFR, Mumbai	Member
7. Prof. S. C. Lakhotia, BHU, Varanasi	Member
8. Prof. Raghavendra Gadagkar, IISc, Bangalore	Member
9. Prof. Sanjay Dhande, Director, IIT, Kanpur	
10. Prof. K. B. Sinha, Director, ISI, Kolkata	Member
11. Prof. S. Dattagupta, S. N. Bose National Centre for Basic Sciences, Kolkata	Convener