



EXTERNAL PEER REVIEW IIT GANDHINAGAR

AUGUST 28-29, 2014

Reviewers

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Prof Indira Rajaraman (Member)

Mr. Vijay Thadani (Member)

New Delhi
Sept 20, 2014
Oct 07, 2014

Minister of Human Resource Development
Chairperson
IIT Council
Delhi

Sub: Panel for External Peer Review of IIT Gandhinagar

Hon'ble Minister,

Thank you for the opportunity given to us to participate in the External Peer Review of IIT Gandhinagar. The review was conducted by the three of us from the five member committee on Aug 28-29, 2014 at Ahmedabad & Gandhinagar.

We hereby attach our report for your kind consideration. We are available to you for any clarifications that you may require.

Thanking you once again,


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REVIEWER PROFILES

Girijesh Mehta

Dr. Girijesh K. Mehta is the Chairman of NIT-Bhopal and Hon. Eminent Scientist at the Inter University Accelerator Centre (IUAC) New Delhi. He is also the former Vice Chancellor, University of Allahabad, former Director Nuclear Science Centre, New Delhi and Prof at IIT Kanpur. Dr. Mehta has held Research Scientist positions at Columbia University, Brookhaven National Lab, USA, Atomic Energy Res. Est. Harwell, U.K., Centre and Etudies Nucleaire, Saclay, France.

Dr. Mehta has been felicitated with many honors and awards including Best R&D Man-1995; Excellence Award of National Foundation of Indian Engineers., Homi J. Bhabha Award for Research in Applied Sciences (1996), Indian Phys. Association - Chugani Award for Excellence in Applied Physics (2010), and Indian Nuclear Society - INS Eminent Scientist Award (2012).

Indira Rajaraman

Indira Rajaraman holds a PhD in Economics from Cornell University. She has taught at Delhi University; the Indian Institute of Management (Bangalore); University of Illinois (Urbana-Champaign); and the Indian Statistical Institute (Delhi). Her research papers span a wide range of development economics issues in fiscal policy, formal and informal financial institutions, and exchange rates and trade. She was a Member of the Thirteenth Finance Commission and of several committees that have shaped the process of financial and fiscal reform over the last two decades. She has been a regular columnist in the Indian financial press since 2001. She was a Member of the Board of Directors of the General Insurance Corporation (1997-2001), and is presently Member, Central Board of Directors, Reserve Bank of India (2011-2015) and Member, Technical Advisory Committee on Monetary Policy.

Vijay K. Thadani

Vijay K. Thadani is the Chief Executive Officer of NIIT Ltd, a leading Global Talent Development Corporation. As the co-founder of NIIT Group, Vijay led the Group's globalization efforts since 1991, taking the NIIT flag to over 40 countries. He also serves on the Board of NIIT Technologies Limited. He has served in important capacities with industry bodies like MAIT, National Accreditation Board for Education and Training (NABET), QCI. He was the Chairman of CII Northern Region for 2011-12 and a member of AIMA Governing Council. He served as Chairman of Board of Governors of IIIT, Allahabad, and Member, India Advisory Board of the Maastricht University, Netherlands. A 'Distinguished Alumnus' of the premier Indian Institute of Technology, Delhi, Vijay is also the co-founder of the not-for-profit NIIT University established in 2009.

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1. INTRODUCTION

This Peer Review of IIT Gandhinagar (henceforth IITGN) is conducted by three members of a five-member committee appointed by the IIT Council. The institution is among the new set of eight IITs set up by the Government of India, and has been in operation for only six years. Clearly, the nature of the review will be slightly different from what it would be for the older, well-established IITs. The purpose of the exercise as set out for the benefit of the reviewers by the letter of appointment was to assess how far it has progressed towards the following goals:

- International comparability
- Outreach to community
- Commitment to national goals
- Sustainability
- Linkages with industrial and economic development

Accordingly, the five chapters that follow will deal with the above, under the broad chapter heads as listed in the table of contents.

The Chairperson and Members of the Review Committee spent two full working days at the Institute's temporary premises in Gandhinagar. The Appendix presents their programme of work on the two days. The Institute made detailed presentations on governance, faculty recruitment procedures and on research directions pursued by the faculty in place. They also had extended discussions with undergraduate and graduate students, and with faculty belonging to the three divisions – engineering, science, and humanities and social sciences. They also visited the new campus, and had a detailed presentation from the engineers supervising the construction.

IITGN is fortunate in its Director, Prof Sudhir Jain, who is on leave from IIT Kanpur, his parent institution. His dynamism and sense of purpose has given the institution the tremendous growth it has achieved since its start of operations in 2008. Already, in six years, it has in place programmes of study towards the following degrees:

- BTech, PGDIIT and MTech in Engineering
- M.Sc. in Sciences (including **Cognitive Science**)
- M.A. in **Society and Culture** (from 2014)

- PhD in all areas of Humanities, Sciences and Engineering

The current strength of the institution is:~900 students ~90 faculty ~100 staff

Eventual target: 2,500 students and 250 faculty

Work on its 400-acre campus started after land acquisition on 30 July 2012 and major construction contracts were awarded by 30 July 2013. The staff and students are expected to move into the new campus by summer of 2015. Allowing for reasonable construction delay, it is fully expected that by the start of the next academic year in July 2015, all academic activities would have moved to the new campus. Construction is being done by the CPWD, by a handpicked team of engineers, which includes BTech graduates from IIT Kanpur. The Director himself is a well-known Civil Engineer, holding a PhD from the California Institute of Technology (Caltech), one of the premier engineering institutions in the world.

The faculty in place are all young academics, holding PhDs from acclaimed universities such as Harvard, Cornell, Maryland, University of Illinois, Urbana Champaign, Carnegie-Mellon, Purdue, University of Michigan Ann Arbor, University of California at Berkeley, University of California at Los Angeles, University of Chicago, University of Cambridge, and Max Planck Institute. They have had post-doctoral experience in universities such as Caltech, Harvard, University of Michigan Ann Arbor, Carnegie-Mellon, and University of California at Los Angeles, University of Washington, Georgia Tech, Northwestern, Columbia, and Max Planck Institute. The senior faculty in place are typically visitors from the established institutions since it is difficult for a newly established institution to persuade senior faculty to move before retirement.

Since IITGN started operations in 2008, and BTech is a four-year degree, three batches have graduated so far. A high proportion opted for higher studies, with 10%-15% admitted into top universities in the US, such as Caltech, Stanford, University of Texas at Austin, Carnegie-Mellon, and Princeton University. Many went on to other IITs for further study. Three stayed on to pursue a PhD at IITGN. Others went on to Indian Institutes of Management, or to other academic institutions in India. Of those who did not opt for higher studies, several became entrepreneurs - two companies have been incubated by IITGN (1 in pipeline).

An especially notable feature of IITGN is that as many as one-third of the BTech students graduated with international experience as summer interns. This remarkable feature of the IITGN experience for students was made possible by the very successful fund-raising initiatives of the institute. The

BTech students, as a result of this exposure among other factors, have produced numerous journals and conference papers, and have seven US patents and one Indian patent. These are outstanding achievements for such a young institution, which has graduated just three batches of BTech students so far.

There are 205 PhD students currently in the institute. One-fifth of them have degrees from the IIT system. Many hold among the top three ranks of good engineering colleges. One-fifth is in the 95th percentile or higher in the GATE examination.

An innovative feature of the BTech programme at IITGN is a five-week Foundation Programme. This is an initial orientation period, during which students are taught societal awareness and concerns, values and ethics, communication, leadership and teamwork. In the regular programme of study, they have a compulsory course on biology, design and innovation and world civilization. Altogether, there is a high humanities and social sciences content of eight courses. Also, there is high emphasis on sports.

This radical course composition policy is readily visible in the higher confidence level of the students, and is in line with the topmost engineering institutions in the world, which are anxious not to graduate students with a narrow technology focus, and no awareness of the larger world in which they are embedded.

At the same time, the rigour of the programme is not diluted in any way. There is a Comprehensive viva voce in every semester, so that students do not just get by with routine study for examinations. There is remarkably flexible provision for students to change their branch of study if they wish, not just within divisions, but across divisions as well. There is an emphasis on projects and presentations.

Finally, a progressive feature introduced by the Director that has yielded great dividends is a liberal attendance norm, accompanied by a focus on class participation, which has ensured a high level of student attendance. This has to be seen in light of the low student attendance, which is a common feature of other institutions in the IIT chain.

For a new institution, the very sensible approach followed so far has been to take in quality faculty in whichever field within the broad spectrum of engineering, science and humanities and social sciences. Then, use those appointed as a nucleus around which to grow particular fields of study. In the chapters that follow, we point out that after this initial phase, the institute will have to decide which fields it wishes to develop expertise in, and follow that objective rather than be guided by faculty availability, which was inevitable in the initial stages.

Despite the dependence on faculty availability, the institute has already developed five unusual centres of specialisation, cutting across the usual departmental boundaries of pre-existing IITs.

These are:

- Fire Safety, Earthquake Safety, Process Safety
- Design and Innovation
- Biomedical Engineering
- Archaeological Sciences
- Brain and Cognition

The academic flexibility that is the hallmark of IITGN has enabled these centres to grow, drawing upon faculty from different departments and divisions. For example, the Archaeological Sciences centre draws upon faculty from Engineering and Humanities, and seeks to connect heritage, society, culture, and science.

If there is a lesson from IITGN, it is that flexibility in the right hands alone can develop these newer institutions to become leading centres in the country and in the world. The Board and the Director are to be commended for having worked their way around a number of binding restrictions so common in the Indian academia, so as to attract faculty, and create the laboratory space needed in the temporary campus.

In the chapters that follow, further aspects of the Institute are explored under the respective chapter heads. Although much has been achieved in a short time, much remains to be done if the institute is not to lose its way going forward. These pointers towards improvement will be collected together in Chapter 6, the concluding chapter of this report.

2. NURTURING STUDENTS

IITGN seems to have acquired a special place for itself in the family of IITs. This is the impression we had while meeting the students and hearing their comments during informal discussions organized during our visit. Students from distant states opted for this IIT as their choice, as is visible from the domicile statistics of the students. This seems to be because of special efforts being made to nurture the young generation in this Institute. At present, the statistics of BTech students studying in IITGN is: Maharashtra 23%, Rajasthan 21%, Andhra 13%, Gujarat 11%, UP 8%, MP 6%, Bihar 4%. There are ~ 17 % girl students. A Gender Embarrassment Cell has been created. No case whatsoever has come before the cell so far.

There are Life-Skill workshops, Awards for Curricular & Extra -Curricular achievements, Career Counselling, Mock Aptitude Tests Cultural activities are organized with faculty-student participation. In addition to a large number of annual cultural events, there is extensive participation in sports. There is also an on-line magazine.

Internships are arranged for BTech students for duration of 8-12 weeks in summer. 30% of the students taking internships, receive foreign internships. These have resulted in patents and publications. Placement offers are received by 90% students, of whom 60% prefer jobs, 25% go for higher studies while others try various other possibilities. There is also provision for students from elsewhere to come to IITGN as summer interns. There were 171 interns from 45 institutions across India in summer 2014.

IITGN has taken special steps to provide additional financial support to students through the support of the Governing Board to ensure that every student, regardless of his or her family background can attain his/her maximum potential by availing of the numerous curricular, co-curricular and extra-curricular opportunities. Opportunities are provided to students through Earn while you Learn Scheme for a maximum of 8 hours per week.

Direct interaction with the students and pointed questions to them gave the impression that the students are very happy with the environment, particularly with the kind of direct interaction with the teachers. There were some comments about improvements needed in instructional methodology especially while deploying technology based learning.

IITGN has been making very special efforts to attract good students for PhD research projects.

Toppers in Masters level degrees from other institutions are being offered special scholarships to pursue research.

Courses on offer:

BTech

- Mechanical Engineering (from 2008)
- Electrical Engineering (from 2008)
- Chemical Engineering (from 2008)
- Civil Engineering (from 2013)
- Materials Science and Engineering (from 2014)

Two-year M.Sc.

- Chemistry (from 2013)
- Mathematics (from 2013)
- Cognitive Science (from 2013)
- Physics (from 2014)

Two-year MA

- Society and Culture (from 2014)

MTech (from 2011)

- Chemical Engineering (from 2011)
- Civil Engineering (from 2011)
- Mechanical Engineering (from 2012)
- Electrical Engineering (from 2012)
- Materials Science and Engineering (from 2012)

PhD (from 2009)

- Biological Engineering
- Chemical Engineering
- Chemistry
- Civil Engineering
- Cognitive Science
- Computer Science and Engineering
- Earth Sciences
- Electrical Engineering
- History
- Language & Literature
- Materials Science and Engineering
- Mathematics
- Mechanical Engineering
- Philosophy
- Physics
- Political Science
- Psychology
- Social Epidemiology and Sociology

PGDIIT: Additional channel for professionals

- Full time (one year)
- Part time

The PGDIIT diploma programme has a flexible curriculum. It can be a stepping-stone to the MTech. Or PhD. programmes, and also offers an exit option for those who are unable to perform well in the MTech. and PhD programmes.

Flexibility: An innovative feature of IITGN is the emphasis that they have on projects and presentations. There is a compulsory course on design and innovation, and there are projects outside the curriculum (with no credit). There are many electives on offer, and choice is open across disciplines. Instead of a B. Tech project, students can take project course electives. The BTech course carries an Honours designation for the major specialization chosen for an additional five course electives within the discipline, and permits minors, for an additional five courses from any other discipline.

Individual attention to students: A student-specific academic path is enabled. There is a comprehensive viva voce examination at the end of every semester, which is truly unusual, because this involves considerable expenditure of faculty time. In this manner, early weaknesses are identified with a plan for correction.

Change of specialisation: Liberal shifts in branch specialisations are permitted, and in 2010, all the students seeking branch change could be accommodated. Roughly, 10%-12% of the students seek and are granted a change in every batch.

Special features of the teaching programme:The 'Unstructured' laboratory course in the undergraduate Physics curriculum is an example of an unusual insertion in the teaching programme. In Chemistry there is unorthodox content and approach to the undergraduate core course, although the Peer Review Committee in Sciences (see chapter 3) pointed out that the use of standard texts would make the undergraduate teaching programme conform more to curriculum content elsewhere. In Mathematics, there is an example of an initiative to teach Mathematics to undergraduates through applied projects. The approach to teaching is best summed up by the following excerpt from one of the departmental brochures: "We teach and do the research we are passionate about ...and encourage students we mentor to pursue their interests." Simultaneously with this flexibility, there is provision in the core curriculum for broad spectrum exposure to the world, with compulsory courses on world civilizations and on life sciences.

Incentives for academic excellence: There is a Dean's List of students with superior academic performance. It is expected that about a quarter of each batch will make it to the list every year. In order to attract good students to the PhD programme, additional fellowships of Rs. 5,000 per month are given to PhD candidates ranking within the top 5% in any relevant national level qualifying

examination; Rs. 10,000 per month to PhD candidates with at least one of their previous degrees from a premier institution like IITs, IISc, etc. Cash awards are given to students for research publications (Rs. 25,000 per publication, up to a maximum of Rs 50,000 per student).

International travel support: Rs. 2 Lakhs (for PhD students)/Rs. 60,000 (for other students) is provided for attending conferences or workshops.

Student research projects: Some notable projects on which students have been working are listed below:

- Agarbatti project: A device to reduce the labour involved in rolling Agarbattis, developed by Keshav, an IITGN graduate. The project is currently being incubated at IITGN.
- Mobile apps for the blind: Students have worked with a school for the blind to develop mobile apps.
- Litter free Ahmedabad contest: IITGN students developed solutions to discourage littering in the city. Three prototypes of waste bins for Ahmedabad streets were developed.
- Gujarat 4D: A unique tourism-based website offering 4D visualizations of tourism points in Gujarat, developed by a team of 3rd year students, is being mentored at the DIC.
- Bio- degradation system: Prof Dinesh Korjan is coordinating a project on designing a waste bio-degradation system for Ahmedabad.
- Zero Litter Phase 2: This project seeks to create value from kitchen waste and has resulted in two prototypes of a micro bio gas unit for evaluating the quantum and quality of usable gas from typical daily household food waste and associated issues of using such a unit.
- One Hundred and Fifty two students undertook the challenge of developing an electrical vehicle platform specifically targeted at understanding safety challenges in Indian conditions. They also succeeded in transforming a conventional autorickshaw into a battery-operated vehicle by making minimal changes to its existing structure.

Remedial provisions: Although there is no formal remedial programme, there is a guided progress scheme, with a specific faculty advisor, and courses at a slower pace, for students who find the going difficult. There is also a peer-assisted learning scheme, where two junior are attached to a senior student who will offer assistance with either academic study or adjustment to the environment. At a time when school and undergraduate education in the country does not promote communication skills, IITGN offers remedial English to undergraduate students, and a compulsory course on “Cultures of communication” for postgraduate students. There is a Writing Centre with an

instructional facility to help students become effective and confident writers, and individualised consultation on writing projects.

Core values: The approach towards students at IITGN is very international at its core. Students are treated as responsible adults who are capable of taking decisions on their own. They are encouraged to take initiatives, and to have convictions and opinions. They are encouraged to participate in the decision making process at the institute. In this way, the institute instils self-esteem in its students.

Foundation course: BTech students are inducted into life at IITGN through a five-week Foundation Course, which is conducted on a full-time basis from early morning to late night, with no other classes. There are five areas of focus: physical activities and sports; fostering creativity; communication skills and teamwork; values and ethics; social awareness. In this way, the course lays at the very beginning the groundwork for students to be aware of their environment, and the needs for effective nation building.

Incubation: GridAnts is a technology innovations start up co-founded by four electrical engineering students of the pioneer batch of IIT Gandhinagar. **Tinker Tank** is a ready-to-go-operational social enterprise which designs and distributes need-based low-cost tools and machines with an aim to reduce the drudgery of intense manual-labour.

Technical Extra-Curricular Activities: There are various technical clubs that students participate in. The clubs provide an opportunity to the students to implement their learning in a fun, creative and constructive manner.

- Amalthea: The Technical Summit
 - 2010: Renewable Energy and Challenges
 - 2011: Infrastructure
 - 2012, 2013: Design and Innovation
- Mean Mechanics – The Robotics Club
- Odyssey – The Astronomy Club
- Coding Club
- Researchers' Ferret Confab (REFECO): An interdisciplinary platform for dissemination of knowledge, it is organized entirely by PhD students (including fund-raising), invites both undergraduate and postgraduate students, and has expanded participation to other colleges

Earn while you learn: Initiated in 2009, this is another example of a new institution harnessing its needs for help with running the library and computer centre, managing external relations and

grading assignments. Students benefit from it directly since it gives valuable work experience, while at the same time inculcating respect for the dignity of labour and enhancing self-esteem through partial financial independence.

Non-degree courses: Students from other institutions in the country can register at IITGN for a semester or two. There are also opportunities for working professionals to register for one or more courses in a totally flexible way. This is an excellent example of academic outreach offered by an elite institution to the external world.

- Full-time non-degree students:
 - Students from other institutions in the country can register at IITGN for a semester or two
- Part-time non-degree students:
 - Opportunity for working professionals to register for one or more courses for their capability/knowledge enhancement

3. NURTURING FACULTY AND STAFF

Recruitment of faculty and nurturing them is the most important task facing any institution. This is particularly so for an institution in its formative stages. IITGN has made an excellent beginning by adopting some unique approaches which at present appear to have proved effective. IITGN is succeeding in attracting young faculty through its dynamic approach. It is suggested that there should be special efforts to analyse the positive points of the present approach and see the additional efforts needed to cover the weaknesses.

An indicator of how seriously IITGN takes the issue of building up an excellent faculty body is that it has already appointed Peer Review Committees, separately for the three groups of disciplines: Engineering; Sciences; and Humanities and Social Sciences. The reports of these committees were made available to us. A review of these, beginning with Engineering, is a useful way by which to start our review of the progress made by IITGN in nurturing and growing its faculty body.

Engineering: In general, the review committee felt that the total number of faculty in almost all disciplines was sub-critical for the kind of broad spectrum programmes on offer. This is inevitable in any new institution, but is a critical area on which IITGN needs to focus. Many of the suggestions made by the students to the committees are useful pointers to the directions in which faculty recruitment should go, for instance, that the electrical engineering department should have more traditional expertise in topics like Communication, Power Systems, and Wireless Control, and less in electronics. As will be shown in detail further below, IITGN has an innovative two-channel method of faculty recruitment, which is flexible, and suited to a start-up institution. Therefore, they are well positioned in terms of institutional structure to address the expertise gaps in the engineering disciplines, but of course are subject to the same market shortages as afflict older IITs. The committee recommended that there may be need for additional technical manpower support for maintenance of high-end hardware and software.

In order to nurture engineering faculty, a number of Centres have been established, with industry support. The laboratories available for experimental research are judged adequate, which is particularly commendable for a young institution. The committee commended the practice of sharing of equipment and infrastructure at the institute level across disciplines. Faculty are reported as well-funded for their research, from both industry and government sources, and the committee particularly noted the high level of international research collaboration. Most of all, the committee found the high level of multidisciplinary research, with a degree of cross-discipline collaboration of

faculty in research and teaching that is not often found elsewhere. The committee however warned that this flexibility may be difficult to sustain into the future as the faculty size grows, unless the academic administrative structure is designed to accommodate flexibility.

Sciences: Here again, the review committee found an unbalanced curriculum in Physics and Chemistry, and suggested the use of standard texts independent of the particular faculty teaching the course. They suggested that there should be an elective on Quantum Physics for Physics students.

Humanities and Social Sciences: The review committee found the faculty strength of HSS, at 20 percent of total faculty, especially commendable, as also the emphasis on developing research clusters integrating HSS with other disciplines. They cited the examples of cognitive science, public health and social epidemiology and language, culture and translation, as sufficiently innovative and important that their presence should be web-linked to other such multidisciplinary groups elsewhere. A cautionary note sounded by the committee was that PhD graduates should be well-equipped for jobs with recognisable disciplinary grounding, and that this should not be lost sight of in the cross-disciplinary focus.

Faculty positions: The faculty positions in IITGN carry the usual academic hierarchy among the career faculty, and a very large range in types of contractual positions in the short-term category to accommodate the wide variety of talent that can be tapped, in terms of very senior or very junior people, and to differentiate between the expected duties in each case. These are listed below. Some are positions for teaching only, some for research only, and others have a mix of expectations in terms of duties. There is also a provision for appointment of Assistant Professors on a contractual basis.

Career Faculty

- Professor
- Associate Professor
- Assistant Professor
- Assistant Professor (Contract)

Short-Term Faculty

- Visiting Faculty (various levels)
- Teaching Faculty
- Research Faculty
- Adjunct Faculty (Part-time)
- Scholars-in-Residence
- Teaching /Research Associate
- Guest Faculty

Appointing Faculty: IITGN has a rolling advertisement (www.iitgn.ac.in/faculty-recruitment.htm) for faculty recruitment requirements as they emerge, which goes through the defined formal procedure involving the final step of interviews by a Selection Committee. The special innovation in the appointment of faculty has been the parallel functioning of two channels. There is a Standing Committee, which is empowered to appoint career faculty (in the usual academic hierarchy, listed above, on scales of pay) or short-term faculty (also listed above, on consolidated salaries or honoraria), in both cases for a period of up to two years. The Statutory Selection Committee, which is the formal route for appointment of regular faculty, then ratifies appointments made by the Standing Committee, or makes fresh selections of its own. In addition, the Selection Committee can also decide on any cases brought before it for short-term appointments. In this manner, the Standing Committee acts as a bridge to the Selection Committee, and enables quick actions on candidates applying for faculty positions, without having to wait for the appointment and assembly of a Selection Committee. And once the Selection Committee is constituted, it in turn is free to appoint candidates to contractual positions. The Standing Committee is appointed by the Board of Governors, and consists of the Director and identified functionaries.

There is also a Faculty Search Committee, a single committee across the Institute but with a coordinator for each discipline, which functions year-round, and brings interested applicants (after an initial categorisation system, described below) to the Institute for an in-person evaluation that is conducted not just on the basis of the professional opinion of the relevant department faculty, but also on the basis of student reactions.

From the online applications made, candidates are divided based on three independent opinions into three categories. Category A is a fast forward process, starting with informal skype interaction and a campus visit. Category C is dismissed and not taken forward through the Standing Committee. Category B candidates are explored further, by seeking information through reference letters, feedback/discussions with faculty, and informal skype interactions. At the end of this, the candidates are classified into A or C, or possibly remain in category B for further investigations.

The visit to IITGN typically takes two days, during which the candidate is asked to teach a session to students on a fundamental topic in his/her discipline. He/she also gives a research seminar, and has one-on-one discussions with faculty. Advisories are issued to applicants detailing both the process and what the institution is looking for in its recruits.

These have been the key innovations that have enabled the institute to grow rapidly, without in any way sacrificing quality or rigour in the appointments process. This should also stand the institute in

good stead in its bid to balance out its faculty in various disciplines, the need for which was pointed out by the peer review committees.

Faculty facilitation: New faculty are provided financial support in the form of relocation expenses through an interest-free soft advance and travel support. IITGN deals with married couples seeking jobs as independent applicants, each evaluated on his or her own merits, and given separate appointment letters. If a married couple applies with an interest in joining only if both get jobs, they are given letters of appointment only if both individuals are independently evaluated and judged suitable. In this manner, IITGN has attracted a number of married couples seeking jobs, and one-fourth of its faculty are women, which is a very high percentage.

Even in its temporary accommodation, IITGN has set aside space for an excellent day care facility for children of faculty and staff. The centre is well stocked with attractive equipment for children. This is a truly unique case of institutional concern for the well-being of its employees, and has earned rich rewards in terms of productivity, since employees do not have to worry about their children while at work.

Sponsored research and consultancy: The major projects presently under way with external funding are listed below:

- Measurement to management (M2M): improved water use efficiency and agricultural productivity through experimental sensor network, Media Lab Asia (Amount: Rs. 1,31,00,000)
- High Fidelity Computational Design Of Engineered Systems On High Performance Computing Platforms (Amount: Rs. 1,18,06,000)
- Quantitative near-and mid-infrared wavelength modulation spectroscopy for gas sensing applications, DST (Amount: Rs. 54,88,700)
- Statistical learning of Category Information: A neuroimaging investigation (Amount: Rs. 51,20,000)
- Colloidal Particles Self Assembly in Liquid Crystals, DST (Amount: Rs. 45,30,000)

The consultancy projects under way are listed below:

- Technical Support to IITRAM, IITRAM (Amount: Rs. 72,00,000)
- Seismic design criteria for metro structures, MEGA (Amount: Rs. 24,71,920)
- Peer view of design basis report for construction of bridges on freight corridor between Kanpur and Khurja, DFCCIL (Amount: Rs. 16,85,400)

- Cost-Benefit Analysis of Integrated Scheduling and Production Control, ABB (Amount: Rs. 13,61,803)
- IITK-BMTPC Earthquake Tips, Phase II, BMTPC (Amount: Rs. 13,61,803)

Research facilitation: The Institute has implemented extremely liberal norms for granting one year leave to new faculty (for example, within a semester of joining the Institute) for international post-doctoral research exposure. There are externally funded research centres, listed below, which are inter-disciplinary in nature:

- Safety Centre, Funded by **Underwriter Laboratories'** (UL, USA)
- Design and Innovation Centre, Funded by **Ricoh Company, Ltd**
- Biomedical Engineering Centre, Funded by **Government of Gujarat**
- Archaeological Sciences Centre, Proposal submitted to **MoC**

There is a research support team constituting faculty and administrative for facilitating research, a very interesting initiative, since research cannot flourish when there is no administrative support for equipment purchase and other requirements.

The Safety Centre: To promote safety in public and private spheres, industry and the informal sector. The Safety Centre advances these objectives with activities to:

- **Discover:** Research projects, consultancy and project implementation. Promoting awareness and undertaking public advocacy around safety.
- **Teach:** Introducing industrial safety courses in IIT Gandhinagar's graduate and undergraduate curriculum.
- **Outreach:** Safety conferences and seminars to enable safety professionals from around the world to network and explore the state of the art and new safety technologies; as well as training programs for safety professionals.

Practice: Training staff and students on safe working practices in all aspects of IIT Gandhinagar's operations such as labs and event organization.

The Design and Innovation Centre: To develop innovations that have a strong impact both locally and globally.

- Fosters a multidisciplinary approach, supports innovative projects and collaborates with globally acclaimed institutions.

- The projects at the DIC have a strong industry and social focus and follow a human-centric design philosophy.
- Projects range from social innovations, ecological design, to frugal engineering, among others.

Biomedical Engineering Centre: To carry out research and development in the areas of Biomedical Engineering and Healthcare Technologies.

- To develop low cost, affordable cost-effective technologies related to health care to help people in rural areas.
- To collaborate with foreign universities and prominent national and international institutes to conduct research in three major focus areas.

Archaeological Sciences Centre: Set up with the following objectives:

- Support teaching and research in archaeological sciences at the Institute.
- Support archaeological studies in the country through a state-of-the-art dating facility.
- Provide small grants to investigators across the country interested in research in archaeology in a timely manner

Feedback on performance: Among the innovative initiatives made by IITGN is having a mid-term evaluation of courses through students' feedback. This provides a very useful basis on which faculty can do a mid-course correction. Every faculty member is required to prepare a self-evaluation report in a specified format once a year. Feedback on these reports is discussed with the faculty.

Faculty promotions: IITGN has an academic advisory council which meets annually. The membership of the council includes distinguished external academics, like Prof. Paul Jennings, former Vice President and Provost of the California Institute of Technology, and faculty members currently serving at the older IITs. It also includes internal faculty members from IITGN. From the summary of discussions of the council it would appear that they have advised flexibility in the expectations of faculty regarding evaluation for promotions. The council suggested that each individual be allowed to choose his/her mix in respect of the three major activities in which they are to engage – research, teaching, institution building. As a broad guideline, this is certainly advisable, especially in a new institution, where the burden of institution building might be heavy.

IITGN is presently bound by the general IIT system, where decisions on faculty promotion are taken along with faculty recruitment by an external selection committee. The Council recommended that IITs follow the IISc pattern of internal evaluation, with the power of decision-making retained

internally, but with inputs from external review of the work done by the person seeking promotion. The Council further recommended a two-tier internal process, first by the department, and subsequently by the institute.

The Academic Advisory Council laid down certain norms, subject to their recommendation of flexibility. An Assistant Professor looking for promotion to Associate Professor is expected to have taught at an acceptable level of student acceptance a range of courses, typically two to three, within his discipline. A sustained publishing record, with at least one completed doctoral dissertation, and a production rate of one or two PhDs every year is expected. The Council recommended that shortfalls in institutional and administrative contributions might be overlooked, but not in research or teaching. In keeping with its overall recommendation of flexibility, the Council refrained from numerical targets in research, but suggested that there be a sustained focus on quality.

For promotion from Associate to full Professor, the Council recommended that there should be evidence of impact either in terms of contributions to the field, or generating research funding and setting up centres, along with graduated PhDs numbering at least six. Mentorship of young faculty was also laid down as a quality to be rewarded, although in exceptional cases, the absence of this was not held as deserving of penalty.

Post-professor incentives and inducements were also suggested, in the form of higher pay scales or named chairs and such like. These are somewhat remote to the concerns of IITGN today, whose career faculty are mostly at the Assistant Professor level.

The next big challenge that IITGN faces is the selection of Associate Professors from among its Assistant Professors some years down the line. How this selection round goes will determine the future of the institution. One suggestion made by the Council, in order to accommodate the institution building pressures on young faculty in a new institution, was that the interval of time be extended by two years beyond the usual five year period, for a faculty member to assemble enough research experience and performance to qualify for the next rung.

A critical need for IITGN at this stage is to use its built-up flexibility in the appointment process and positions to have teaching faculty who will in the short term fill in the subject shortfalls in each discipline, in terms of the range of courses on offer.

Joint appointments: Whenever appropriate, IITGN does appoint faculty to more than one parent department, and provides the tremendous flexibility and considerable cross-departmental offerings of courses and PhD student guidance. The Academic Council recommendation was that the Standing Committee be allowed to assign interested faculty a limited term joint appointment in another

department, for a five year period say, with a further extension possible, and the same has now been implemented by the Institute. But in general, a single departmental mooring will be the permanent state as long as the present practice of department-specific selection committees continues.

Outreach: There is also a faculty development programme whereby interested teachers of other colleges can pursue PhD with an initial year of preparation, followed by two years of course work and research. There is also a seamless relationship with the Physical Research Laboratory in Ahmedabad, with mutual exchange of courses and doctoral guidance facilitated.

Technical Staff: Each laboratory, teaching or research, needs trained technicians to assist in the development, upkeep and constant attention towards the possibilities of augmenting the facilities. An environment can be created where the technical staff feels a part of the scientific/technical activities in the laboratory. Experimental research in fact creates an environment where the technical staff provides some useful training to students. Each laboratory should have a plan of training the technical staff along with the students

Technical persons need to be trained, and then empowered to make good decisions. Trusting the person given some specific assignment can help towards motivating persons to take on more responsibilities. When people take on more responsibility they begin to take ownership. This is a good thing when we are talking about the technical developments. People do not like to be micromanaged. If you have provided the proper training, trust your employees to use it.

Office & Supporting Staff: Administrators and the Supporting Staff in an IIT are facilitators to help the faculty and students. Their task is to implement educational policy set by the faculty and to make the system of learning more efficient.

Administrative staff have to undertake a wide variety of duties, including those performed by Data Entry Clerks, Analysts, Secretaries, Personal Assistants and Executives. IITGN requires from their administrative staff dedication, efficiency, and ability to work alone or as part of a team. There are roughly two categories, an Office Assistant literally being one who helps in an office, especially as a subordinate, whilst an Administrator is one who manages the affairs of the Office/Department/Section. IITGN recognizes the importance of continuous training and up-gradation of skills of all its technical and non-technical staff. A Staff Training and Educational Programme (STEP) Cell has been created. IITGN has also been encouraging its staff members to participate in various trainings/ workshops/ seminars conducted by other institutions viz. ISTM, ASC, Academic Institutions, IITs, Govt. Departments, etc. for administrative/ professional development. A

number of employees have been participating every year in such events. The Institute has made provision for meeting their registration and TA/ DA expenses.

The Institute also inspires its employees to upgrade their educational qualification in line with their profession/ academic discipline. The Institute provides financial incentives for acquiring higher academic qualification. In addition, provision of ten special casual leaves has also been created to facilitate pursuing of such programmes. The non-teaching employees are also permitted to register for the courses being offered at IITGN, as non-degree students. A number of employees have benefitted from this scheme.

The present scenario looks good for smooth operations and planned growth of the Institute. But one has to plan for the worst scenario which can emerge in the long run. This needs constant review from various angles, particularly from the side of the supporting staff. Appropriate lessons should be taken from the scenario which had emerged in IIT-Kanpur in the form of "Karmchari-Sangh" with support from sizable number of faculty members. This had effected the academic environment for a long time and left a permanent mark on that institution.

4. LEADERSHIP AND GOVERNANCE

IITGN is a benchmark example of a very strong and dynamic leadership team led by the Director, ably supported by a strong management team, and appropriately empowered by the Board of Governors. The team is fully involved in all the fundamentals that define an institute's excellence—infrastructure, academics, research, administration, industry collaboration, student centricity, and most important social relevance.

The foundation of the management team is deeply rooted in a shared value system built around transparency of information, decisions making and professional ethics. Every policy, process and decision made by the management is clearly documented, communicated and transparency exists at all levels. This was clearly evidenced in the rather voluminous but well organized documentation submitted to the Peer Review Team

The other leadership characteristics included leading from the front, participative management, team empowerment, focussed attention to talent attraction, industry connect, social consciousness, relevant R&D, win-win partnerships, and pragmatic management policies .

The IITGN credo is Rabindra Nath Tagore's poem "Where the mind is without fear." As we reviewed the leadership and governance, we found many examples and instances of how the institute is living this credo to build a strong, future-focused, world-class institute that is also relevant to the current needs of India. It was heartening to see that the vision percolates in the entire team and is actively translated into action.

Some of our observations were:

Dynamic leadership team: IITGN has a very dynamic and balanced leadership team with appropriate empowerment from the Board of Governors. The Director, Prof Sudhir K. Jain, is a hands-on visionary leader who has successfully enrolled his team in the well-defined vision, mission, goals, values, and core features of the Institute.

The faculty pool comprises of scholars trained and experienced both in Indian and International environment.

Empowerment & Participative management: The Director, Prof Sudhir K. Jain is a hands-on leader and strongly believes in participative management but does not hesitate to take hard decisions, if the need arises.

To ensure that there is a balance between short-term and long-term focus of the institute, the Director has appropriately delegated the ongoing operations of the institute to his senior leadership team and empowered them to take decisions. In addition to providing oversight to the Institute's operations, Director is engaged in longer-term, future-focused institution building activities, such as partnerships, internationalization, and building the permanent campus. He has skilfully buffered his team from external administrative agencies and stakeholders so that they can manage the present operations in an unhindered manner.

IITGN faculty shoulders a balanced responsibility that includes teaching, research, non-academic development of the students and institution building.

Overall, the leadership team of IITGN is a hands-on, engaged and aligned team that is working together to turn the vision of the institute into reality. The passion with which the various presentations were made indicates the ownership and excitement of the team in building this world-class institute.

Pragmatic management practices: Rabindra Nath's poem includes the lines *"Where knowledge is free, Where the world is not broken up into fragments, By narrow domestic walls..."* IITGN has taken an innovative approach to remove the departmental divide.

Instead of departments based on disciplines of study, IITGN organizes itself around issues and centres of excellence. These centres of excellence provide a platform for students from multiple disciplines, multidisciplinary faculty and industry and organizations to come together and holistically approach a problem statement. For example, the Archaeological Sciences Centre aims to connect heritage, society, culture and science. The centre is enriched by the cooperation of ASI and MoC.

This truly path-breaking step builds the students' and researchers' ability to think through holistic solutions thus doing away with an important bane of disconnect between industry, society and academia.

Talent attraction and retention policies: IITGN leadership team is extremely realistic and innovative in their approach towards recruitment and retention. The practices followed by them ensure that while there are no non-compliances with the rules and regulations, the constraints that are sometime created by these rules are addressed effectively.

An example of this is the Institute Standing Committee supplementing the Statutory Selection Committee for quick decisions on recruitment. This has been discussed in detail in previous chapters.

Salary-related constraints that pose a challenge in retaining talented faculty are addressed by channelizing part of the philanthropic funds to provide top-up salaries.

The leadership of IITGN recognizes the challenges of a new institute in attracting exceptional faculty talent. Therefore, the institute has laid down an innovative approach to address this. IITGN focuses on recruiting bright, talented young PhDs who provide the energy and enthusiasm and balances that with re-employed retired faculty who provide the wisdom and maturity.

The Early Start Program to attract brilliant students for pursuing PhD programs, discussed earlier, is another example of innovative recruitment policies.

Funding: The IITGN leadership realises that in the longer term, government funding alone cannot sustain the institute. Hence, there is a clear focus on funding through industry partnerships, R&D projects and philanthropic funds

So far, about 60 R&D projects have been sponsored worth nearly Rs 19 crores.

The institute has initiated a US \$ 20 Mn for 2020 campaign wherein some philanthropic funds have already been received. The usage of philanthropic funds has been earmarked for:

- Top up salary for faculty
- Top up scholarships for students
- International travel
- Overseas semester for PhD students
- Top up to recruit critical staff
- Support for distinctive centres
- Internationalization

All of the above areas of fund utilization are focused at building long-term excellence and to make IITGN the preferred destination for future generations of students, staff and faculty.

Win-Win partnerships: Starting from ground zero and competing with well-established institutes is a challenging task. IITGN leadership team has ensured that through mutually beneficial partnerships, they leverage the existing ecosystem.

Underwriters Laboratory, USA, Ricoh Company, Japan, The Neilson Company, USA, Gujarat Minerals Development Corp, Ministry of Earth Science, Govt. of India, and Department of Industries, Govt. of Gujarat, Physical Research Laboratory are some of such examples.

Their partnership with VGEC, the campus in which the institute is currently housed is another example. When the IITGN shifts to its own campus in December, it will leave behind 9,000 square meters of additional built-up area besides the ethos of a world-class institute.

To bridge the divide between industry and academics, IITGN starts engaging the industry right from the start of a program. For example, industry takes active participation in the five-week induction program for the under graduates. Further in the program this is supplemented by the visits and sessions by industry experts during the program.

Socially conscious policies: The most distinctive feature of the IITGN leadership team is the focus on social relevance.

The community outreach program ensures that the students inculcate a sense of responsibility towards the society. However, what struck us the most was the initiative taken by the management to care for not just the faculty but the non-academic staff and the extended teams, such as the construction workers working towards building the institute.

At their own campus, IITGN leadership decided to first build the temporary residences of the construction workers before they started work on their infrastructure. In addition, the institute takes ownership of health and development of the families of the construction worker. Each family of contract workers (e.g., mess staff, house keeping staff, and security staff) is given up to Rs. 10,000 per annum from philanthropic funds towards reimbursement of expenses incurred on education of their children. Funds are also assigned for providing ad-hoc financial support to contract workers for medical emergencies. These socially responsible gestures also ensure that every person whether a permanent or temporary employee is fully aligned and committed to the Institute's goals.

IITGN is admirably one of the few institutes that have a day care centre for the faculty and staff at the campus.

As covered elsewhere in the report, even the research projects taken up by the institute are on topics that are socially relevant.

Broadening the horizons: IITGN's leadership team recognizes the industry's need for well-balanced professionals who are not only technically sound but are well rounded socially aware connected professionals and compassionate human beings.

IITGN has made good progress in integrating engineering, science, humanities and social sciences in the curriculum making good progress in balancing science and humanity. Some of the innovations covered elsewhere in this document include:

Five-week foundation program that focuses on sports, fostering creativity, communication, leadership and teamwork, values and ethics and social awareness and concerns.

- Compulsory courses on Biology, Design and Innovation, and World Civilization
- Courses on humanities and social sciences
- Emphasis on viva voice, projects and presentations

Design & innovation Centre is another unique environment created by IITGN. This centre allows students and faculty from multiple disciplines to come together to find solutions for socially relevant problems.

Employability & Entrepreneurship: IITGN leadership is acutely aware of the fact that for their graduates to be better employable, in addition to the technical knowledge & skills, there has to be a major focus on providing Professional Life Skills like communication, teamwork, interpersonal skills, critical thinking, problem solving etc. These are imparted through a rich humanities & Social Sciences curricula & participation in a wide range of extra-curricular activities. The Institute actively promotes entrepreneurship opportunities for its students through the IITGN Incubation Centre. Two companies, GridAnts Technologies Pvt. Ltd. and Tinker Tank have already been incubated.

Strive to be the world's best: The focus of the leadership of IITGN to be the world's best is clearly translated into actions as well. For an institute that is six years young, they have already published over 100 papers and filed 8 patents- 7 US patents and 1 Indian patent.

Both students and faculty are encouraged to get a rich global exposure. Amongst the three B Tech batches that have graduated from IITGN, about one third of the students have graduated with international experience. Faculty of IITGN is motivated to participate in international conferences to collaborate and to build relationships. Additional travel funds from endowment are earmarked for this objective.

While global exposure is one dimension of being world-class, the other is continuous learning and benchmarking with the best practices.

To guide the Institute in its strategic directions, IITGN organizes an Annual Leadership Conclave. The Conclave brings together thought leaders in education (including academia, industry and government) from India and across the world. The objective of this event is to discuss the way forward on high priority strategic issues for the Institute.

5. INNOVATIONS

Embedded in the preceding chapters there are references to several notable innovations that have enabled IITGN to grow as rapidly and surely as it has. It is useful to bring all those together in this chapter, including some not mentioned earlier, to serve as a template for new institutions starting out in any field.

Appointment of faculty: This has been dealt with in the chapter on nurturing faculty, where the details have been spelt out. At the moment, IITGN is tied into the IIT rules, which require that statutory Selection Committees be appointed for selection of career faculty. However, given the need of the hour at a new institution, facing the task of quickly putting in place courses and degree-awarding programmes, IITGN has a parallel track for faculty appointment, through a Standing Committee, appointed by the Board of Governors, and consisting of the Director and identified functionaries. The Standing Committee is empowered to appoint career faculty (in the usual academic hierarchy, on scales of pay) or short-term faculty (on consolidated salaries or honoraria), in both cases for a period of up to two years. The Statutory Selection Committee, which is the formal route for appointment of regular faculty, can ratify career faculty appointments made by the Standing Committee, or make fresh selections of its own. In addition, the Selection Committee can also decide on any cases brought before it for short-term contractual appointments. IITGN has a very wide variety of contractual positions, to accommodate the wide variety of talent that can be tapped, in terms of very senior or very junior people, and to differentiate between the expected duties in each case. There is also a provision for appointment of Assistant Professors on a contractual basis.

There is also a Faculty Search Committee, a single committee across the Institute but with a coordinator for each discipline, which functions year-round, and brings interested applicants (after an initial categorisation system described in detail in the chapter on nurturing faculty) to the Institute for an in-person evaluation that is conducted not just on the basis of the professional opinion of the relevant department faculty, but also on the basis of student reactions.

These have been the key innovations that have enabled the institute to grow rapidly, without in any way sacrificing quality or rigour in the appointments process.

Day care facility for faculty and staff: Even in its temporary accommodation, IITGN has set aside space for an excellent day care facility for children of faculty and staff. The centre is well stocked with attractive equipment for children. This is a truly unique case of institutional concern for the

well-being of its employees, and has earned rich rewards in terms of productivity, since employees do not have to worry about their children while at work.

Financial Sustainability: IITs have government funding, but have to plan ahead for the financial burden that will fall upon them once Plan funding ceases for operating expenditure. IITGN has met this challenge of financial stability in a far-seeing manner. The institute has made a very determined effort to raise funds towards a corpus, not a simple matter for a new institution without an alumni roster. There is a year 2020 target for fund raising, and Rs 15 crore has already been raised so far. The details on the industry linkages through which the fund has been raised has been described in detail in the chapter on leadership and governance. The interest from this corpus is used to top up faculty salaries with funding for attending conferences, and to fund student internships. Importantly, another use is towards medical assistance for staff needing secondary or tertiary health care.

Environmental Sustainability: The new campus has been designed with strict adherence to green principles, and is targeting a GRIHA rating. The bricks use fly ash from a nearby thermal plant. There is use of solar panels for supplementary energy, and a complete water harvesting system.

Outreach to community: A special feature of the new campus is the housing that was first put up, before any other structure, in order to accommodate construction workers. There is a sanitation system for this housing, with a septic tank. There is also a scheme called NYASA under which there is continual engagement, including provision for schooling, for children of the construction workers and there are a number of other activities for such as the collection of clothes for the construction workers. There is a scheme called SAKAR whereby the students and faculty are encouraged to go out and promote interest in mathematics and science in schools.

International exposure for students: A truly astonishing one-third of students get international internships during their stay at IITGN. This has been made possible by the fund-raising effort of the institute. There are also international students who come to visit for short periods, funded by their parent institutions, and join IITGN students on the India ki Khoj trips.

Recruitment for PhD programme: There is an Early Start program whereby students in Master's programmes are encouraged to apply while still in their last year of study. In addition to the batch recruitment, which is common to all institutions, there is also a system of accepting students on tap during the academic year, if for any reason they wish to switch from another institution.

Student and teacher attendance: In higher education institutions in India today, teacher attendance is a problem, and in IITs where it is in general not a problem, student attendance is a problem. IITGN

has neither of these. The students are lightly governed, on an honour system, but the requirement of class participation provides in effect a penalty for not attending classes. IITGN therefore provides a most refreshing to the general malaise and paradox of institutions, rated as among the most difficult to enter in terms of the percentage of applicants selected, finding that once students are admitted, they have no incentive to attend classes.

Individual attention to students: A student-specific academic path is enabled. There is a comprehensive viva voce examination at the end of every semester, which is truly unusual, because this involves considerable expenditure of faculty time. In this manner, early weaknesses are identified and open to correction.

Student feedback: Student feedback is given directly by students to faculty mid-semester, and is a major innovation because feedback at the end of the semester really comes too late to benefit the students taking the course. There is also formal feedback at the end of the semester which is communicated by the head of the department to the instructor concerned.

PGDIIT programme: In addition to the full range of degree programmes of study, IITGN has a post graduate diploma course, which can be pursued full-time for one year, or part-time over a longer period. This offers a flexible point of entry into the M.Tech and PhD programmes, and at the same time offers an exit route for students unable to cope with the rigour of the regular programmes of study. This innovation is exactly what is needed in the current educational context in India, where students with aptitude, but without sufficient academic exposure, can make a stage-wise entry into the regular programmes of study. At the same time, the exit option is exactly what is needed for students unwilling to commit the time or effort for a regular degree, but who nevertheless want a marketable qualification.

Management of Research and Development: There is a strong focus on R&D in IITGN, with faculty encouraged to encapsulate their research and obtain intellectual protection. What has been an enormous help in this direction is the flexibility whereby faculty across departments within disciplines, and even across disciplines, collaborate freely. Doctoral students can register in one department, such as chemical engineering for example, and actually execute their project in the brain and cognitive sciences department. In part, this may be an outcome of the present small size of the institute, but the tradition has been so strongly set that it is likely to be sustained even as the institute gets larger.

Linkages with industry: There are strong industrial links visible in the research centres that have been set up with funding and collaboration from corporations. There is also an incubation centre. As

a result of these ongoing links, IITGN has an excellent placement record, with 80-93 percent success among those graduating students opting for placement. The BTech students have seven US patents and one Indian patent. These are outstanding achievements for such a young institution, which has graduated just three batches of BTech students so far.

Commitment to national goals: Students doing projects as a part of regular course work, or on summer research, are encouraged to produce socially relevant products. There is a biomedical chair that has been developed which can be used by the disabled or infirm. There is also a wide variety of research being done on environmental issues such as environmental protection, water preservation. Students are continually made aware that they are part of a larger nation with pressing issues that they can use their education to solve. At the very outset of the BTech programme, there is a 5-week Foundation course, during which time no courses from the regular curriculum are started. Instead the students are given an intensive exposure to fostering creativity; communication skills and teamwork; values and ethics; social awareness. In this way, students are made aware that the needs of the nation require not merely that they absorb classroom instruction, but that they use it to creatively address and solve the myriad needs of the national environment.

Non-degree courses: Students from other institutions in the country can register at IITGN for a semester or two. There are also opportunities for working professionals to register for one or more courses in a totally flexible way. This is an excellent example of academic outreach offered by an elite institution to the external world.

Faculty Development: There is also a faculty development programme whereby interested teachers of other colleges can pursue PhD with an initial year of preparation, followed by two years of course work and research. There is also a seamless relationship with the Physical Research Laboratory in Ahmedabad, with mutual exchange of courses and doctoral guidance facilitated. A Knowledge Network with other colleges in Gujarat enables sharing of resources and faculty upgrade.

Innovative areas of focus: Finally, the areas in which the institute has chosen to focus are unique to IITGN. Safety in the face of natural and man-made disasters; archaeology; design and innovation; and brain and cognitive sciences are some of the focus areas which draw faculty from across all departments and disciplines.

6. RECOMMENDATIONS

The interaction with students, faculty and the reports of the peer review committees all uniformly speak well of IITGN, and of the dynamism shown by a young institution. The recommendations given below are gathered together from that very feedback, to help the institution learn of the further directions in which it could improve and go forward, after a great start.

Curriculum: The engineering peer review reported that B. Tech students thought some of the core engineering courses had become too overloaded, with some courses having been merged, and the instructor trying to cover all the topics with the same rigour as in the earlier courses which went into the merger. They also seemed to find the distribution of courses uneven, with too great an overload in semesters 5 and 6. B. Tech Electrical engineering students found too much emphasis on electronics, and not enough coverage of traditional topics like communication, power systems, wireless and control. They felt that this was perhaps the reason why IITGN electrical engineering students had not done so well in the GATE examination. Master's students in engineering also questioned the need for two compulsory HSS courses in their programme. In the Sciences, there seemed to be concern that the Chemistry courses at both Bachelor and Master levels should conform to global standards and use standard texts. The sciences peer review suggested that there should be a quantum physics course as an undergraduate elective. In the five-week foundation course, there is need for a course on what engineering is, and also a course on the history of science.

Sustainability of initiatives for BTech students: The emphasis on project based learning, international exposure for BTech students through summer internships, and peer assisted learning at the BTech level are all among the great innovations at IITGN, specially commended by the peer review committee for engineering. However, there are worries as to how these initiatives, requiring as they do artisanal attention to students, could be sustained as the student intake rises and the institute grows. There would be a need for a formalised structure through which these get irreversibly encrusted.

Laboratory facilities: Because of the criticality of these facilities in the training of students and in research, the institute could in the orientation programme for students inform them about the facilities existing, and how access may be obtained. The general sense seemed to be that there is no shortage of facilities, which in itself is remarkable in a young institution, but that there was not the kind of awareness there should be on the pattern of availability and access.

Faculty augmentation: The institute's innovative faculty recruitment drive has already resulted in remarkable speed of faculty growth. However, there is a need for continued attention to faculty growth as the size in some specialisations is not sufficient to sustain a full academic programme. The remarkable flexibility that IITGN has shown so far in reaching across disciplinary boundaries has to be codified in its academic administration policy more precisely, so that this flexibility is not lost going forward, while at the same time its advantages are retained. This is once again a sustainability issue. The institute has supplemented its faculty requirements by calling on retired faculty from the older IITs to sustain its teaching programme, but there is a need for institutionalising the learnings from retired people, including perhaps videotaping the courses of star faculty.

In addition, IITGN needs to chalk out plans to attract some senior and mid-career faculty to take up important responsibilities essential in any new institution. Younger faculty should concentrate more on academics and R&D and going forward can spend lesser time in Institute building. It is always difficult to attract senior faculty or mid-career faculty but a new Institution can succeed by projecting its Vision plan in some well-defined futuristic directions with state of the art laboratory facilities. This is very possible in a place like IITGN in its present stage where new campus is being developed with new buildings and reasonably good funding is available.

Sustainability of flexibility with respect to faculty assessment: In the self-assessment that faculty are expected to do each year, there is a commendable emphasis on the discipline of the faculty member as it influences the type of work they do, and the intellectual passions they pursue. However, the sustainability of such flexibility going forward necessarily requires more uniformity in expectations to keep it fair and transparent. This is a fairly urgent issue, since most of the career faculty recruited so far are at the Assistant Professor level, and will be coming up for promotion to Associate Professor category in the coming few years.

New teaching techniques: Students suggested improvements in Instructional Methodology while using PowerPoint presentations and slides. They also wished to have the course material emailed to them in advance so that they come to the classroom with the material basically absorbed, and with questions for the instructor. There is perhaps a need to engage with newer techniques of learning, with the involvement of the cognitive science faculty in the institute.

Future directions for research: The Institute has already developed several research centres that involve faculty members from different departments in interdisciplinary research. IITGN will have to make special plans to carry forward these initiatives, with funding from various govt. departments: DST, CSIR, BRNS, and DRDO. These are essential for contribution towards national needs. Fast

developments in atomic and subatomic mediums is opening up new vistas. Possibilities to create nanomaterials to engineer the desired properties in materials is a challenge which can be taken up by IITGN.

It is noted that research in basic science in IITGN is presently mainly focused on theory such as quantum gravity, gravitational-wave astronomy, quantum optics, high energy nuclear physics. It is assumed that gradually the focus will shift towards experimental areas, particularly in the scientific fields related to technology which will motivate collaborative efforts between Faculties in Science & Engineering departments.

There is a great possibility for IITGN to merge the following subspecialisations among the Science faculty into a single Nano science department, with the objective of producing nanomaterials with prescribed properties, with the help of the appropriate engineering departments. This could establish IITGN as a centre for such research.

- Physics: Quantum gravity, Biophysics, Quantum Optics
- Chemistry: Molecular modelling and Quantum chemistry, Medicinal Chemistry, Materials Chemistry
- Biological Engineering: Cancer biology, Nano-Biocatalysts, Structural biology, Biophysics of DNA
- Mathematics: Harmonic Analysis, Optimizations and Approximations

R & D Laboratories: Institute is going through a transition phase, as the new Campus is getting ready. Considerable work has been done in setting up of the various sophisticated facilities in the labs in the present temporary buildings. Transferring the working labs to a new location is always a big challenge. There must be well defined plans to set up various R&D labs focused in different areas in the new buildings with appropriate strategy to address the fast changing scenario in scientific research and its impact on emerging technologies.

IITGN may like to review its strengths in different areas particularly experimental fields and plan recruitment in some areas which can help the institute to focus on futuristic technologies. Each department should plan a laboratory for interdisciplinary research.

Science is getting focused in a direction that is bringing various disciplines together to understand mysteries of the Nano-materials. A new word, CHARPAN, has been coined which is to focus attention towards Charged Particle Nanotechnology.

With the current interest of the faculty in different departments in areas such as, Nanomaterials, Smart Materials, Nanostructures, Nanoparticles, etc., and growing possibilities of interdisciplinary research using ion beams, the Institute may consider making plans to set up facilities of this kind.

Future directions for the doctoral programme: Since IITGN is poised for a global presence, doctoral students need to be guided to think about what they are trying to learn in graduate school, for success differentiators in their careers. In addition to the doctoral degree, the student will need managerial and leadership skills required in research environments. For this, guides need to sit with their supervisees regularly, to get an update of their work, and to let them have reactions of their peers to the problems they face. This will equip researchers to run laboratories, oversee postdoctoral and doctoral researchers, and to run many projects simultaneously with far-flung research collaborations. Supervisors need to be approachable at all times through email. When a student makes a technical mistake it has to be taken seriously but not too seriously. What is needed is to analyse what happened, help the student to correct assumptions or misconceptions that may have underpinned the error, and walk through a task step-by-step to ensure that they understand it.

Other recommendations:

- The Institution has made an excellent beginning and has taken several initiatives in directions that are unique in many ways. This will need close monitoring and frequent assessment to consider necessity to continue that or make appropriate modifications to ensure their impact in the desired directions.
- The Institute may consider to identify a few focused areas in which it will like to excel and create centres with some uniqueness in the country.
- Some special steps should be considered which can provide incentive to focus on research projects to drive innovation in areas of interest.
- The Institute has made remarkable innovations in Humanities disciplines. Some efforts should be made to nurture collaboration in different departments to develop courses and associated laboratories in specialized areas
- IITGN should review their present strength in different departments and plan recruitment in some specific areas which can help the Institute to focus on futuristic technologies.
- Faculty should be encouraged to get project funding for development of national facilities in the desired fields of national importance.
- Collaborative R&D projects with some, preferably local industry should be given special attention.

Vision for the future: IITGN is well poised to develop into a full-fledged technological university of global standards. There should be a Five Year Vision Plan towards this objective, approved by the Senate and Governing Body, with time lines about the expected developments and planned achievements. There should be an elaborate exercise each year to review the progress and plan corrective measures.

Each department should prepare detailed plan of its development with detailed discussion involving all the faculty members of the department and some from other departments who have overlapping interests.

7. APPENDIX

**INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR
PEER REVIEW MEETING: AUGUST 28-29, 2014
PROGRAM SCHEDULE**

28 August 2014 (Thursday):

09:30	Overview of the Peer Review by Prof. S. P. Mehrotra (Philosophy and Process)
09:45	Achievements and Challenges of IITGN: Presentation by Prof. Sudhir K.Jain, Director
10:30	Presentation by Prof. Bhaskar Datta, Associate Dean Academic Affairs (Including Q & A)
11:00	Presentation by Prof. Jaison Manjaly, Dean Student Affairs (Including Q & A)
11:30	Presentation by Prof. S. P. Mehrotra, Professor-in-Charge R&D (Including Q & A)
12:00	Faculty Recruitment Process at IITGN – Prof. Harish P.M., Chairman, Faculty Search Committee (including Q & A)
12:30	General Discussion
13:00	Lunch Break
14:30	Visit of the facilities in current campus (Sheds, labs, library, hostels etc.)
15:30	Presentations on Sciences, Engineering and HSS disciplines (10 minutes each) followed by interaction with the faculty Engg: Prof. Arup Lal Chakraborty HSS: Prof. Rita Kothari Sciences: Prof. Bhaskar Datta After these presentations the panel of experts will be split into three groups to separately interact with the faculty in three different rooms.
17:15	Meeting with the UG Students - in auditorium
18:15	Poster session - L-block foyer - with faculty members and PhD students
20:00	Dinner hosted by the Director

29 August 2014 (Friday):

09:05	Visit to Permanent Campus
10:30	Departure from Palaj to Chandkheda campus
10:50	Tea Break
11:15	Meeting with PG students in A-Block Auditorium
12:15	Interaction with Leadership Team
13:15	Lunch break
14:30	Internal meeting of the committee members
16:00	Concluding session with the key officials

