

**THE STRATEGIC PLAN
VISION 2010**

**INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI**

CHAIRMAN'S FOREWORD

The Indian Institute of Technology Madras has passed through various stages of development and growth in the forty odd years of its existence. During the first decade, the Institute concentrated on faculty / staff recruitment, developing curricula, examination systems, placement of students, and setting up infrastructural facilities. A strong emphasis was given to academic excellence and for laying a good foundation for research. During the next two decades, postgraduate and doctoral programmes as well as research, technology development and consultancy projects were actively promoted. The Ministry of HRD constituted two Review Committees in 1971 and 1986 that made several recommendations for improvement and new initiatives many of which have been implemented. During the fourth decade the Institute experienced substantial growth on all fronts.

Several major changes have taken place, both globally and nationally, in the recent past. These changes include those due to external agencies such as the Government, Industry and higher Technical Educational Institutions in India and abroad; changes in Markets and Technology; Globalization and Liberalization; and consequent socio-economic and cultural changes. These changes present challenges as well as opportunities for IITM. The Board of IITM launched the Strategic Management Project in 1996 to help IITM to respond to these changes in its complex social and economic environment. The Institute initiated a number of activities to build up internal capabilities for change. The change processes were to be developmental, participative and learning in nature. The project included extensive studies by five internal task forces and two external consultants as well as many workshops that benefited from the participation of a wide cross-section of faculty, staff and students of IITM. This comprehensive report is a concise documentation of IITM's Vision 2010.

I am confident that the implementation of the recommendations of this document will enhance IITM's world-class status and make this an institution that is intellectually exciting, financially and administratively autonomous, with sustainable competitive advantages in all its activities in the decades to come. I wish to congratulate the successive Directors, Prof. R. Natarajan (1995-2001) and Prof. M.S. Ananth (2001-), the former Deputy Director, Prof. C.R. Muthukrishnan and Prof. R.S. Ganapathy of ACME for their leadership and commitment that brought this project to such a successful completion. I am sure that Vision 2010 will serve as a benchmark document for many higher technological Institutions in the coming decade. I wish IITM a glorious future in the service of our nation.

8-6-2003

K. KASTURIRANGAN
Chairman, Board of Governors

DIRECTORS' PREFACE

Inaugurated on July 30, 1959 by Prof. Humayun Kabir, the then Union Minister for Scientific Research and Cultural Affairs, the Indian Institute of Technology Madras (IITM) at Chennai was founded with financial and technical assistance received from the Federal Republic of Germany with matching support from the Government of India. In 1961 it was declared an Institution of National Importance by Parliament. It has established a reputation, both nationally and internationally, for excellence in Technical Education, Research and Industrial and Educational Consultancy. Its strengths include highly motivated and talented students, highly qualified and dedicated faculty, comprehensive experimental and computing facilities, and well-trained technical and administrative supporting staff.

Several major changes that have taken place, both globally and nationally, in the recent past have made it imperative for IITM to identify strategic directions for its future in order to maintain and enhance its excellence. Following the recommendations of the Synergy Committee set up by the then Union Minister for Human Resources Development, Shri Madhav Rao Scindia, the Board of Governors of IITM constituted a Strategic Planning Committee. As a consequence, the Institute has initiated a number of activities to build up internal capabilities for change.

The Strategic Management Project (SMP) at IITM has several unique features and involves a systematic and comprehensive effort of strategic change with the participation of a large number of stakeholders. The SMP has been designed as a series of coordinated interventions to bring about changes in the directions, structure, processes, interfaces and performance of the Institute. The use of external consultants, the reliance on multiple sources of knowledge, the design of coordinated interventions and development of a set of shared goals are significant features of this Project. Approximately three-fourths of the inputs for the Project have come from IITM, and one-fourth from outside. The Strategic Plan consists of an integrated and interdependent set of action plans that must be viewed and acted upon in a holistic manner. The process should be one of guided and directed organic change, which would lead to the achievement of short and long term goals. The effects of the change strategies ought to be sustainable, as they have been internally generated.

This report of the SMP is a documentation of a remarkable community effort that has examined several facets of IITM, articulated Strategic Initiatives for change, and spelt out Action Plans for each of them. It includes, apart from an Introduction, eight chapters on Environmental Context; Vision, Mission and Goals; Educational Processes; Human Resources; Physical Resources; Governance; Building Relationships; and Financial Resources.

An Executive Summary has been included in the Report. The articulation of the Vision and Mission of IITM was itself a revealing exercise in introspection for an Institute that has come to take its excellence for granted. While the report is being formally brought out in 2003 after several internal revisions, many of the strategic changes that are recommended have already been internally implemented.

The implementation of the Strategic Plan is intended to make IITM a world-class institution – a place that provides intellectual leadership in chosen fields and is administratively and academically autonomous, with sustainable competitive advantage. Most of the proposed changes can be implemented internally. In fact, the Institute has already initiated, over the last few years, several measures such as curricular reform, HRD programmes, ISO 9001:2000 certification for several of its sections, IT infrastructure

development and industry-oriented academic programmes. A few strategies may require enabling provisions in IITs' Statutes or government policy. A clear commitment to the strategic goals through visible top management support, solid teamwork, and continuous monitoring and feedback are critical for its implementation.

The SMP has been a significant experience for the Institute and for us, in particular, in building a learning organisation that can manage continuity and change effectively. Many members of the IITM community participated in the project in various ways: e.g. Workshop participation, Working group membership, Interviews, Written submissions. A number of other external resources for this task were also mobilised over time. We hope that this experience will be helpful in shaping the future of this remarkable Institute and possibly serve as a model for others.

Many things remain. Indeed Strategic Management is itself a continuing process not a one-time exercise. In particular IITM needs to undertake a major effort in benchmarking its activities (education, research, and services). This will be an exercise situating IITM in relation to the best practices around the world that are hallmarks of excellence. Such an exercise will carefully analyse the processes and outcomes and present a set of meaningful goals for continuous improvement of IITM in the next decade. It will also address issues of competitiveness, accreditation, organisational climate, etc. The study will call for assistance from national and international agencies as well as other excellent institutions like Carnegie-Mellon, MIT, Imperial College, Tokyo University of Technology, etc. This benchmarking effort will be a part of the ongoing change process. Already we have begun the process of visits by Visiting Committees of Peers of international standing for several of our Departments and Centres.

We have no doubt that IITM will continue to enjoy its pre-eminent position as a world-class Institution, attracting the best of faculty, students and staff.

Prof. R. NATARAJAN
Former Director (1995-2001)

Prof. M. S. ANANTH
Director (2001 -)

ACKNOWLEDGEMENTS

We wish to thank numerous individuals, both within IITM and from outside, who have participated in the Project and have enriched its outcomes. Their names appear in Annexure I. Some individuals deserve special mention in this regard. The contributions of Prof. S. S. Gokhale and Prof. L. S. Ganesh have been valuable. Mr. R. Sundaram of the Centre for IC & SR mobilized the internal resources and organized the logistic support for the Workshops.

Prof. R. S. Ganapathy of the Academy for Management Excellence, Chennai, and Prof. C. R. Muthukrishnan, Deputy Director of IITM (1996-2001), jointly coordinated this challenging effort. Dr. M. S. Swaminathan, Prof. U. R. Rao and Prof. K. Kasturirangan, the successive Chairmen, Board of Governors of our Institute, took a very lively interest in this project and gave us many valuable suggestions. The Strategic Planning Committee provided constant encouragement and advice.

For their part as expert consultants, we wish to acknowledge the contributions of Dr. F. C. Kohli, Mr. S. Mahalingam and Prof. P. N. Murthy of Tata Consultancy Services, Mr. T. Shankar of A. F. Ferguson & Co., Dr. Ramaswamy P. Aiyar and Dr. D. K. Lahari of Academy for Management Excellence, Prof. L. Prasad and Prof. R. Ravikumar of IIM, Bangalore and Prof. B. N. Srivastava of IIM Calcutta. Mr. V. Balaraman, then CEO of Ponds India, Mr. G. S. Krishnamurthy and Mr. Lalit K. Vohra of DSQ Software, made valuable contributions to the discussions.

Prof. R. NATARAJAN
Former Director (1995-2001)

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Director (2001 -)

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I INTRODUCTION

The primary objective of the Indian Institutes of Technology is to provide scientists and technologists of the highest calibre who would engage in research, design and development to help building the nation towards self-reliance in her technological needs ... Pandit Jawaharlal Nehru.

1.0 THE INDIAN INSTITUTE OF TECHNOLOGY MADRAS

The Indian Institute of Technology Madras (IITM) was established in 1959 by the Government of India, as an Institute of National Importance. The primary objective of the IITs, in the words of Pandit Jawaharlal Nehru was, “to provide scientists and technologists of the highest calibre who would engage in research, design and development to help building the nation towards self-reliance in her technological needs”. During the early years, the Federal Republic of Germany assisted the Institute both technically and financially.

The activities of the Institute in various fields of Technology and Science are carried out in thirteen Departments and ten advanced Research Academic Centres. There are over a hundred well-equipped laboratories in the Institute for teaching and research.

1.1 EDUCATIONAL PROGRAMMES

The Institute offers undergraduate and post - graduate programmes leading to the B.Tech., M.Sc., M.B.A., M.Tech., M.S., and Ph.D., degrees in a variety of specialisations. Over the years, the Institute has responded to environmental changes and user needs, by reshaping curricula ; offering new undergraduate, postgraduate and research programmes, and organising continuing education programmes. The trends in student enrolment and faculty and staff strength are given in Tables 1.3 and 1.4.

Table 1.1: General Information about IITM

The Entrance to an
Idyllic Campus



1.2 SPONSORED RESEARCH, INDUSTRIAL CONSULTANCY AND CONTINUING EDUCATION ACTIVITIES

The Institute has extensive facilities for both basic and applied research. A number of R & D projects at IITM are sponsored by Government agencies. The Institute conducts a number of continuing education programmes for professionals from industry and other Government organisations, and teachers from other technical institutions. Consultancy for a variety of clients is an important activity of the Institute faculty. The growth in gross revenue from these activities is given in Table 1.5.

1.3 INTERNATIONAL COLLABORATION

In addition to close collaboration with German universities, IITM has active linkages with academic / research organisations in Austria, Belgium, Canada, France, Japan, Malaysia, Nepal, The Netherlands, Russia, Singapore, Switzerland, Thailand and the USA.

1.4 STRATEGIC MANAGEMENT PROJECT AT IIT MADRAS

The Institute has passed through various stages of development and growth in the forty years of its

DEPARTMENTS

- Aerospace Engineering
- Applied Mechanics
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Science & Engineering
- Electrical Engineering
- Humanities and Social Sciences
- Mathematics
- Mechanical Engineering
- Metallurgical and Materials Engineering
- Ocean Engineering
- Physics

ACADEMIC CENTRES

- Bio-Technology Research Centre
- Centre for Computational Fluid Dynamics
- Centre for Continuing Education
- Centre for Finite Element and Design
- Centre for Sustainable Development
- Centre for Systems and Devices
- Composites Technology Centre
- Educational Technology Centre
- Materials Science Research Centre
- Regional Sophisticated Instrumentation Centre

ADMINISTRATIVE SECTIONS

- Administration Section
- Academic Section
- Finance and Accounts Section
- Engineering Unit
- Stores and Purchase Section

CENTRAL FACILITIES

- Computer Centre
- Central Electronic Centre
- Central Gas Supply Unit
- Central Glass Blowing Section
- Centre for Industrial Consultancy and Sponsored Research
- Central Library
- Central Photographic Section
- Central Workshop
- The Air-Conditioning Unit

existence. During the first decade, the Institute concentrated on faculty/staff recruitment, developing curricula, examination systems, placement of students, and setting up infra-structural facilities such as laboratories, hostels, housing and facilities for extra-curricular activities. A strong emphasis was given to academic excellence and for laying a good foundation for research. During the next two decades, postgraduate and doctoral programmes as well as research, technology development and consultancy projects were actively promoted. During this period, the Ministry of HRD constituted two Review Committees in 1971 and 1986. The Review Committees studied the IIT system and its working, and submitted a Report with recommendations for improvement and new initiatives, many of which have been implemented [1, 2].

During the fourth decade the Institute has experienced substantial growth in all these sectors. Several major changes have taken place, both globally and nationally, in the recent past and it is necessary for the Institute to identify strategic directions for its future. IITM has therefore embarked on a programme of strategic change. The Board of IITM set up a Strategic Planning Committee and the Institute initiated a number of activities to build up internal capabilities for change. The change processes were to be developmental, participative and learning in nature.

1.4.1 Project Design

The Strategic Management Project design was based on the following principles:

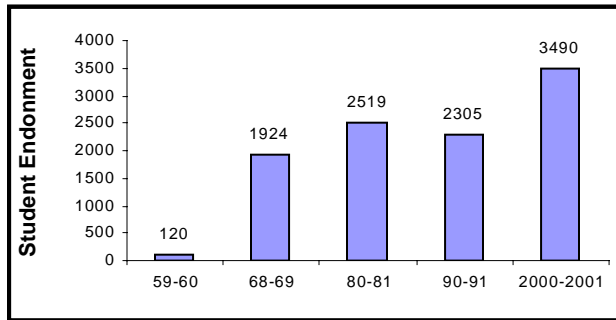
For a meaningful and sustained effect strategic change needs to be internally generated.

External consultants can play an important role as resource persons and catalysts in this process.

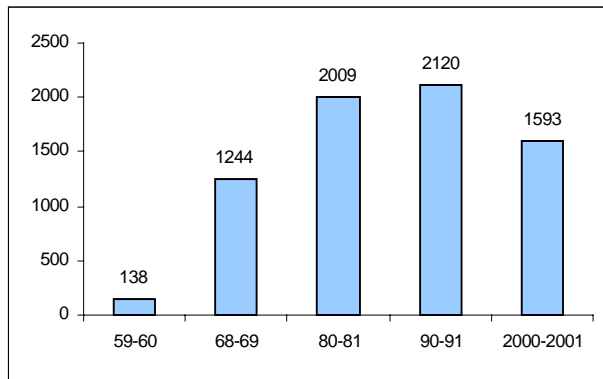
Recommendations for strategic change needs to come from multiple (internal and external) sources.

The project activities should consist of a series of coordinated interventions, to accomplish the change objectives.

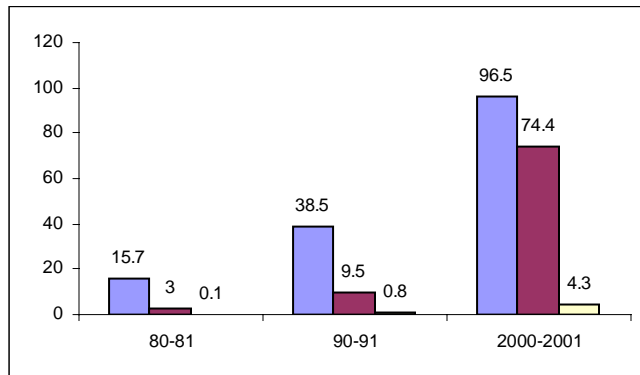
Student Enrolment



Faculty and Staff Profile



Gross Revenue (Rs. Millions)



As a prelude to this Project, two workshops on “Organisational Change Processes” were conducted in order to build up internal change capability. A number of faculty and staff of IITM participated in the workshops which covered various aspects of Team Building, Interpersonal Relationships, Group Decision Making, Change Strategies and Project Planning. Another workshop on “Strategic Issues in IITM-Industry Interface” was organized to explore the changing nature of the IITM-Industry interfaces in education, research and services, and to develop strategic options to manage them more effectively in the future.



One of the Hostels
on the Campus

Seven areas of intensive study for the Project were identified in these workshops. Five internal Working Groups and two External Consultants carried out the studies. The scope of work in each area was identified and discussed with the working groups and external consultants, at the beginning of the Project.

The study teams covered the following components:

- q Analysis of the emerging trends in technology, industry, policy environment and best practices.
- q Identification of IITM's needs and priorities over the next ten years.
- q Assessment of the effectiveness of the present system and practices.
- q Development and evaluation of alternatives to meet the techno-economic, administrative and financial needs.
- q Development of a Strategy.
- q Development of an Implementation Plan (Resources, Administrative Structure, Organisational Responsibility, Time Frame, Policy Changes).

The Reports of these Working Groups and the external consultants [3 - 9] were presented to different groups and fora in the Institute and necessary modifications were incorporated in the reports in an iterative fashion. The key emphasis at this stage was on the processes of wide consultation, debate and consensus building. The task of integrating the reports of the working groups and the preparation of an integrated Strategic Action Plan required concurrent analysis of inputs in the form of the Task force Reports, IIT Review Committee Report (1986), Ninth Plan Proposal of IITM [10], and secondary literature [11 – 18].

The drafts of the Integrated Strategic Action Plan for IITM were discussed in various groups for feedback and change, before submission to the Strategic Planning Committee / Board of Governors for approval. These included two workshops for faculty and staff, and one workshop for students to discuss the Institute's Vision and Mission statements, one workshop for external professionals and industrial managers. A committee set up specifically for the purpose compiled all the information, inputs and feed-back to arrive at the final version.

Table 1.6 The Seven Areas of Study

1	Scenario building	Internal working group
2	Restructuring and governance	Tata Consultancy Services
3	Quality of support services	Internal working group
4	Human resources	Internal working group
5	Infrastructure development	Internal working group
6	Resource assessment, funds mobilisation and accountability systems	A.F.Ferguson & Co
7	Marketing of IITM's products	Internal working group

Sylvan Surroundings



The Project outcomes are expected to enhance IITM's world-class status in the early years of this decade to a place that is intellectually exciting and financially and administratively autonomous,

with sustainable competitive advantages in all its activities. The Project is not an implementation of a Master Plan but rather a process of directed and guided organic change. Most of the proposed strategic change measures need to be implemented internally. A few strategies may also require enabling provisions in the Institute's Statutes. The implementation of the strategic change will be monitored by an independent Committee.

This Report comprises, apart from this Introduction, eight chapters on Environmental Context, Vision, Mission and Goals, Educational Processes, Human Resources, Physical Resources, Governance, Building Relationships and Financial Resources.

II THE ENVIRONMENTAL CONTEXT

There is a symbiotic relationship between environmental changes and organisational strategy.

2.0 INTRODUCTION

The Strategic Management Project has been launched to help IITM to respond to external changes in its complex social and economic environment. These changes include those due to external agencies such as the Government, Industry and higher Technical Educational Institutions in India and abroad; changes in Markets and Technology; Globalization and Liberalization; and consequent Socio-Economic and Cultural changes. These changes present challenges as well as opportunities for IITM.

Survival, stability and strength are the basic requirements of a healthy, competitive and excellent organization. Massive and complex environmental change can adversely affect any organization, and there are many examples of organizations (industrial, commercial, educational, and service) becoming sick or extinct, because they failed to respond to their changing environments. Thus, understanding the environmental context of IITM is imperative for the development of a meaningful and innovative strategy. A ten-year perspective has been taken as the time frame for developing IITM's strategy.

There is a symbiotic relationship between environmental changes and organisational strategy. While environmental changes provide the stimuli to which organizations respond with their strategies, it is also true that sometimes organizations develop pro-active strategies that influence (or cause) environmental changes. The latter relationship is generally associated with highly innovative and learning organizations. IITs are expected to be such organisations and pioneers or leaders in their domain of activities. This chapter reviews the major environmental determinants in the context of IITM.

The Gajendra
Circle



Environmental Changes and Organisations - A symbiotic relationship



In this context, IITM should take cognisance of the emerging orientation in higher education all over the world as summarised in Table 2.1.

2.1 ENVIRONMENTAL CHANGES

Over the past four decades there have been significant external and internal changes relevant to IITM. This section provides a summary of the major qualitative and quantitative changes that have affected the IIT system in general and IITM in particular. The sources of these changes, each of which is described briefly in this chapter, include:

- ❑ The Knowledge Revolution.
- ❑ The Need for Sustainable Development.
- ❑ Government Policy Initiatives, including new paradigms of funding.
- ❑ Growing competition in higher technological education.
- ❑ Rapid and complex changes in markets and technology.
- ❑ Unprecedented growth in the service sector.
- ❑ Multiple dimensions of institutional accountability.
- ❑ New forms of Knowledge Delivery.

2.1.1 The Knowledge Revolution

The information technology revolution that is radically altering the whole world at an ever-accelerating pace touches every aspect of IIT life. It has a significant impact on the core of IIT's mission viz., the generation, preservation, dissemination, and application of knowledge.

The bio-technology revolution has had significant impact on the engineering of life itself (including people), technologies that self-replicate and technologies that evolve. The bio-technology revolution, made possible in part by the information technology revolution, has indeed affected areas central to humanity - food, medicine and reproduction. The engineer of the twenty-first century must have a good grasp of the fundamentals of the life sciences as much as knowledge of Newton's laws and Maxwell's laws. Curricular changes are warranted in every field of engineering to enable students to cope with these knowledge revolutions. The future holds much in store for the engineer:

- ❑ Broad access to massive data sets, such as those associated with the Human Genome Project.
- ❑ Genetic Engineering, Tele-medicine, Food Production and Preservation.
- ❑ Bioinformatics and Proteomics.
- ❑ Nanotechnology and Smart Materials.
- ❑ Global Information Systems.
- ❑ Convergence of the Internet, Broadcasting and Telecommunications.
- ❑ Extensive Wireless, Mobile, Embedded and Wearable Computing.
- ❑ Smart houses, Smart buildings, Smart transportation and so on.

Student Activity Centre

As the potential for communication increases, concerns about security and privacy also increase. At the same time, information has become an increasingly valuable commodity, and new opportunities have arisen for the IITs to participate in the "knowledge economy."

In addition to simply assessing information and communication technology needs, IITs should take a broader, deeper look, survey existing strengths and weaknesses not only in the infrastructure, but also in the uses of the technology and its impact on our profession and lives. The explosive growth in new technologies poses challenges and opportunities. Substantial investment in human capital and physical infrastructure, strong leadership, and co-ordinated campus-wide involvement is required. This would help preserve IITM's position of strength in virtually all areas of research, scholarship, and teaching.

2.1.2 The Need for Sustainable Development

Another very important development is the beginning of an acute awareness of the need for proactive steps to make life sustainable on our planet [19]. Engineering education for a sustainable future is central to this awareness.

The unprecedented growth in the world's population and our modern lifestyles are altering the face of the earth and the composition of the atmosphere. A healthy environment is essential to human existence, health and well-being. We need a paradigm shift in our thinking about the relationship of humans to the environment. Society must adopt new strategies that allow the needs of an expanding population to be met in an environmentally sustainable and equitable manner.

Future scientists, engineers, and managers must design technology and economic processes that sustain rather than degrade the natural environment, enhance human health and well-being, and live within the limits of natural systems. Such a shift in thinking calls for a long term societal effort to make environmental and sustainability concerns a central theme in all education, particularly for engineers, economists and managers. Institutions like the IIT's must play a strong role in education, research, policy development, information exchange and community outreach and support. They should influence future leaders through their students and current leaders through their alumni. IITs should play a pioneering role in this context.

2.1.3 Government Policy Initiatives

A very significant change concerns the recent initiatives in Government funding policy towards the IITs. These include encouragement for resource mobilisation, and promotion of standards and quality.

The system of Government funding for the IITs since 1992-93 has encouraged them to generate resources through a variety of means. This measure has strongly influenced the mix of activities which IITM is involved in, placing emphasis on sponsored research, industrial consultancy and continuing education activities.

The Government of India established the All India Council for Technical Education (AICTE), as a statutory body in 1987 for overseeing technical education. In 1994, the AICTE set up the National Board of Accreditation (NBA) in order to develop standards and build quality in higher technical education. The IITs have been chosen to serve as the benchmarks within India. This places a great responsibility on the IIT system, which will have to benchmark itself with the best international practices.

A Fermentor in the Biochemical
Engineering Laboratory

2.1.4 Growing Competition in Higher Technological Education

Compared to the past, the Institute is in a fiercely competitive environment in all its activities: Education, Research and Services. There is competition to attract students; to recruit and retain faculty; to secure educational and research funding; to secure consultancy assignments and to provide technology as well as knowledge-based services. IITM's major competitors in these areas are other educational/R&D institutions; consulting firms; industry; and foreign organisations. In the rapidly changing ecology of this competitive market place, IITM's strategy will have to continue to create value for its stakeholders, as well as be flexible and responsive. The recent World Competitiveness Report indicates that India, in spite of its high quality (second and third ranks) of engineering education and technical manpower, ranked quite low (forty-fifth and forty-ninth ranks) in technological productivity

and innovation. This clearly shows, *'inter alia'* India's lack of competitive advantage in providing 'relevant' technical education and research. There is a clear need for IITM to actively pursue strategic alliances with domestic and international organisations to improve its competitive advantage.

2.1.5 Rapid and Complex Changes in Markets and Technology

Global markets for various products and services as well as technological developments in key sectors are changing very rapidly. For example, changes in the markets for entertainment, consumer goods, educational services, living space / environment and recreation have changed beyond recognition in the last twenty years. Simultaneously, advances of a fundamental nature are taking place in materials technology, information technology, bio-technology, etc. These changes have profound implications for IITM. To be relevant and effective in the future, the Institute must initiate corresponding changes in its academic programmes, portfolio of research projects, and consultancy services. In the years to come, the growing global demand for knowledge-intensive products and services will significantly affect the Institute's competitive position. These issues are addressed in the chapters on Educational Processes, Resources and Relationships.

Reverse Osmosis Water
Purification Plant for Hostel
Sector

2.1.6 Unprecedented Growth in the Service Sector

The tertiary (service) sector of the economy now contributes close to half of the Gross National Product, assuming primacy over agriculture and industry. In the emerging society, the demand for the services of IITM will undergo a major change. The diversity of students (in terms of maturity, enrolment

status, gender, etc.); the diversity of choice of courses, institutions, modes of delivery and location; the increasing role of alliances in providing educational programmes and the growing concern for value for money among educational clients – all point to the fundamental changes that are taking place in the educational markets. The time has come for the Institute to extend its focus beyond fresh graduates from high schools and engineering colleges as its entry level candidates.

2.1.7 Multiple Dimensions of Institutional Accountability

The stakeholders of the Institute are becoming a more diverse group. Earlier, parents and students; faculty and staff; and the Government were the main stakeholders. Presently, new groups like funding agencies, clients for services, industry, contracting organisations, local communities, and other international / national educational organisations, hold a stake on the Institute in a variety of ways. The interests of these stakeholders and the demands they make on the Institute are very significant factors in understanding the Institute's environment. The intellectual property rights issue is another factor that may compel the Institute to make use of its knowledge resources in specific ways. Thus, accountability to peers, Government, markets/customers and stakeholders is likely to become dominant in the coming years.



Solar Energy Park

2.1.8 New forms of Knowledge Delivery

The open, democratic and un-moderated nature of access to the World Wide Web has revolutionized earlier concepts of using computers and networks to create, store and disseminate information as well as to manage intellectual property rights, and to create viable economic models for Digital Library services. There is an urgent need to exploit the rapid advances in Information and Communication Technologies to meet the demand for :

- ❑ Extensive access to and enhancement in the quality of technical education in the nation.
- ❑ Periodic training of engineering teachers and working professionals at their work-place to maintain and upgrade their IT and related skills.
- ❑ Access to the Institute's library resources through the setting up of a digital library.

2.2 ENVIRONMENT AND STRATEGY

It was argued earlier that the environmental context significantly influences organisational strategy. Three critical environmental factors, in the IITM context, are highlighted below:

- ❑ The investment in IITM over the last forty years, on a current cost basis, is approximately Rs.4000 millions. In the face of limited resources, the need for higher performance and more effective utilisation of IITM's assets assume crucial importance. Hence, in determining investment priorities, more productive utilisation of existing assets should take precedence over creation of new assets.
- ❑ The need for value addition or value creation for stakeholders in the Institute's activities is related to the above issue. This critical test will significantly alter the product mix of IITM. Based on this criterion, some current activities need to be phased out and new initiatives launched simultaneously.
- ❑ The environmental opportunities in specific technologies will serve to identify priority areas of research at the Institute.

2.3 CULTURAL CONTEXT

In an overview of the Environmental Context, alongside the environmental changes, the cultural context of the Institute also needs to be examined.

The cultural context of the Institute must take into consideration the increasing convergence of styles of Industry and Academe. For example, collaboration, networking, outsourcing, autonomy, flat organisational structure and participative/collegial processes are becoming important characteristics of a corporate enterprise. Conversely, corporate style of governance, leaner organisations, functional emphasis (marketing, finance, etc.), co-ordinated planning and emphasis on resource mobilisation are becoming important in academic institutions.

The current perceptions of the Institute can be characterised as follows:

- ❑ Change is seen primarily as externally driven.
- ❑ There is resistance to any significant change from the existing patterns of information flow, hierarchy and governance.
- ❑ There is poor orientation to market/customer needs as the emphasis is more supply - driven.
- ❑ Attitudes towards risk and uncertainty are conservative.
- ❑ There is a preference for a stable, bureaucratic culture and centralised decision-making.

Thus, it is clear that interventions for change are required. In response to these issues, specific recommendations have been made in the following chapters.

III VISION, MISSION AND GOALS

There is a need to articulate the purpose of the Institute in the current idiom, namely its Vision and Mission Statements.

3.0 INTRODUCTION

A Vision refers to the long-term desire or the planned state of performance and recognition that an organization wishes to fulfil, either at an explicitly specified or unspecified point of time in the future. A Mission statement reflects the purpose of existence or *raison d'être* of an organization expressed in terms of the activities it seeks to perform and the attendant standards or manner of performance. An organization's Vision is both, time- and leader-dependent. It changes as a function of time. It is dynamic, and if the leader changes, the Vision may also change. In contrast, an organization normally does not change its Mission, which is a more enduring statement of its designed efforts. The Quality Policy talks about the manner of execution of the Mission.

3.1 DEVELOPMENT OF VISION AND MISSION STATEMENTS

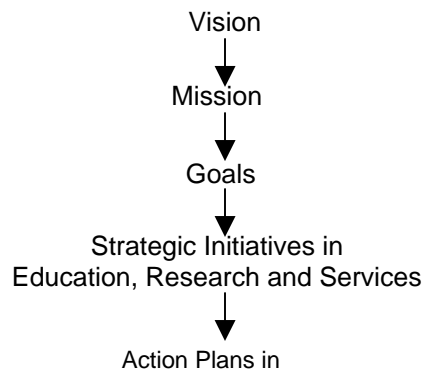
IITM was established about four decades ago by an Act of Parliament as an "Institute of National Importance", for higher technological education and innovation. Several Statutes have been framed under this Act, which lay down the powers and duties of officials as well as the rules and procedures.

The Act does not explicitly specify a Mission Statement for the IITs. Given the vast changes that have taken place in the environment over the past four decades since IITM was set up, there is a need to articulate the purpose of the Institute in the current idiom, namely Vision and Mission Statements. The Institute's main activities are: Education, Research and Services. While there are issues of priority, metrics, time frame and evaluation concerning goal-setting as a part of strategic planning, it is necessary to articulate Vision and Mission Statements developed through the participation of the various stakeholders. The considerations that have gone into this articulation are summarised in the next few paragraphs.



The Motto of IIT Madras

The defining quality of an educational institution lies in its intellectual character and its academic environment should be one in which mistakes are the true stepping-stones to learning. Experimenting with new paradigms and retaining a willingness to do so are therefore important characteristics of a research university. Research is the relentless pursuit of truth and demands an uncompromising integrity and an ambience that nurtures creativity and academic freedom. In all its interactions with the environment, IITM must remain true to its fundamental mission and values and avoid inappropriate conflicts of interest and commitment.



- Educational Processes
- Human Resources
- Physical Resources
- Financial Resources
- Governance
- Building Relationships
 - Industry
 - Government
 - Research Laboratories
 - Alumni
 - Professional Societies
 - Society

Teaching should remain IITM's unifying activity. Engineering education should retain a rigorous science base and advance with the times, dealing with changing applications using the most advanced tools. But above all, it should help the students learn to learn. IITM cannot afford to take its excellence for granted and rest on its laurels. It should rely more on inner conviction than on external criteria like comparisons with less fortunate institutions in India, praise for its students from abroad, and strive continuously for excellence in all its endeavours. IITM should constantly uphold and assert the core values on which the institute was founded.

It is critical that the administration be transparent to student, faculty and staff with a predisposition to assist in making things happen. The faculty should act responsibly, ethically and morally, and ensure that academic freedom is accompanied by responsibility and accountability. Students in turn have equally great responsibilities. They are among the fortunate 0.1 % of our eligible population who receive a highly subsidized world-class education. It would be grossly unfair if they are allowed to waste this opportunity. Their obligation is to do their best to acquire knowledge, know-how and most importantly desirable character traits, and strive to be in dynamic equilibrium with our social, ecological and economic environment. They will then be the kind of human resources that IITs were envisioned to produce in the service of our nation.

3.2 VISION

To be an academic institution in dynamic equilibrium with its social, ecological and economic environment striving continuously for excellence in education, research and technological service to the nation.

3.3 MISSION

- ❑ Create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, ecological, and economic issues.
- ❑ Pursue research and disseminate research findings.
- ❑ Provide knowledge-based technological services to satisfy the needs of society and the industry.
- ❑ Help in building national capabilities in technology, education and research.

3.4 QUALITY POLICY

To pursue global standards of excellence in all our endeavours namely teaching, research, consultancy and continuing education and to remain accountable in our core and support functions, through processes of self-evaluation and continuous improvement.

3.5 CORE VALUES

- ❑ Development of human resources in the service of the nation.
- ❑ Recognising teaching as a unifying activity.
- ❑ Nurturing integrity, creativity and academic freedom.
- ❑ Retaining a willingness to experiment with new paradigms.



Foundation Stone of
IIT Madras

3.6 LONG-RANGE GOALS

In order to fulfil IITM's Vision and Mission for the future, the following long-range goals have been identified :

- ❑ Identify a strategic activity mix for the Institute for the next ten years to achieve higher levels of utilisation of physical and human resources, and increase the value addition per employee significantly.

- ❑ Continue to impart high quality UG education to prepare the graduates for a variety of challenging careers.
- ❑ Impart high quality PG education that is interdisciplinary, research based and focused in the application of advanced concepts and skills.
- ❑ Pursue interdisciplinary research in thrust areas identified on the basis of IITM's current strengths as well as national relevance.
- ❑ Continuously strive to improve the knowledge and skills of faculty and staff through a variety of internal and external human resource development efforts in order to achieve higher levels of performance.
- ❑ Develop state-of-the-art infrastructure, keeping in view the emerging technological options and funding sources, so as to enable IIT Madras to be a world class institution in education, research and services.
- ❑ Exploit the rapid advances in Information and Communication Technologies and provide unprecedented access and enhancement to learning in a nationally coordinated manner.
- ❑ Develop new synergistic alliances with leading institutions (academic, research or consulting) in India and the world for mutual benefit.
- ❑ Raise the financial resources required to achieve the Goals through intelligent exploitation of intellectual Capital.
- ❑ Design widely understood, fair and transparent Appraisal Systems as well as transparent Governance mechanisms to better support the core activities of the Institute.

IV EDUCATIONAL PROCESSES

The design of an effective academic system is crucial to support the strategic activity mix of the Institute.

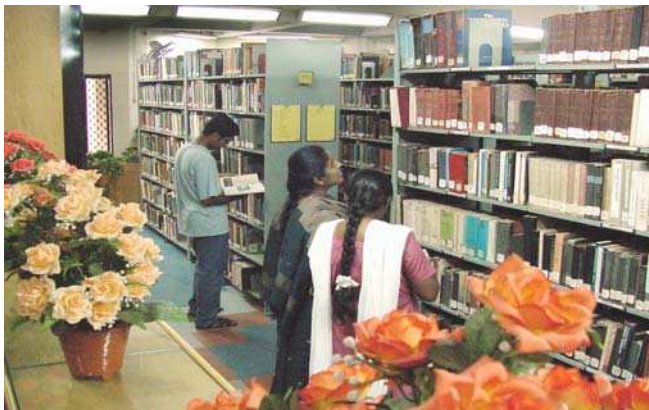
4.0 INTRODUCTION

Academic programmes are at the core of the Institute's functions. They comprise the three basic activities – education, research and services – articulated in the Institute's Mission Statement. The Institute's academic activities are currently divided between Departments and Centres. The emphasis in the Departments is on education and research, while that in the Centres is on interdisciplinary research and services. The Departments are responsible for awarding all the Institute degrees, while the Centres are primarily engaged in research and services.

The main Goals of the academic programmes of the Institute can be stated as follows:

- ❑ To impart high quality undergraduate (UG) education that includes mastery of the fundamentals of Science, Engineering, Technology and Management to prepare students for a variety of challenging careers.
- ❑ To impart high quality postgraduate (PG) education that is interdisciplinary, research-based, and focused on applying advanced concepts and skills.
- ❑ To pursue research characterized by interdisciplinary inquiry for generating knowledge, technology development and applications in chosen areas.
- ❑ To impart state-of-the-art knowledge and skills to diverse stakeholders, through continuing education, enabling them to make improved professional contributions.

The design of an effective academic system is crucial to support the strategic activity mix of the Institute. This chapter outlines the changes in academic organization and programmes which have been proposed in response to environmental challenges. Some of these changes have already been implemented e.g., the new B.Tech curriculum, introduction of new courses such as Engineering Design, and Computer Aided Drafting, introduction of new programmes such as the dual-degree M.Tech programme, User-Oriented M.Tech programmes in Automotive Engine Technology, Computational Engineering, Construction Technology, Digital Signal Processing, Information Technology, Ocean Engineering and Software Engineering,



Students in the Library

UG and dual degree programmes in Biotechnology and Engineering Physics.

The anticipated paradigm shifts in learning are indicated in Table 4.1 [adapted from reference 17]. The strategic changes recommended in the next section will be consistent with these directions of change.

4.1 STRATEGIC INITIATIVES AND ACTION PLANS

The existing structure of academic programmes at the Institute has been critically analysed in the context of the Institute's emerging environment, the best practices in academic curricula around the world, and IITM's Mission. The recommendations made in this chapter recognize that resources (human, financial and physical) are limited, and hence initiating new academic activities will entail restructuring or even elimination of some existing activities.

4.1.1 Research

- Through extensive discussions in the Institute and from the reports of the Task Forces and Working Groups, the following sixteen inter-disciplinary areas of research have been identified as the main research priorities of the Institute. These areas will encompass the research activities of the Centres and Departments and become the basis for all research based PG education and research at the Institute. Annexure IV lists the sub-areas corresponding to these areas.

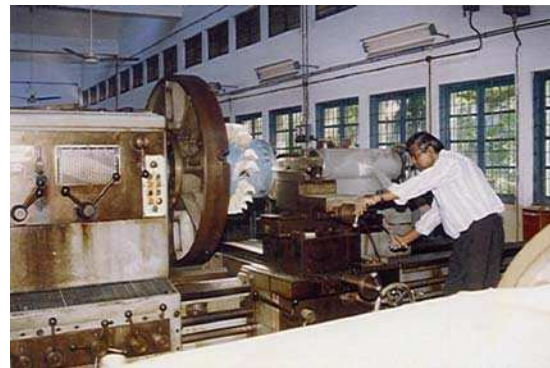
1. Biotechnology
2. Chemical Physics and Molecular Biology
3. Communication Technology
4. Complex Systems
5. Computational Engineering
6. Development Studies
7. Energy Technology
8. Environmental Technology
9. Infrastructure Technology
10. Instrumentation and Control
11. Materials Technology
12. Measurement, Testing and Diagnostics
13. MEMS
14. Methodologies
15. Quality assured Design and Manufacturing
16. Transportation Engineering

These interdisciplinary programmes should be the thrust areas of research at the Institute, and should be independently reviewed at least once in five years, and changed, if needed.

- Research programmes should primarily be user-driven and performance-oriented, and aimed at obtaining results in the medium-term. At least eighty percent of IITM's research should be in the above sixteen programmes. All research, except individual research, should be programme-based and in the form of different projects.

- ❑ Research Coordinators need to be appointed for each of the above programmes for a three-year term. The Institute should provide seed money to the Research Coordinators for evolving a strategy for technology development. The Research Coordinators should submit proposal(s) within a period of six months from the time of their appointment.
- ❑ An increased level of autonomy and corresponding accountability are necessary for academic areas which need to grow and evolve faster than the rest of the Institute, in response to shifting environmental needs. The creation of new academic units, to be called “Schools”, can fulfil this need. Keeping in mind the need for autonomy, the Senate needs to play a supportive, supervisory role in developing guidelines for such Schools. It is proposed that IITM consider establishing such Schools in the areas such as Management, Energy, Environment, Manufacturing, over the next five years.

Workshop Facilities



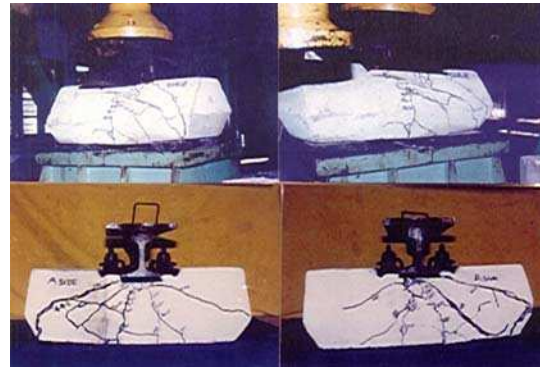
4.1.2 Course-based Programmes

- ❑ The UG programmes of the Institute should continue to focus on traditional disciplines offered by the departments. Interdisciplinary UG programmes should be offered on an Institute-wide basis. The UG programmes need to provide the fundamental capability and broad base for employment, entrepreneurship or for advanced studies in more specialised areas.
- ❑ Curricular changes, in response to changing requirements are being made periodically. Need-based changes in content, design, delivery, and evaluation are carried out every semester. Recent, major restructuring of the UG programmes of the Institute (vide Annexure III) is a significant initiative in the proposed direction. To facilitate optimal use of faculty time, cross-departmental listing of courses that are of common interest should be implemented. Examples of such courses are: Numerical Methods, Finite Element Methods, and Operations Research.
- ❑ The PG programmes of the Institute (M.Sc, M.Tech, M.B.A., M.S. and Ph.D.) will be in specialised areas of knowledge, reflecting the research strengths and priorities of the Institute, emerging frontier areas of Science and Technology, and manpower needs in the fast-changing professional S&T market. Specialized elective courses for the UG programme may be related to the Research programmes identified in 4.1.1.
- ❑ M.Tech / M.Sc programmes should be inter-disciplinary in nature, wherever applicable. These programmes are conceived as being specialised, user-driven and application-focused,

deriving their knowledge-base and methods from a variety of Engineering and Science disciplines. This strategy will enrich the distinctive character of IITM as a “Research University”. The existing departmental Master’s programmes can continue to be offered with Institute-wide inputs, in line with PG priorities. Students with different UG backgrounds could be selected for the inter-disciplinary Master’s programmes according to their aptitude and academic standing.

- ❑ The Science departments in IITM have a distinct identity, clearly distinguished from similar units in Universities. Besides UG and PG electives, these departments should consider offering masters programmes with an applied focus, in collaboration with the Engineering departments. One such recent example is the M.Tech programme on Industrial Mathematics and Scientific Computing. Other suggestions include Fuzzy Logic and Control, Surface Phenomena, Catalysis, Applied Optics, and Optimization. Such programmes will have strong, organic links with the Institute’s research strategy. This implies significant restructuring of existing M.Sc. and M.Tech. programmes.
- ❑ A separate department of Biotechnology has to be established. Life science subjects should be introduced both as core and elective subjects in the UG programmes of all departments.
- ❑ A separate department of Management should be
- ❑ established to offer UG courses and PG programmes. This school should be carved out of the present Department of Humanities and Social Sciences. Visiting faculty from Industry should be invited to participate in the teaching and research programmes of the School.
- ❑ All engineers must learn a number of concepts such as: systems thinking, evolution of the natural world, the interdependence of humans and the environment, mirroring natural system in resource use and cycling, remediation of environmental problems, and preservation of biological diversity.

Reinforced Concrete Testing



- ❑ The process of education must emphasize active, experiential learning and real-world problem solving using the campus as a laboratory for environmental management and sustainability.
- ❑ Students should be permitted to register for a certain number of courses in other academic institutions under academic advice. Similarly, students from other institutions national / international may be permitted to register for courses offered in IITM under certain conditions.
- ❑ The progress of students should be regularly monitored and their choice of courses approved by

- ❑ Individually assigned academic counsellors. Academic counselling is to be performed as a continuing activity throughout each student's stay in the Institute. It must be distinct from personal counselling made available through an Office of Student Services.
- ❑ In order to provide a "reality check" on Education and Research in IITs, it is important to develop a meaningful interaction with Industry and the Government. It is desirable to set up an Advisory Committee in each Department consisting of a few prominent industrialists, a senior representative of the planning arm of the Government as well as a few academicians of repute from outside the Institute, in order to advise the Heads of Departments as well as the Research Coordinators in matters relating to curricula and research. The Committee should meet at least once a year and the feed back from the Committee should be placed before the Senate in a structured format. Such meetings will also provide the Departments / Research Groups an opportunity to create an awareness about the relevance of research activities.



Water Jet Cutting Machine

4.1.3 Technology Enhanced Learning

- ❑ The World Wide Web has revolutionized earlier concepts of using computers and networks to create, store and disseminate information as well as to manage intellectual property rights, and to create viable Digital Library services. There is an urgent need to exploit these rapid advances in Information and Communication Technologies and provide :
 - Large-scale access to and enhancement in the quality of technical education in the nation.
 - Periodic training to engineering teachers and working professionals at their work-place to maintain and upgrade their IT and related skills.
 - Access to information through creation of a digital library.
- ❑ IITM should pioneer the exploitation of developments in information technology to accumulate, store and disseminate knowledge and education in three sectors: university, industry and government. There should be a Committee to direct and implement Technology Enhanced Learning activities. To begin with, this may involve three initiatives:
 - Setting up a Digital Library.
 - Development of Courseware.
 - Delivering Distance Education.

- ❑ The overall objective should be the development of new learning environments that will provide greater access and enhancement to acquisition of critical knowledge, skills, and abilities for economic and social development.
- ❑ All faculty will be placed in a matrix structure that will require them to be appointed in a Department, and simultaneously be associated with one or more Research Programmes listed earlier. The matrix structure will create academic synergy in the Institute.
- ❑ The proposed Action Plans are consistent with the Institute's emerging environment and its proposed governance. They also reflect the Institute's priority to strengthen the PG programmes and attract high-quality faculty and students, necessary to maintain the character and excellence of IITM as a leading Research University.

Central Library Counter



4.1.4 Continuing Education

- ❑ *Continuing Education Programmes at IITM need to:*
 - Lay greater emphasis on meeting industry / user needs and explore the possibility of collaboration with other leading institutions for this purpose.
 - include open-learning programmes, using advanced educational technology.
 - Include technology up-gradation and manpower development programmes for the middle and higher level professionals of Industry.

4.1.5 Strategic Alliances

q The Institute should explore and enter into strategic alliances for its academic programmes (UG, PG, Research and Continuing Education) with leading international institutions in order to exploit global opportunities. The alliances should fulfil the general conditions outlined in chapter VII on Governance. Some examples of possible alliances are:

- Joint degree programmes.
- Student and faculty exchange programmes.
- Joint research programmes.
- Overseas campus programmes.

Value addition, mutuality and synergy should be the guiding principles in forming and operating the alliances. Research programme Coordinators must propose specific alliances for their programmes.

□ Recent successful models of strategic alliances at IITM are:

- Aerospace Technology Development, with Indian Space Research Organisation.
- User-oriented Masters programmes in :
 - Construction Technology and Management, with Larsen & Tubro – ECC.
 - Automotive Technology with Indian Society.
 - Digital Signal Processing with Texas Instruments, Analog Devices and Philips.
 - Software Engineering and IT with Laser Soft Info Systems Ltd., Inautix Technologies (I) Pvt. Ltd., Hexaware Technologies and Scap Velocity Net Solution Ltd.
 - Computational Engineering with Tata Consultancy Services.
 - Ocean Technology Development with National Institute of Ocean Technology.
 - Research Collaboration, with Indian Space Research Organisation and the Indira Gandhi Centre for Atomic Research.
 - Certificate Course in Computation Engineering with BHEL.
 - PG programme in Industrial Mathematics and Computer applications with University of Kaiserslautern.



X-ray Generator with
Vertical Diffraction Facility

V HUMAN RESOURCES

Higher educational institutions now, more than ever before, have the responsibility of character building using secular tools.

5.0 INTRODUCTION

The most important among the resources of IITM are the four categories of human resources: Students, Research Scholars, Faculty and Staff. The goal of Human Resources Management (HRM) in IITM is to develop the human potential consistent with the stated policies and priorities of the Institute, in its continuing effort to become and remain an institute of excellence in education, research and services. Human Resources Management is a critical institutional function and consists of the following activities:

- ❑ Manpower Planning involves the identification of the need for different categories of faculty and staff members at various levels over a period of time.
- ❑ Recruitment seeks to translate manpower needs into positions at appropriate levels with suitable compensation packages to attract and retain personnel.
- ❑ Training & Development seeks to improve the knowledge and skills of faculty and staff through a variety of internal and external human resource development efforts, such as orientation programmes, workshops, and professional development activities, in order to achieve higher levels of performance.
- ❑ Personnel administration includes activities like establishment, welfare programmes, and personnel records, etc.
- ❑ Evaluation of performance is an important dimension. Career advancement takes place through the processes of evaluation. Evaluation systems should be designed to motivate people to perform better. Incentives should be based on evaluation. Performance evaluation should normally be widely understood, fair and transparent.

Wave-basin



5.1 STRATEGIC INITIATIVES

5.1.1 Optimal Size of Human Resources

Several leading organizations the world over have felt the need to become lean and efficient to ensure their ability to compete effectively in the market. This has been achieved using the idea that is related to the 'core competence' principle adopted by those organizations.

Consequently, the organisations have shed several functions and lines of activity in their attempts to be among the market leaders in prioritized areas. The human resources planning exercise must optimise the age, levels, socio-cultural and positions-mix among the faculty and staff in order to develop a diverse academic community committed in technology innovation and excellence in learning. The age-mix of human resources in the Institute represents the balance between dynamism and stability, so essential for the orderly pursuit of academic excellence. The levels-mix represents the balance between the core and support activities of the Institute and is a key determinant of its organizational climate. The socio-cultural mix is vital for the generation of diversity in academic/administrative thought and practice, and for a cosmopolitan and lively campus community. The positions-mix defines the balance among academic/administrative policies, decisions, operations and control mechanisms.



Sarang

5.1.2 Faculty and Staff Recruitment

In recruiting high-quality faculty, the Institute, is in serious competition from various sources, including foreign academic/research institutions, other leading academic/research institutions within India, and industry.

In the current socio-economic milieu, a career in industry, government, or entrepreneurship, is preferred to an academic career. However, IITM has an advantage in some specialized areas, in comparison with other institutions in India. HRM practices need to be dynamically reviewed in order to enhance the Institute's ability to attract and retain high quality manpower in the next decade. Many of the early recruits will retire in the next five years. The number of retirements may become a problem, unless faculty recruitment becomes more dynamic and innovative.

The Institute's HRM policies must be so formulated that they attract and retain high-quality human resources at various levels for its complex tasks. In the professional employment market, potential recruits at various levels should see in IITM an attractive career opportunity. Achieving a sound HRM system over the next five years is an important challenge for the Institute.

5.1.3 Optimal Use of Existing Human Resources

The existing human resources should be utilized in an optimal and productive fashion through:

- ❑ Better job design (e.g. multi-tasking, group-work).
- ❑ Upgrading the quality through new skills.
- ❑ Training for improving on-the-job performance.
- ❑ Providing incentives for improved performance.

In addition, the human resources should be augmented in certain areas through outsourcing, which is a more economical and effective option in the long run. The Institute should evolve suitable policies to identify courses that require outsourcing of faculty (e.g. Engineering Drawing, first-level courses in Humanities and Sciences). Similarly, there are academic tasks that could be performed by guest faculty rather than by full-time faculty, especially in those areas in which the Institute needs only teaching faculty and has no abiding research interest. The Institute must simultaneously engage in a vigorous search for top-class faculty especially for the proposed new academic programmes.

5.1.4 Right-sizing

The strategic activity mix for the Institute for the next ten years has been discussed in Chapters IV on Educational Processes and Chapter VII on Governance. The proposed mix of activities will involve higher levels of utilisation of physical and human resources, and will increase the value addition per employee significantly. However, a higher level of activities does not necessarily imply a significant increase in manpower. Such growth is possible with marginal addition to staff through careful deployment of IT and ET, HRD efforts for improvement in the production of employees, and alliances with organisations having complementary capabilities. It is anticipated that the additional manpower requirement for doubling the level of current activities will be significantly less than twice the present strength. With the changes proposed in the structure and processes, rightsizing the employee strength is of critical importance. This restructuring, it must be emphasized, need not be uniform across the different organisational units.

Graduates taking the Pledge



5.1.5 Recruitment

Nearly 30% of senior faculty and staff, who have worked for the Institute since its inception, will retire in the next few years. This depletion in the human resources of the Institute necessitates careful planning for recruiting new faculty and staff, in terms of numbers as well as the projected areas of expertise

required now and for the long-term future. This exercise should also consider the vastly changed environment and the emerging needs of the Institute within the broad framework of its stated Vision and Mission.

Recruitment procedures of the Institute need to become more flexible. In view of the acute scarcity of highly qualified faculty and skilled staff, the recruitment processes should be proactive and prompt. In general, all vacancies need not be filled with permanent appointees. Contractual positions, adjunct / visiting / part-time appointees and out-sourcing may be resorted to, for meeting a portion of the manpower needs.

The new positions indicated for the TechNovator (in Chapter VIII on Building Relationships) especially at the level of Managing Director, General Managers and Managers, should be offered on contract and with competitive terms of employment. These major changes in the composition of the Institute's human resources are aimed at fostering a progressive work culture, one in which excellence in performance is the most cherished value, and accountability is the cornerstone of efficient administration.

5.1.6 Training and Development

The employees of an organisation pursuing global standards of excellence must have knowledge and skills that can be described as "state-of-the-art". This calls for continuous upgradation of employee capabilities leading to better utilisation of existing human resources. Training and Development is a major strategy to accomplish this objective. In view of the flexibility required to respond effectively to the rapidly changing environment, HRD efforts must enable the employees to perform multiple tasks in multiple roles. Specific proposals are made here for a variety of training programmes, internally and externally, and an organisational structure for HRM to implement human resources policies, to improve the performance of faculty and staff at all levels.



Fourier Transform
Infra-red Spectrophotometer

5.1.7 Compensation Pattern

The Institute must offer an attractive compensation package in order to emerge as the "preferred choice" of prospective employees. The compensation package should include attractive options for:

- ❑ Monetary benefits through service activities such as consulting.

- ❑ Other benefits in the form of :
 - Excellent work ambience with state-of-the-art facilities.
 - Opportunities for career growth and professional recognition.
 - Ample scope for professional development (conferences, workshops, training programmes, and exchange programmes).
 - A lively and vibrant campus.

5.1.8 Performance Appraisal

Performance appraisal and feedback should become a source of learning at IITM. There should be an incentive structure associated with appraisal. Management responsibility for appraisal should not be merely procedural, and must be geared to retain and motivate performing faculty and staff.

5.1.9 Student Development

- ❑ **Character Building** : Character is easy to recognise while character-building processes are difficult to define and implement. Character traits such as honesty, truthfulness, integrity, initiative, competitiveness, self-esteem, leadership, work ethic and teamwork have lasting value. Higher educational institutions now, more than ever before, have the responsibility of character building in their students. Apart from curricular inputs, such as NCC / NSO / NSS opportunities should be provided to the students for personality development, soft skills, human values and ability to face conflicts and challenges.

Students in Systems Laboratory



- ❑ **Co-curricular and Extra-Curricular Activities** : Co-curricular and extra-curricular activities play a significant role in building character. Co-curricular activities are academically-oriented programmes complementary to the formal curriculum, augmenting the learning processes in a non-formal environment. The active participation of students in the programmes of departmental associations and student chapters of professional bodies, participation in competitions organised by IITs and other institutions, attending lectures by experts, industrial visits etc., should be encouraged, as these widen the knowledge base, encourage team spirit, promote healthy competition, foster ethical values and lead to a sense of achievement. The curriculum introduced in 1998 includes a compulsory course on professional ethics and a student-formulated honour code for all students.

- ❑ NCC and NSS are part of the curricular requirement. Students should be encouraged to take part in extra-curricular activities like sports and games and cultural activities.
- ❑ **Practical Projects** : IITM should harness the creativity and innovativeness of the student community as a valuable resource for undertaking product-oriented practical projects. These projects encourage teamwork and innovation. Computerisation of student elections of the Institute is a typical success story of group effort by UG students outside the curricular requirements.
- ❑ Projects should be given to students who are capable of meeting challenges. An intangible outcome of using the students for practical projects is the improvement of faculty-staff-student interaction outside the classroom in an informal atmosphere.

5.2 ACTION PLANS

- ❑ Rightsizing can be achieved by increasing the productivity of the employees:
 - Carry out an institute-wide “Training Needs Assessment” exercise, periodically and provide training opportunities for skill and efficiency improvement.
 - Arrange for conduct of in-house and external orientation programmes, workshops and advanced training programmes for faculty and staff members. About 20% of the total staff must be put through training schedules each year.
 - Educate staff on the need to acquire skills that would enable them to perform multiple tasks.
 - Develop compensation packages for faculty and staff comparable to the best practices in similar institutions.



Teleconferencing during
Shaastra

- ❑ Balance faculty attrition and maintain excellence in academic programmes by:
 - Strengthening prioritized academic areas by recruiting faculty, preferably, through short-term and medium-term contractual appointments.
 - Outsourcing or employing part-time faculty for teaching courses/subjects in which the Institute does not foresee any significant research in IITM.
 - Establishing endowed Chairs in prioritized academic areas. The target should be to establish about 25 endowed Chairs, over the next five years, at least one in each of the interdisciplinary areas of thrust.
 - Develop a cosmopolitan faculty community.

- Evolve schemes for providing faculty with modern accommodation, and personal / official transport, communication and computing facilities.

- The Institute should :
 - Develop benchmarks for all components of basic activities, viz. education, research and services (external and internal), for setting performance targets.
 - Articulate annual performance targets for individuals, groups/teams and Departments.
 - Set-up a system of rewards based on recommendations of Committees using feedback from multiple sources including peers, customers, superiors and subordinates.
 - Create flexible designations/job titles for staff to enable them to perform multiple tasks. The new designations should reflect the professional work culture in the Institute.
 - Ensure transparency in career advancement norms by explicitly indicating minimum expected performance.

- IITM will encourage use of educational technology effectively by:
 - Having some courses taught through programmed self-learning materials/software and tutorial assistance, with flexible student evaluation by faculty.
 - Production of appropriate educational modules for use in large, dispersed classes and web-learning programmes.
 - Setting up a multimedia learning facility.

- IITM should create and strengthen :
 - Professional associations in all the departments.
 - Student chapters of professional bodies.
 - Sports facilities; educate students on the need for safety at work and play.
 - A well-equipped hobby workshop with facilities to help students carry out practical projects. encourage faculty involvement in these activities.
 - Avenues for student participation in technical competitions both in-house and in other Institutions.

VI PHYSICAL RESOURCES

Physical resources are a crucial determinant of the productivity of a higher technological institution.

6.0 INTRODUCTION

The physical resources of the Institute include class rooms, laboratories, workshops, library, computing and communication facilities and educational technology facilities. Campus amenities for living, healthcare, security and recreation are also important physical resources.

Physical resources are a crucial determinant of the productivity of a higher technological institution and the quality of the physical resources has a significant impact on its work culture and organizational climate. Most of IITM's physical resources are three to four decades old, and major investments are necessary to upgrade and modernize them. In recent years, the demands for technology up-gradation of infrastructure have increased significantly. Further, proposals for expansion of educational programmes are being implemented. Hence, significant new investments are called for in the medium term and in the long term, to improve the quality of physical resources. Table 6.1 summarises the additional expenditure for infrastructure, as envisaged in this report.

Infrastructure Budget (1998 - 2007)



The Central library

The strategic plan pertaining to physical resources envisages:

- ❑ Efficient utilization, maintenance, and upgrading of existing infrastructure.
- ❑ Creation of new infrastructure, keeping in view the emerging technological options for a world class institution in education, research and services.

This initiative is linked to the other initiatives in three notable ways:

- ❑ High-quality infrastructure can play an important role in attracting the best talent to serve in the Institute.

- ❑ The provision of adequate infrastructure in educational technology will enhance the effectiveness of the teaching-learning processes.
- ❑ The electronic infrastructure is a crucial component of a modern educational institution and a pre-requisite for efficient governance.

The key issues in infrastructure development include:

- ❑ Mobilizing and ensuring a steady flow of adequate funds.
- ❑ Prioritizing development options.
- ❑ Developing project management.
- ❑ Emphasising aesthetics and functionality.

It is also important to evolve management control to ensure proper utilization and maintenance of all the infrastructural facilities, which, in turn, require appropriate administrative and technical training.

The Computer Centre



6.1 STRATEGIC INITIATIVES

6.1.1 Classrooms, Laboratories and Workshops

Modernizing of the Institute's educational facilities is an integral part of the entire strategic initiative proposed here. Audio-visual and multimedia equipment, capable of on-line networking with other selected national and international instruction sites, should be used to enhance the efficiency of the teaching-learning processes at IITM. The Institute also needs to exploit the wide availability of educational software.

6.1.2 Library

Traditionally the library has been a central but nevertheless passive participant in the educational process. The traditional libraries however have many shortcomings. In the knowledge society of today, information doubles every two years. So traditional libraries need to cater to increasing demands in the face of spiralling costs. Further information retrieval is likely to become an increasingly difficult and slow process.

The Digital Library, freely accessible to all through the intranet, will therefore improve the educational process in ways beyond measurement. It will make retrieval of relevant information from inside books, manuscripts and journals much easier and far more reliable. Students will succeed far more in finding exactly what they seek and increased success will encourage more of them to get more readily involved in research. More than one individual will be able to use the same book at the same time. Thus, material will

not be physically checked out and thus become unavailable to others. The role of the Central library has to move beyond the traditional role to one of being an active participant in the dissemination, multiplication and validation of knowledge. It will be expected to :



The Swimming Pool

- ❑ Play the role of a navigator of knowledge, a facilitator of retrieval and dissemination.
- ❑ Subscribe to world-wide networks and facilitate teachers and students to participate in innovative learning experiences that allow interactions across distance and time.
- ❑ Facilitate access for teachers and students to researchers, industry experts, and technologists worldwide.
- ❑ Become a key partner in the education and learning experiences of the society as a whole.

Technological solutions for improving the library's operations will enable it to extend much wider access and encourage more effective utilization of its facilities and academic resources.

6.1.3. The Integrated Computing Environment

- ❑ **The Concept:** An integrated high-speed network (of the order of 100s of Mbps or a few Gbps) exists on campus with Intranet architecture. This network is capable of 622 Mbps speed. The proposed Integrated Computing Environment (ICE) encompasses Cooperating Distributed Autonomous Systems, Client – Server Systems, Computing Grids, and Stand-alone systems. ICE is to be realized in an incremental fashion and adapted to include the growing availability of hardware and software. ICE is designed to be technology independent and will act as a Universal Homogenizing Agent. ICE is to Computing Facility what IP is to Internet. The ICE architecture from a protocol perspective and from a system perspective are shown in the adjoining figures.

Usage of ICE will be dictated by availability of appropriate software with license. The licenses should be procured in adequate numbers, but distributed, installed, and maintained from a central point for easy logistics.

ICE Architecture – Protocol View

VB APPs	WEB APPs	Document Sharing	Email FTP	Browsing
TCP				
IP				

The IITM campus network needs major re-engineering on several formats : IP address allocation, security, expansion and reach, quality of service and reliability all at affordable cost. IP address allocation concerns the issue of manageability of the network. Security addresses concerns about intentional/unintentional break-in to different IITM servers and is of special importance in the context of IT Act 2000. Expansion and reach reduces digital divide on campus and the per-capita investment in common facilities through rapid expansion of the user base. Quality of Service addresses the issue of “how much a person/node gets” out of a common resource such as Internet bandwidth, or “how long” does it take to reach any point of service such as a web, mail or proxy server. Reliability in this context refers to the consistency in the availability of any service as seen by the ultimate user.

Representative set of software that will be part of ICE

Browsing	MikTek
Citrix	MS Office
Email	MS SQL Server
Mathematica	Oracle
Matlab	Scientific Word

□ The Implementation:

- IITM campus network should follow Class A IP address allocation as expanded in this document (subnet per department).
- Firewalls should be installed at the subnet level which can double as routers.
- The Institute will be seen as consisting of modules of 250, 350, 500 and 750 nodes. Of these, 250, 350, and 500 represent different hostels, 350, 500, and 750 represent departments of various sizes. Irrespective of the size, the design should be such that a node reaches (i) a server in a maximum of three multiplexing steps and (ii) a service in a maximum of two firewall/router delays.
- Approximately 8000 nodes are required across the campus; 5000 in hostel sector and 3000 in the institute academic zone and residences.
- The ability to share a common resource allocation is best measured in the form of Internet bandwidth (10, 20, 50, 100 kbps etc.) experienced by the user at his/her node during browsing. It is a direct derivative of the Internet bandwidth subscribed to by IITM.
- As far as reliability is concerned, at least two points of interaction with ISPs are required; IITM has VSNL and ERNET as ISPs already.

- There are three choices - 1000/1000/1000 or 1000/1000/100 or 1000/100/10 - for a network with three levels of multiplexing. Of this first is ruled
- out for the next few years as the interface to a node (PC or laptop) is either not available or too expensive. The last option is ruled out as the network interface cards for PCs or laptops as well as the ports in switches or hubs are 10 or 100 and are automatically selected. As 100 is freely available, 1000/1000/100 becomes a natural choice.
- The points of aggregation of bandwidth comes in units of 8/16/24. For cost effectiveness 24 ports per switch is recommended. In a typical hostel, each floor will require four such switches and for all three floors, the uplink will be made to the fibre entry point at 1000 Mbps. As all these fibres have to be aggregated in the backbone, it is necessary to have a capacity of 1Gbps or 2.5 Gbps or 10 Gbps is recommended as the differential cost of these conversions are marginal.
- A node on campus will experience 1:24 multiplexing into a 1000 Mbps and 1:16 multiplexing at a second level and 1:8 multiplexing at the third level. So the 1000 Mbps available at the backbone level will be seen as 1.2 Mbps at all three levels and it will be more pronounced at the first level, viz., the 1:24 multiplexing level. Cables should be laid for future use at 1000 Mbps. Simple Network Management Protocol
- switches will be required for each unit of 250 nodes cabling at enhanced CAT 5 or CAT 6 will be also required. The initial cost of each is likely to be about Rs.5000/-.
- The Backbone should be upgraded (naturally) to support the enhancement and reach. A ball-park estimate to replace the three switches will add a per-capita investment of about Rs. 2500 per node.
- The expansion and reach can be supported and a better Quality of Service can be experienced only when the external bandwidth is enhanced in proper proportion. IITM should make efforts to do so.



The Educational
Technology Studio

6.1.4 Educational Technology

Investments should be made to improve the Educational Technology infrastructure in order to improve the learning environment. Such improvements will support the Institute's efforts to widen its reach, and establish IITM as a global leader in higher technological education.

6.1.5 Campus Amenities

The residential character of the Institute demands that accommodation and facilities in terms of communication, recreation and sports should be improved and maintained well. On-campus commercial facilities should also be strengthened and modernised.

6.1.6 Preservation of the Ecosystem

The beautiful campus is a mini ecosystem. It should be preserved and maintained with the help of students, staff and faculty as a Green Zone.

6.1.7 Health Services

The Institute Hospital was started as a First Aid centre in one of the bays in our Central Workshop in 1962 with a part-time medical officer. The hospital moved to the present location in 1966. From such humble beginnings the IIT hospital has grown to the present strength of 12 doctors and 36 supporting staff. It provides 24 hour emergency service.

The hospital has 35 beds for in-patients. Separate beds are allotted for females, children and infectious, obstetric and post-operative cases. Emergency service is available round the clock with a duty doctor on call and supporting staff in the hospital. An efficient Ambulance service is also available on call round the clock. The hospital has a clinical laboratory with two laboratory technicians. The hospital has a well equipped operation theatre with sophisticated operating microscopes, bronchioscope, instruments for IOL surgery, cardiac monitor, etc., along with regular equipment.

A multi-user, multi-modular software has been developed in-house for various routine activities such as inventory control, registration of members, etc.

The Institute Hospital

6.2 ACTION PLANS

- ❑ State-of-the-art educational technologies should be used to provide instruction in classrooms. The corresponding hardware and software to enable effective instruction must also be provided.

- ❑ The number and size of classrooms must be rationalized and existing classrooms need to be remodelled to be consistent with the proposed changes in the academic programmes. Investments must be made to improve the physical quality of classrooms, laboratories and other instructional sites. This would entail installing new furniture and office facilities, making civil repairs and the use of modern IT- based equipment for the production and delivery of educational materials. More efficient utilisation of existing facilities should be an important strategy.
- ❑ A state-of-the-art digital library that provides information for education and research in engineering, technology, sciences and management, with state-of-the-art information service capabilities/facilities should be developed.
- ❑ The Information Technology facilities at IITM should be comparable to those in the best institutes world-wide. A campus-wide, world-class computing network, connecting all the stakeholders and providing access to information within the campus and connectivity to the internet, will serve this purpose.
- ❑ An efficient and open working environment, with minimal paper flow, must be introduced to improve productivity.
- ❑ The network's performance and quality must be monitored by periodic feedback from users.
- ❑ The Institute must install a two-way satellite uplink facility for distance education and continuing education.
- ❑ The concept of individual messes in every hostel seems to have outlived its utility. A central large dining facility appears to be a desirable alternative.
- ❑ A cyber café should be set up in the hostel sector. The telephone facilities in the hostel require to be improved, employing also the wireless options.
- ❑ The Student Facilities Centre should be developed into a good shopping complex with modern amenities.
- ❑ The SAC should be made more functional. The stadium needs a master plan for development.
- ❑ Investments must be made in water harvesting and renewable energy applications.
- ❑ The guest house capacity should be increased or a new "green" guest house should be constructed.
- ❑ Periodic inspection and preventive maintenance must be largely outsourced. The Institute should develop effective processes for maintenance activities.
- ❑ All faculty and officers should be provided, with a multi-functional PC connected to the campus network. This will be consistent with the increasing trends of tele-working and dispersed / remote work.
- ❑ The Institute should investigate the feasibility of installing a captive power plant to provide good-quality power to meet its requirements.
- ❑ To maintain the environment, additional space requirement may be met by vertical expansion.

- ❑ Environmental groups should be formed to study the biodiversity of the campus and to take up projects to preserve and protect the campus ecosystem.
- ❑ As land use has a high opportunity cost in environmental and economic terms, off-campus alternatives must be identified and located to meet a part of faculty and staff housing needs. A Satellite campus should be developed to serve the increasing needs of the institute.
- ❑ Individual inpatient rooms with attached toilets need to be constructed.
- ❑ A biochemistry laboratory with semi-auto analyser needs to be installed and a qualified biochemist should be appointed.
- ❑ An X - ray unit (300 MA machine) needs to be installed and a radiographer needs to be appointed.
- ❑ The present emergency room requires to be expanded by about 200 square feet. It also requires adding a few more equipments such as cardiac monitor, centralised oxygen supply etc.

VII GOVERNANCE

Governance is concerned with the design of an appropriate organizational structure, systems and procedures in the pursuit of the institute's mission.

7.0 INTRODUCTION

Governance is concerned with the design of an appropriate organizational structure, systems and procedures, in the pursuit of the institute's mission. This chapter identifies

- ❑ New tasks / roles for IITM.
- ❑ Structural / organizational / process changes.
- ❑ Policies for strategic alliances that will ensure congruence between structure and strategy.

Governance influences the agenda for the other strategic initiatives identified here. In general, the most significant changes in an organization's strategy are rooted in changes in its structure. Structural changes directly lead to changes in the organization's work culture, decision-making, operations, and performance.

The faculty members of the Institute perform four types of activities: education, research, services, and administration. The character of the Institute is reflected by the mix of these activities which should be designed as a planned, strategic response to the significant changes in the environmental context.

The average distribution of time spent on each activity - education, research, services and administration - by the IITM faculty (or average workload mix) is presently estimated to be 40-25-25-10 percent of total time (ref: Working Group Report on Scenario Building). This mix has evolved through the significant quantitative and qualitative changes in the activities of the Institute since its inception and represents an optimal balance of faculty and IITM interests. It is a dynamic and evolving core-activity-mix and the Strategic Plan must be sensitive to it.



The Administration Block

Without significantly altering the overall work-load, the following alternatives are available in order to sustain and strengthen IIT's leadership position in higher technical education and research:

- ❑ Education and research to receive the highest priority and services taking the next place.
- ❑ Greater priority given to research over education, with services coming third.
- ❑ Assigning equal importance to the three basic activities.

Based on the feedback from various Task Force and Working Group reports, the strategic plan recommends that IITM's activities for the next decade should become a judicious mix of education, research and services. Each of the activities, in the new strategic mix, should be chosen to maximize effective utilization of physical and human resources, value addition and resource generation.

To facilitate such an activity mix, the detailed costing of the faculty time needs to be carried out. Additionally, the proportion of time spent on each activity by a faculty member could be monitored and evaluated over a five-year period. This policy ought to provide the necessary flexibility and responsiveness demanded by the environment and satisfy the goals of the faculty as well as those of the Institute. This will also significantly increase the capabilities of the Institute to generate resources.

7.1 STRATEGIC INITIATIVES

7.1.1 Structural Reorganization

While the proposed strategic activity mix of the Institute is a planned response to environmental changes, redesigning the organizational structure becomes imperative for improving the efficiency of the operations within the framework of the proposed mix.

Extracts from the IIT Review Committee pertaining to the activity mix issue vis-à-vis leadership position are given in Table 7.1. In the current context, IITM has to change from performing a predominantly academic role, to performing both an academic and a knowledge-industry role, nationally and internationally. Any structural reorganization effort in the Institute must reckon with this major change.

7.1.2 Process Changes

The 'structural' changes in the organization have to be matched with process changes pertaining to all transactions within the Institute, such as decentralization of power, transparency in decision-making and accountability for performance. Additionally, IITM should strive to form strategic alliances with academic and industrial organizations.

Table 7.1 Extract from Review Committee

"IITs have at present neither the commercial nor the University type of management structure. Neither style of management is indeed appropriate. The IITs need their own special management style."

"The current ethos in administration is not in consonance with the academic climate needed for reaching excellence."

“The IITs must be bold enough to experiment and create their own culture, management style and structure to fulfil their own needs.”

“Technological manpower production is admittedly the basic function of the IITs.”

“To preserve IIT’s character as institutes of national importance and to maintain their leadership and pace-setting function in technological education, research and extension and to be able to produce the kind of technological manpower set out above, their goals must be:

- ❑ To excel in teaching, research and in all aspects of academic activity and produce a high quality science-based engineering student

- ❑ To survive on specialization, work increasingly in front line areas that transcend disciplines

- ❑ To accept extension and public service as a third dimension to their role in addition to education and research

- ❑ To maintain and foster interactive linkages with leading technological institutions and centres of research in India and abroad.”

— *IIT Review Committee, 1986.*

The creation of alliances should be based on mutually beneficial objectives, and their operation judged by mutually accepted, explicitly stated performance measures. Activities under these alliances, should emphasise long term benefits and sustainability. All such alliances need to be continuously and carefully nurtured so as to result in a sustainable stream of activities.

7.1.3 Leveraging Industry – Institute Synergy

The Centre for Industrial Consultancy and Sponsored Research (IC & SR) was created in 1973 in order to leverage the Industry-Institute synergy. Through IC&SR, IITM has been interacting with industries, research organisations and governmental agencies for taking up consultancy and sponsored research projects. Such projects strengthen the academic programmes of the Institute. These projects and assignments require a great amount of scientific and technical input from the faculty and staff of the Institute. IC & SR has evolved into an efficient and well-organised division of the Institute for facilitating this valuable synergy. It has recently been awarded the ISO 9001:2000 certification. IITM should strengthen this activity in the coming decade.

7.1.4 Exploiting Intellectual Capital

With increasing emphasis on exploitation of intellectual capital, revenue generation and reduced dependence on government funding, the activities of IITM should reflect an economic orientation as well. As the organizational features for meeting the new goals include higher flexibility, more customer responsiveness, less bureaucracy and more professionalism, a new affiliate organization, TechNovator, the business face of IITM is proposed to be formed.

This organization company should be managed by professionals and should develop a professional business face for the Institute. This marketing organization should be lean and flexible, facilitating the Institute’s faculty in undertaking the tasks of research, consulting, continuing education and services for

various clients. This concept has successful parallels in the form of the University Companies in UK, Australia and China. Similar examples in India include the Foundation for Innovation and Technology Transfer of IIT Delhi, the Technology Foundation of IIT Kharagpur, and the Society for Innovation and Development of IISc., Bangalore.

The proposed organizational structure requires the formation of a company under Section 25 of the Indian Companies Act, to be limited by guarantee for serving as an interface between IITM and its clients in the marketing of its knowledge, products and services.



The IIT-Chemplast Cricket Stadium

7.2 ACTION PLANS

- ❑ Externally funded research and consulting should continue to assume importance while Continuing Education programmes need to get a higher emphasis than at present.
- ❑ Faculty members desirous of exploiting their intellectual capital for technology incubation and entrepreneurship should be encouraged through suitable policies.
- ❑ Individual faculty members may be permitted to trade off time among education, research and consultancy activities according to a mutually agreed, flexible, annual work plan.
- ❑ The present and proposed organization charts depicting various departments, programmes, units, offices, etc., are presented in Table 7.2 and 7.3. In managing the increasingly complex affairs of the Institute, the Director should be supported by as many as two Deputy Directors.
- ❑ Appointments to the positions of Deputy Directors, and Deans should be based purely on pre-specified, mutually agreed, transparent, performance agreements and leadership potential and not on seniority. These officers should set policies and monitor key indicators of performance and should delegate powers significantly to lower levels.
- ❑ Hierarchically there will continue to be three well-identified tiers in the governance of the institute.
 - Policy and the legislative issues, within the framework of MHRD, IIT-Council and the Act and Statutes, handled by the Director, the Deputy Directors and the Registrar.
 - Academic and administrative policy guidelines dealt with by Deans / Associate Deans and Heads.
 - The actual implementation and execution of works, procedures and processes will be the responsibility of senior and middle level administrators.

- A Professor-in-charge (Quality Management) will assist the Director, and be in charge of independent evaluation of processes and activities; internal audit; and quality assurance of support services and academic programmes.
- ❑ The Act and Statutes of Institutes of Technology need enabling provisions in the changed scenario.
- ❑ A Task force should be set up to review and simplify existing operating rules and procedures. It should aim at simplification, codification, elimination, and documentation.
- ❑ The Office of Quality Management will focus on all the quality aspects pertaining to the support services of the Institute.

Twelve major service units of the Institute have secured ISO 9001:2000 certification from RWTÜV of Germany for establishing and applying a Quality System for Design of Academic and User Oriented Programmes; Support Services, namely, Library, Computer Centre, Workshop, Industrial Consultancy and Sponsored Research, Administration, Engineering Unit, Finance and Accounts, Security, Stores and Purchase and Central Electronics Centre. It is important to continue to maintain the quality of practices in conformity with the certification.

- ❑ Appointments to the positions of Heads of Departments and Research Coordinators should be based purely on a pre-specified, transparent, performance agreements and leadership potential and not on seniority. The tenure of these positions should normally be three years.
- ❑ A limited company called The TechNovator should be formed to help IITM exploit the economic value of its intellectual capital.
- ❑ The TechNovator will be headed by a Dean IC&SR who will report to the Director of the Institute. The Director will be the ex-officio Chairman of the company. The Dean will be assisted by appropriate professionals to take care of continuing Education Programs, Intellectual Property and Technology Transfer, Outsourcing and Planning.
- ❑ A senior Professor should be identified as Professor-in-charge of Strategic Alliances.
- ❑ The existing alliances / MOUs between the Institute and other national and international academic institutions, industry and government organizations/ departments should be energized and activated, where necessary. Other alliances need to be strengthened to improve their effectiveness.
- ❑ The Institute should identify national and international strategic partners, evolve clear parameters and guidelines for recognizing and selecting the Institutions, and develop evaluation mechanisms for monitoring the effectiveness of the alliances.
- ❑ The Institute should carefully develop new alliances for joint degree programmes, collaborative research, continuing education and consultancy with leading institutions (academic, research or consulting) in the world.

VIII BUILDING RELATIONSHIPS

IITM must build relationships through selective strategic alliances with government, industry, institutions and other organizations.

8.0 INTRODUCTION

Competition in the field of higher technological education has become significant in recent times. There is competition to attract the best students; find the best placement opportunities; recruit the best faculty; seek project funding and consultancy work; get suitable participants for continuing education; enter into the best strategic alliances; and to market the Institute's products and services in a competitive environment.

These unprecedented changes, both at the global and local levels, require IITM to build enduring relationships with different entities in order to achieve its Vision and Mission. These can be broadly classified into:

Government and other sponsoring agencies for a sense of national perspective and prioritisation.

Industry for technological consultancy and for realising the economic value of IITM's intellectual capital and services.

Alumni for leveraging their contributions to their Alma Mater.

Society and the media through information dissemination, especially on technology issues that affect society and through outreach programmes.

Various service providers for optimising and rightsizing IITM's human resources.

These relationships should be founded on the principles of mutuality, synergy and complementarity although different approaches are required to build each of these relationships. This chapter describes in detail the strategic initiatives and action plans for building such relationships.

The Lobby of IC & SR Building



8.1 BUILDING RELATIONSHIPS

Three factors, namely personal relationships, seeking mutual benefits, and accepting differences, play an important role in building productive relationships [20].

- ❑ IITM should not underestimate the importance of personal relationships and commitments. The fundamental structure of the network is social, not technological.
- ❑ The fundamental issue in seeking benefits concerns the way quality is measured in building relationships. IITM should measure quality not by spending, but by output or performance. Then it is not the size of the input that matters, but the difference that it makes to the creativity of the faculty and students.
- ❑ It is important to recognise the differences between institutions before entering into partnerships. Private institutions are entrepreneurial and ideas that attract resources are of paramount importance while Public institutions emphasize process and consultation and value means more than the ends.

8.1.1 Strategic Alliances

Several leading organizations the world over have realized the need for strategic alliances with other organizations in selected lines of activity. The main arguments in favour of strategic alliances include:

- ❑ The presence of a comparative advantage (e.g. lower cost, higher quality).
- ❑ The attractive returns from larger projects that can be implemented.
- ❑ The need for leveraging resources for mutual benefit.
- ❑ The benefits that will accrue from establishing long-term partnerships founded on the principles of mutuality, synergy, and complementarity.

Some programmes for deriving synergy from the alliances include: joint degree, student and faculty exchange, joint research, foreign or overseas campus, specialized continuing education and societal outreach.

Table 8.1 Extract from TCS Report

“...strategic alliances are at the heart of all new activities. IIT needs to recognize the design and management of such alliances as a major element of its strategy.”

— Study report of
Tata Consultancy Services, Madras, 1997.

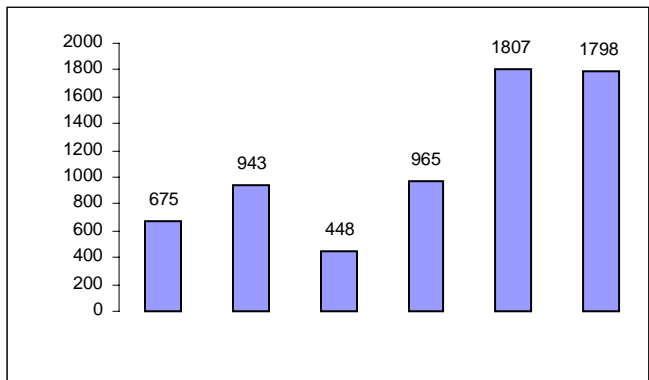
8.1.2 The Centre for Industrial Consultancy and Sponsored Research

The Centre for Industrial Consultancy and Sponsored Research (IC&SR) was set up as early as 1973 to build synergistic relationships with the government, industry and sponsoring agencies, and various service providers. IITM has been interacting with industries, research organisations and governmental agencies for taking up consultancy and sponsored research projects. These are either referred to the Institute or are sanctioned based on specific project proposals submitted by the faculty members. Such projects pose considerable scientific, technological and academic challenge to the faculty and students of our Institute. Further, the academic programmes of the Institute are strengthened by such active interaction

with the industries. These projects and assignments require a significant scientific and technical input from the faculty and staff of the Institute.

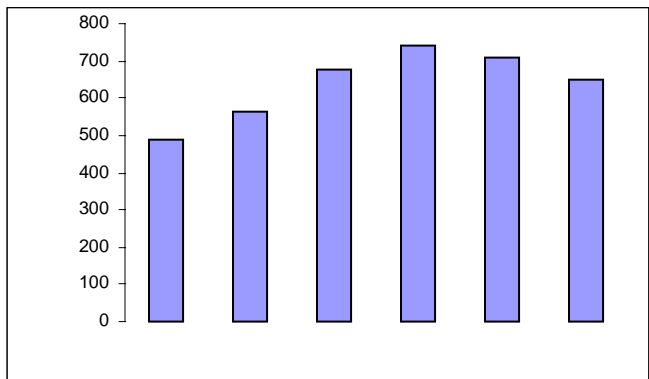
The Centre for IC & SR coordinates three types of projects or assignments: Sponsored research projects; Consultancy and Routine Technical Services. The Centre for IC & SR has well designed policies, with reviews, control of system and internal quality audits to ensure compliance and continued effectiveness. The Centre has

Sponsored Research Earnings



- ❑ **Sponsored Research Projects:** These are R & D projects sponsored by Government agencies, industries or other institutions with a view to generating new knowledge, to developing a new technological process or new products. These are long term assignments in emerging areas and in highly specialised fields of Science and Technology. Typical government funding agencies within India who sponsor research projects are : Aeronautics Research and Development Board, Council of Scientific and Industrial Research, Defence Metallurgical Research Laboratory, Defence Research and Development Organisation , Departments of Atomic Energy, Department of Electronics, Department of Environment, Department of Non-Conventional Energy Sources, Department of Ocean Development, Department of Science and Technology, Indian Council of Agricultural Research, Indian Council for Medical Research and Indian Space Research Organisation.

Industrial Consultancy Earnings



- ❑ **Consultancy:** Projects that can be executed and problems that can be solved readily utilising the professional knowledge and expertise of the faculty are classified as consultancy assignments. The Institute facilities may be used for research work, theoretical analysis or experimentation required for generating sufficient information and data for this problem solving operation. These assignments are heavily dependent on the existing know-how and skill of the staff concerned and are mostly related to the application of an already known technology.
- ❑ **Technical services of Routine Nature:** Routine technical services refer to assignments like testing, calibration of an instrument, or writing a routine computer program, where the specialised professional knowledge or expertise of the faculty is hardly used. Such technical services are not encouraged and are taken up only when the industry has no other alternative in this region than to depend on the facilities available in IITM.
- ❑ **Information Dissemination:** The Centre brings out publications periodically highlighting the research in different laboratories of the institute. Every two months IC&SR organises several Technology Appreciation Programmes for its Industrial Associates on selected topics with the help of the faculty. This programme facilitates the faculty and industry to discuss the state-of-the-art issues in the identified Technology. In the reverse direction IC&SR facilitates research groups in a variety of ways: value-addition to knowledge base, technology transfer, technical advice, troubleshooting, continuing education, etc. Existing strategic alliances with IGCAR, ISRO and L&T can be models for forming “industry / sector focussed” partnerships.
- ❑ The IC&SR also manages a conference facility in the IC&SR building which is primarily used by the faculty for organising technical meetings, conferences, seminars, workshops and short term courses at the national and international level.
- ❑ **Technology Development:** The IC&SR helps to identify industry-specific applied research problems, the solutions to which might lead to indigenous technology development. Some recent examples of such work at IITM include the development of new DSP (Digital Signal Processing)-based products for Analog Devices (USA), metal matrix composites for automotive pistons for India Pistons, high-density magnetostrictive materials for Asian Electronics and heat pump heat recovery systems for Thiru Arooran Sugars. This synergy is of great importance in the current context of Intellectual Property Rights for technological innovations and patents.



Exhibition Hall

8.1.3 Intellectual Products and Services

- ❑ **The Triple Helix Paradigm:** Significant and profound changes have occurred in the way that industry, governments and universities interact and utilise science and technology for wealth creation. These changes have been driven by paradigm shifts related to innovation, competitiveness and university/government / industry relationships.
- ❑ Firstly the innovation process is no longer viewed as a linear “scientific push” or ‘market pull’ process but as a process involving non-linear ‘system integration and networking’. The latter emphasises team effort with increasingly global linkages. Secondly the real leverage for competitive success depends on localised concentrations of skilled people and technology such as in technology parks, associated with universities linking industry, government and academic R&D activities in a particular area of science and technology, and not on national effort. Thirdly governments are changing their attitude from looking at Universities as investment for the future to institutions capable of more direct contribution to wealth creation. Simultaneously they are offering incentives to the industries in emerging areas for investing in R&D for competitive growth. The resulting new paradigm, sometimes described as ‘The Triple Helix’, envisages a spiral model of innovation to capture multiple reciprocal linkages at different stages of wealth creation from knowledge.
- ❑ Accordingly the Strategic Plan envisages several changes in IITM that are listed under the section on strategic initiatives. These changes are likely to lead to a significant and rapid growth in IC&SR activities in IITM.
- ❑ **The TechNovator:** The role of the Centre for IC&SR will be supplemented by the setting up of The TechNovator Limited. As described in Chapter VII, the TechNovator’s primary mandate will be to realise the economic value of the Institute’s products and services. This company will have considerable flexibility and autonomy to pursue and conclude commercial transactions. In the current competitive environment IITM should leverage the economic value of its products and services. This involves customers, and benchmarking and focusing on selected products and services based on customer needs, and IITM’s comparative advantage.
- ❑ Institutions that compete with IITM are both national and international. Foreign universities, consulting firms, government laboratories, and even enterprises, compete with IITM in a number of areas. The Institute’s reach will have to extend significantly beyond national borders. Meanwhile, the Institute’s range of products and services has also expanded considerably. Marketing thus assumes great significance in the context of the Institute’s plans to exploit effectively the intellectual capital represented by the faculty and educational / research facilities.
- ❑ The TechNovator will serve as the link between prospective customers and the Institute and will have considerable flexibility and autonomy to pursue and conclude commercial transactions. Its responsibilities are listed in the section on strategic initiatives.

- ❑ **Technology Park:** R&D has become very expensive in today's high-tech world. There is definitely a need to encourage industry-relevant R&D. IITM should set up a Technology Park through The TechNovator to serve as a cost-effective form of R&D. The Institute and Industry will mutually benefit through such an arrangement that enables the formation of synergy between the knowledge and innovative inputs of the former, with the professional and financial inputs of the latter.
- ❑ **Continuing Education Programmes:** IITM can realise the economic value of Continuing Education Programmes through The TechNovator, in India and abroad. The exponential increase in knowledge presents never-before opportunities for continuing education, to provide value-added knowledge and skills. It is quite difficult for professionals in industry to access and master state-of-the-art developments related to their work. Continuing education, including distance learning, is an attractive option for them to improve their knowledge and enhance their competitiveness. Continuing Education Programmes have other specific benefits (placement, consulting, joint research, etc.).

The Main Guest House



- ❑ **Software:** The Institute should make the sophisticated software generated in the research programmes of the Institute, user-friendly and also prepare the necessary documentation. Commercialization of such software could be achieved through alliances with top-grade software houses which may also be given the marketing rights, thus enabling the Institute to benefit through royalties.

8.1.4 Alumni Relations

The alumni have an emotional attachment and deep empathy towards their alma mater and place a high value on the education they received in IITM. The alumni who have distinguished themselves in different walks of life - the academe, government and industry - constitute an important resource for the institute to draw upon. The following sections describe strategic initiatives for nurturing its growth in the coming decade:

- ❑ **The Alumni Association:** The Alumni Association was started in 1964 with the first batch of graduates at the first Convocation of the Institute. It is a semi-formal unit that fosters networking and facilitates sustained connectedness within the Alumni, and between the Alumni and the Institute. The Director is the ex-officio Patron of the Alumni Association and a Professor of the Institute nominated by him is the President. The Association publishes and distributes a newsletter called the 'Alma mater'.



Inauguration of the Cyber Cafe

- ❑ **Office of Alumni Affairs:** In the year 2000, the Office of Alumni Affairs was set up by the Board of Governors of the Institute with a Professor as Advisor of Alumni Affairs. The Office of Alumni Affairs looks after the implementation of the alumni-supported projects and provides reports of progress to the donors. The Office of Alumni Affairs also oversees the contributions and the utilization of the support from the Alumni. The Alumni Association and Office of Alumni Affairs complement each other and provide mutual support for interaction between the alumni and the institute. IITM is now about forty years old. In the recent past, the alma mater-alumni relationship has been growing steadily. Several factors have played a role in this growth. These include the opening up of the Indian economy, the Information Technology revolution and the service sector boom; both in India and the rest of the world. Many alumni have started, promoted and headed globally competitive hi-tech companies. Others occupy important positions in major companies and organizations in India and abroad. IITs have come to be recognized as producers of the best talent pool in the world.
- ❑ Alumni, as stakeholders, are very keen to contribute to their alma mater and constantly seek opportunities to participate and share in its development. IITM should leverage this sentiment to its advantage and use the talent, the ideas and the monetary contributions of the alumni in taking IITM to higher and higher levels of achievement. The alumni can contribute in various spheres - student activities, academic activities, creation of academic facilities and Centres of Excellence and general infrastructure. Finally the alumni can also serve on Advisory Boards of the Departments in order to make their rich experience available to the Institute in planning various academic programmes and to serve as a “reality check” for IIT’s research activities.
- ❑ **Interaction with Alumni:** While interaction with other stakeholders has been evolving over a much longer period, development of alumni interaction is a relatively recent phenomenon. For example, the relationship between IITM and industries was initiated in the early seventies. Schemes such as the Industrial Associateship Scheme have been in operation since the mid eighties. So is the case with Sponsored Research and Consultancy, which was initiated in the late seventies and has taken strong roots in the system.
- ❑ Since early 1990, the Silver Reunion meetings annually bring together alumni who graduated 25 years ago as a regular annual event. These events help alumni to connect and re-connect among themselves as well as with the Institute. Many of them return to the Institute after long periods, and the reunion provides an opportunity for them to become aware of the progress and developments in the

Institute. The reunion meetings also generate many useful suggestions and ideas. Since the nineties, many new Chapters have been established both in India and abroad, particularly in the U.S. These Chapters provide increased opportunities for alumni to get together, and develop shared interests in supporting and promoting activities of IITM.

- ❑ ***Distinguished Alumnus Awards:*** To recognize and appreciate the achievements of the alumni, Distinguished Alumnus Awards have been instituted since 1996. Every year, these awards are presented to alumni in recognition of their achievements in academia, industry or government.
- ❑ ***The Alumni Trust:*** IITM Alumni Charitable Trust was established in 1993 with a view to providing a well-structured and organized interface to receive monetary contributions from the alumni. The trust facilitates the receipt of foreign donations, and provides the necessary framework for the eligible tax exemptions for contributions received from abroad.
- ❑ ***Professional Involvement of Alumni:*** In the west, particularly, in the U.S. it is an established practice and tradition to solicit contributions from alumni and build a financial corpus for institutional development. The interaction of the alumni with their alma mater in the above cases extends far beyond financial contributions, and includes in its scope, professional involvement of alumni in academic activities. It is this aspect that would contribute significantly to IITM in achieving its vision. The establishment of the proposed Technology Park is expected to give a fillip to this interaction. A beginning has been made at IITM. Over the past six years, the R&D work of the TeNet group from the Electrical Engineering and the Computer Science and Engineering Departments has resulted in the establishment of several alumni start-up technology companies for commercialization of the products.

Special Convocation



8.2 STRATEGIC INITIATIVES AND ACTION PLANS

- ❑ q The activities of the IC&SR should be supported and strengthened while the nature of its role in consultancy activities should be re-examined.
- ❑ An annual Research Report on the ongoing R&D programmes and research interests of faculty should be published.

- ❑ Scale up Continuing education activities for professionals and teachers.
- ❑ Building research capabilities in a focused technological area through financial support from industry in return for first-hand access to research results and licenses on patents.
- ❑ Keep the public well informed through technology status reports, public seminars and popular lectures.



Silver Reunion of Alumni

- ❑ Establish constructive links with the press and media for widespread coverage and publicity of IIT's valuable contributions.
- ❑ Continue to encourage and expand the specific outreach programmes (such as the Programme for Gifted Youth, open house, guided campus visits) to promote the broader aims of science, engineering and technology.
- ❑ The Office of Alumni Affairs should work together with the Alumni Charitable Trust and the Alumni Association to :
 - Nurture the alumni-institute interaction through continuous involvement and constant communication between the institute and the alumni.
 - Draw up a calendar of events on campus for the faculty, students and alumni to meet from time to time.
 - Identify champions for alumni projects and monitor them like regular sponsored projects.
- ❑ Publish selected Ph.D., M.S. and M.Tech theses, after suitable editing by technical writers, to make them industry – friendly where necessary.
- ❑ The Institute must realise the economic value of its intellectual capital and activities by setting up a section 25 company called the "TechNovator" as the business face of IITM. Its responsibilities will be to:
 - Identify the marketable products and services of the Institute.
 - Adopt a marketing strategy best suited for each of them in terms of:
 - Identifying potential customers and their needs.
 - Developing effective customer relations and services.

- Refining and expanding the customer base.
- Protect IITM's intellectual property.
- Invest in new technology-based faculty business ventures in exchange for profit sharing.
- Manage direct investments in the stock market.
- Build strategic alliances with professional marketing organizations and commercial consulting firms.
- Tie up with professional marketing organizations for selling Educational Technology products, such as videos, multimedia instruction packages and programmed learning materials.
- Help in the commercialization of such software through alliances with top-grade software houses, which may also be given the marketing rights, thus enabling the Institute to benefit through royalties.
- Form strategic alliances with commercial consulting firms so that the Institute will be involved from the early stages of contracts/turnkey assignments.
- Take up patented products and processes for incubation and commercial development.
- Help IITM keep in touch with market realities and be responsive to market changes.
- Set up joint ventures with specific enterprises.
- Set up and manage a Technology Park in or outside the campus in order to :
 - Facilitate collaborative R&D.
 - Incubate faculty or student initiated technologies towards their commercialisation.
 - Invest in incubator projects at different stages: pre-competition, start-up, development and expansion.
- Provide logistic and marketing support to Continuing Education programmes.
- Grant awards to technologies developed jointly by the Institute and Industry.
- Conduct external market studies/research periodically to assess customer profiles, needs, competition, etc.

IX FINANCIAL RESOURCES

Financial Resources constitute one of the key inputs in realising the objectives and achieving the goals of IITM.

9.0 INTRODUCTION

The main source of funds for the Institute is the Ministry of Human Resource Development (MHRD) of the Government of India. Other sources are receipts by way of student fees, Consultancy and Continuing Education, Sponsored Research etc. The break-up of the resources for 1998-99 to 2002-2003 is given in Table 9.1.

9.1 FINANCIAL RESOURCES

9.1.1 Plan and Non-Plan Funds

Every year a Budget Estimate (BE) for the coming financial year is submitted to the Finance Committee and the Board of Governors for consideration and approval. The Board-approved BE proposal is then submitted to the MHRD sometime in February. The Ministry holds a discussion with the Director and the Registrar and determines the actual fund allocation based on their own fund-availability and the BE. The allocation is released in three instalments (the first instalment in the first week of April) in the form of grant-in-aid under two heads: Plan and Non-Plan. Plan grants are towards capital expenditure i.e. for the creation of assets. Non-Plan grants are towards revenue expenditure for meeting the operating expenses of the Institute. The earnings from Industrial Consultancy and Continuing Education augment the institute's resources. Other income by way of fees collected, interest earned etc. add to the Non-Plan Grant for meeting revenue expenditure. In September, the Institute submits a Revised Estimate (RE) of the Budget based on a review of its financial position vis-à-vis the BE and the allocation and the actual expenditure. The release of the second and third instalments is dependent on the RE and the Institute's ability to absorb the grants already released to it as evidenced by the audited financial statements submitted periodically to the MHRD.

The beginning of the IX Plan (1998) saw a steep increase of grants to the IITs and helped the IITM to carry out some over-due maintenance of the campus as well as add new infrastructure in the form of buildings and research facilities. Two smaller but significant increases in the grants followed in 1999 and 2001 both of which have helped IITM greatly in its endeavours to re-establish itself as a world-class institution in terms of its infrastructure.

Financial Resources

9.1.2 Additional Schemes

During the VII Plan period from 1985 to 1990, and 1990 to 1993, MHRD introduced new Schemes, designated as R&D, TAPTECH (Thrust Area Programmes in Technological Education) and MODROB (Modernisation and Removal of Obsolescence), and grants under these were provided on the basis of Project proposals submitted by IITs and other centrally-funded Institutions. Project funding under these

schemes was in addition to the Plan grants to the Institute. Under the TAPTECH Scheme, the thrust areas of Information Technology, Educational Technology and Telematics were supported.

During the IX Plan (1998-2002), the Planning Commission initiated a novel scheme involving joint projects with industry participation in designated areas. These schemes require a 25% commitment of funds for the research on the part of the industry. In these "Technology Development Missions" (TDM), IIT Madras was funded jointly with another IIT/ IISc in the areas of Energy Efficient Technologies and New Materials. Based on the evaluation of the TDM projects it is now proposed to continue the TDM approach for another identified set of Missions in the X Plan commencing from 2003.

During the IX Plan period MHRD in consultation with the IITs also came up with two specific schemes for funding: modernisation of Information Technology Infrastructure and enhancement of student intake in the IITs. The scheme for modernization of Information Technology infrastructure was approved and each IIT was funded to the tune of about Rs.180 million for the period 1997-2002. The scheme for increased student intake was merged with the Plan funding provided by the Ministry, and accordingly augmented Plan funds of about 2 crores were provided. IITM has added nearly 100 seats in each year of the five years of the Dual-Degree Programme (B.Tech.+ M.Tech) since the academic year 1998-99.

In the X Plan the MHRD revised the funding scheme again to one based on Performance. The highlights of the scheme are as follows:

Plan Funding Formula

Infrastructure Grant

70% (based on campus size, programs offered, number of Departments / Faculties, expansion plan for increasing student numbers and program diversification)

Performance Grant

20% (On the basis of volume of activity – Research and Consultancy, Continuing education and support to technical education system at large and industry)

Special Grant

10% (Campus size, location, age factor etc.)

Non - Plan Funding Formula

Based on Student Numbers

90% (In terms of Full-Time Undergraduate Equivalents – FTE with multiple of 1.5 for Postgraduate students, 2.5 for Doctoral students and 0.5 for part-time student)

Based on Generic Research Output

5% (Based on patents / publications other than outcome of sponsored research)

Based on Other Considerations

5% (Campus size, its location and infrastructure bottlenecks, large number of departments / faculties)

9.1.3 The Corpus

In the IX Plan the IITs were permitted to retain and accumulate the surplus in the Non-Plan grant after meeting the revenue expenditure under an Institute Corpus Fund (ICF). This was designed to encourage IITs to build up financial resources and achieve a certain degree of self-reliance for operational expenses by utilizing the interest from the ICF. Under the X Plan IITs are required to limit their Corpus to Rs. 25 crores and are explicitly forbidden from accumulating the surplus Non-Plan grant allocation in the ICF.

9.1.4 Alumni Support

Another important development which augurs well for the IITs is the success of IIT Alumni in high-tech fields by way of entrepreneurship and new ventures. This correlates well with the current global economic framework. During the decade of the 1990s, the Institute initiated several steps for involving the alumni to help sustain the brand equity and image of the IIT. This has opened up avenues for possible alumni support both in terms of funding as well as in terms of participation in activities such as student mentoring, summer internship for students and Chair Professorships.

9.2 STRATEGIC INITIATIVES AND ACTION PLANS

In 1997, A. F. Ferguson (AFF), was hired as consultants to study and report on Resource Assessment, Fund Mobilisation and Accountability Systems. The Report drew up a desirable and feasible scenario, involving 25% increase in student strength, additional Plan inputs and a small increase in Non-Plan expenditure. The scenario envisages a different activity-mix for faculty, with increased participation in Consultancy, Sponsored Research and Continuing Education.

- ❑ All books of accounts should be consolidated to reflect the total activities of the Institute. The accrual basis of accounting should be adopted uniformly across IITM.
- ❑ Separate funds along the lines of PF may be set up for gratuity and pension, payments. Surplus earning through investments should be retained in its own books. Any shortfall in the fund's interest liability could be met out of this.
- ❑ Complete and accurate records of fixed assets should be maintained at IITM. IITM should adopt a suitable policy for depreciating its fixed assets through a "Sinking Fund".
- ❑ A Central Treasury Management should be adopted so as to pool resources and manage cash effectively as well as gainfully deploy temporary surplus cash resources.
- ❑ A suitable system for cash budgeting and planning should be developed.

- ❑ Increase student intake through GATE and JEE and eliminate subsidies especially in the hostel sector.
- ❑ Increase faculty involvement in IC&SR, Research Based Industrial Consultancy (RBIC) and Continuing Education Programme (CEP) activities with time planning and monitoring.
- ❑ Institute monthly time sheet system. Every hour spent by the faculty for the institute to be booked. Increase services fees to include faculty time costs.
- ❑ Increase faculty accountability through a well-defined performance assessment system.
- ❑ Implement a Voluntary Retirement Scheme and evolve a recruitment policy that would lead to a faculty to non-faculty strength ratio of 1:1.5 by 2010.
- ❑ Control all expenditure heads and implement transparent accounting and cost reduction measures.
- ❑ Devise and implement fund-raising programmes, create teams and fix targets.
- ❑ Prioritise, plan, design and execute all construction projects as per schedule.
- ❑ Create and organise Research Groups and identify members and leaders. Set targets and budgets for these groups.
- ❑ Use increased plan funds allocation by MHRD to improve Infrastructure, accommodate more students and establish an institute backbone network.
- ❑ Use increased Non-Plan funds to improve the maintenance of hostels, faculty rooms etc.
- ❑ Set up a separate Office of Alumni Affairs under Dean IC&SR to mobilise additional resources for Infrastructure, R&D and Student / hostel projects as well as to find Faculty champions for such projects.
- ❑ Reduce non-faculty strength by selective recruitment and intelligent outsourcing.
- ❑ Set up an Integrated Computing Environment (ICE) to link all the activities of the Institute and help the authorities by providing data at the desk-top for decision-making.
- ❑ Set up teams / organisation to promote IITM products and services.
- ❑ Evolve mechanisms for raising funds from corporate houses.
- ❑ Set up teams for monitoring the implementation of Institute infrastructure and departmental plan expenditure investments.
- ❑ Increase Faculty strength to 600 and student strength to 6000 by 2010 to maintain a student/ faculty ratio to 8:1 for PG and 15:1 for UG with a PG to UG ratio of 1.25:1 and thereby facilitate undertaking additional sponsored and consultancy projects.
- ❑ Appoint professionally qualified and experienced finance manpower to bring about the proposed transformation. Move towards budgetary control of activities from the present system of expenditure control.
- ❑ Develop objective criteria to decide on cross-subsidies to programmes that are not self-sustainable.

Strategic Management Project at IIT Madras

Composition of Various Committees (1996)

The Boards Strategic Planning Committee

Dr. A. C. Muthiah , Vice-Chairman, & President M/s. Southern Petrochemical Industries Corporation Ltd., Chennai	Chairman
Director Indian Institute of Technology Madras	Co-Chairman
Ms. Mallika Srinivasan , Vice-President M/s. Tractors & Farm Equipment Ltd., Chennai	Member
Shri Vaghul Chairman, ICICI	Member
Dr. M. Anandakrishnan Vice Chancellor, Anna University	Member
Prof. R. Natarajan Dept. of Mechanical Engineering, IIT Madras	Member
Prof. C.R. Muthukrishnan Dept. of Computer Science & Engineering, IIT Madras	Member
Prof. M. Ravindran Ocean Engineering Centre & National Institute of Ocean Technology	Member
Prof. V. Balakrishnan Dept. of Physics, IIT Madras	Member
Prof. R. Rajagopalan Dept. of Humanities and Social Sciences, IIT Madras	Member
Shri A. Ramakrishna Vice President, Larsen & Toubro, Chennai	Member
Shri Suresh Krishna M/s. Sundaram Fasteners Ltd., Chennai	Member
Dr. K. V. Raghavan Director, Central Leather Research Institute, Chennai	Member
Dr. R. Ramachandran Director, Institute of Mathematical Science, Chennai	Member
Dr. Bhaskar Ramamurthy Dept. of Electrical Engineering, IIT Madras	Member
Dr. S.S. Gokhale , Associate Professor Dept. of Aerospace Engineering, IIT Madras	Member
Dr. (Mrs.) Enakshi Bhattacharya , Assistant Professor Dept. of Electrical Engineering, IIT Madras	Member
Prof. K. V. S. Rama Rao , Dean Secretary Industrial Consultancy and Sponsored Research, IIT Madras	Member
Prof. G. Subramanian Secretary Dept. of Aerospace Engineering, IIT Madras	Member

Coordination Committee

Prof. R. Natarajan
Prof. C. R. Muthukrishnan
Prof. R.S. Ganapathy

Director, Indian Institute of Technology Madras
Deputy Director, Indian Institute of Technology Madras
Academy for Management Excellence, Chennai

1. Working Group (1)

Scenario Building and Assessment of Mix of IIT Activities (Education, Research and Service)

Members

1. Dr. M. S. Ananth
2. Dr. K. A. Padmanabhan
3. Dr. N. Rajagopalan
4. Dr. P. Srinivasa Rao
5. Dr. K. V. S. Rama Rao

Dean, Academic Courses, Convenor
Dean, Academic Research
Dean, Administration
Dean, Students
Dean, IC&SR

Resource Persons

1. Dr. V. Balakrishnan
2. Dr. R. Krishnakumar
3. Dr. J. Raviprakash
4. Dr. M. S. Sivakumar
5. Dr. R. I. Sujith
6. Dr. M. Ramakrishna

Department of Physics
Department of Mechanical Engineering
Department of Chemical Engineering
Department of Applied Mechanics
Department of Aerospace Engineering
Department of Aerospace Engineering

2. Working Group (2)

Infrastructure, IT and Educational Technology (Technological choice, Upgradation, Maintenance)

Members

1. Dr. V. Kalyanaraman
2. Dr. S. V. Raghavan
3. Dr. S. Subramanian
4. Dr. M. S. Gopinathan
5. Dr. V. V. Sastry

Department of Civil Engineering, Convenor
Department of Computer Science and Engineering
Regional Sophisticated Instrumentation Centre
Department of Chemistry
Computer Centre

Resource Persons

1. Dr. V. Jagadeesh Kumar
2. Dr. S. Srinivasan
3. Dr. P. C. Deshmukh
4. Dr. Harish Chandra
5. Dr. Shankar Narasimhan

Department of Electrical Engineering
Chairman, Educational Technology Centre
Department of Physics
Central Library
Department of Chemical Engineering

3. Working Group (3)

Human Resources Management

Members

1. Dr. G. Subramanian
2. Dr. V. Ramamurthi
3. Dr. L. S. Ganesh
4. Dr. S. Krishnan
5. Dr. T. J. Kamalanabhan

Department of Aerospace Engineering -Convenor
Department of Applied Mechanics
Department of Humanities and Social Sciences
Department of Aerospace Engineering
Department of Humanities and Social Sciences

Resource Persons

1. Dr. R. Kalyanakrishnan
2. Dr. B. Yegnanarayana
3. Dr. S. Mohan
4. Dr. M. S. Shunmugam
5. Dr. V. G. Idichandy

Department of Computer Science and Engineering
Department of Computer Science and Engineering
Department of Humanities and Social Sciences
Department of Mechanical Engineering
Department of Ocean Engineering

4. Working Group (4)

Members

1. Dr. R. C. Janakarajan
2. Dr. P. Sankaran
3. Mr. N. Malayalam
4. Dr. B. Viswanathan
5. Dr. B. S. Prabhu

Resource Persons

1. Dr. T. T. Narendran
2. Dr. S. S. Gokhale
3. Mr. A. K. Pattabiraman
4. Mr. K. Panchalan
5. Dr. B. V. N. Rao
6. Dr. T. Suryakumar

Quality of Support Services

Registrar - Convenor
Chairman, Estate and Works Committee
Institute Engineer
Chairman, Council of Wardens
Department of Applied Mechanics

Department of Humanities and Social Sciences
Department of Aerospace Engineering
Deputy Registrar (Training and Placement)
Deputy Registrar (Academic)
Deputy Registrar (Finance and Account)
Deputy Registrar (Administration)

5. Working Group (5)

Members

1. Dr. K. V. S. Rama Rao
2. Dr. V. Ganesan
3. Dr. S. Srinivasan
4. Dr. D. Balakrishnan
5. Mr. A. K. Pattabiraman

Resource Persons

1. Dr. A. R. Balakrishnan
2. Dr. Shankar Narasimhan
3. Dr. J. Raviprakash

Marketing of IIT's products

Dean, IC&SR - Convenor
Department of Mechanical Engineering
Department of Electrical Engineering
Chief Techno Economic Officer, IC & SR
Deputy Registrar (Training and Placement)

Department of Chemical Engineering
Department of Chemical Engineering
Department of Chemical Engineering

6. External Study (1)

M/s. A. F. Ferguson & Co.

1. Mr. T. Shankar
2. Mr. C. K. Mohan
3. Mr. M. Sumanth

Resource Assessment, Mobilisation and Accountability Systems

Director
Consultant
Consultant

7. External Study (2)

M/s. Tata Consultancy Services

1. Mr. S. Mahalingam
2. Mr. T. S. Rangarajan
3. Mr. G. Srinivasan

Restructuring and Governance

Vice President
Head-Management Consultancy
Management Consultant

8. Committee Constituted to finalise report of Strategic Management Project

1. Prof. C. R. Muthukrishnan
2. Prof. M. S. Ananth
3. Prof. S. Srinivasamurthy
4. Prof. B. Viswanathan
5. Prof. M.R. Pranesh

Deputy Director
Dean of Academic Courses
Dean, IC&SR.
Dean of Students
Registrar

- | | | |
|-----|------------------------|---|
| 6. | Prof. L.S. Ganesh | Department of Humanities and Social Sciences |
| 7. | Prof. S.S. Gokhale | Head of Aerospace Engineering |
| 8. | Prof. M. Govardhan | Department of Mechanical Engineering |
| 9. | Prof. V.G. Idichandy | Ocean Engineering Centre |
| 10. | Prof. R. Rajagopalan | Department of Humanities and Social Sciences |
| 11. | Prof. T. Sundararajan | Department of Mechanical Engineering |
| 12. | Dr. K. Mangala Sunder | Department of Chemistry |
| 13. | Dr. K.N. Satyanarayana | Department of Civil Engineering |
| 14. | Dr. G. Srinivasan | Department of Humanities and Social Sciences |
| 15. | Dr. Koshy Varghese | Department of Civil Engineering |
| 16. | Mr. R. Sundaram | Industrial Consultancy and Sponsored Research |
| 17. | Mr. V. Suresh | Industrial Consultancy and Sponsored Research |

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THE NEW CURRICULUM - JULY 1998

1.0 INTRODUCTION

Judging by several external indicators, the B.Tech programme of IITM is a successful model that is worthy of emulation. The seats are in great demand, the inputs are of good quality, the quality of instruction is high, all the graduates are placed well-before they complete their programmes, and our alumni are doing very well in many parts of the world. However, many concerns have been expressed, especially in-house, regarding the category-wise distribution of the courses, the lack of informed decision-making in the choice of electives, the relevance of workshop practice, the effectiveness of the laboratory courses, and the need for more design orientation to the programme. Hence, an extensive revision was undertaken in 1996 and the New Curriculum was introduced in 1998.

1.1 Objective

The Objective of the Programme is to educate and prepare students for a variety of challenging careers in

- ❑ industry: production, service, R & D and design sectors.
- ❑ higher education in engineering and management.
- ❑ software development for applications in engineering and technology

1.2 Components

The New Curriculum is structured to include:

- ❑ a well-defined Knowledge component, consisting of coursework in a major professional area, a minor interdisciplinary area, basic engineering sciences, physics, chemistry and mathematics, humanities, social sciences and management and topics of current socio-economic relevance
- ❑ a Know-how component, consisting of laboratory courses, project work, industrial training and opportunities for individual initiatives
- ❑ a Character-building component that includes co- curricular and professional society activities and a case-studies-discussion course in professional ethics.

1.3 Novel features

The New Curriculum has many novel features

- ❑ Engineering courses taught from the first semester itself.
- ❑ Computer-aided drafting.
- ❑ Compulsory 6-week 2-credit industrial training programme.
- ❑ Mini-project option in lieu of a 3-credit course.
- ❑ 2 Non-graded courses to encourage learning for its own sake.
- ❑ One 3-credit course for self-study.

- ❑ Laboratory courses revamped.
- ❑ Engineering Design course for all freshmen to give them the flavour of design as a customer-focussed synthesis activity.
- ❑ A Minor Stream in an interdisciplinary area of current interest.
- ❑ Mathematics, Physics and Chemistry taught as topic-based courses; engineering majors can choose combinations of Physics and Chemistry courses subject to a minimum in each.
- ❑ Humanities courses to include a non-graded 3-credit course covering a study of Professional Ethics.
- ❑ Engineering skills category revamped: workshop and computer-aided drawing, revamped; glass blowing and photographic skills for experimental research included.
- ❑ 180 total credits; 161 minimum category-wise credits; 170 CGPA credits.
- ❑ Co-curricular Activities encouraged.
- ❑ Current Topics of social / industrial / national relevance to be covered as Extra-Curricular activity.

1.4 Category-wise Distribution of Credits

HSS and Management	HSS	9	3 ^a
Basic sciences	SPY&SCY	20	
Mathematics	SMA	14	
Basic Engineering	BES	15	
Engineering Skills	BES	8	
MAJOR PROFESSIONAL AREA			
Theory	PMT	56	7 ^b
Self-Study	PSS	3	
Project	PMP	6	
Laboratory	PML	6	
Industrial training	PIT	5	
Electives		6	
MINOR STREAM	MNS	12	
TOTAL CREDITS FOR A B.TECH DEGREE			180

^a One 3-credit course on Professional Ethics

^b Two 3-credit courses, one 1-credit Industrial Lecture course

1.5 The Minor Stream

The interdisciplinary minor streams currently offered are:

- Biomedical Engineering
- Computational Solid Mechanics
- Environmental Sciences and Technology
- Trends in Business and Finance
- Industrial Engineering
- Operations Research
- Financial Management
- Communication
- Engineering Project Management
- Theoretical Computer Science
- Materials Technology
- Physics for Modern Technology

1.6 Co-curricular Activities

Co-curricular academically oriented activities are designed to augment the learning process in a non-formal environment.

- Shastra – Annual Technical Fest introduced
- Professional Associations in each Department
- Hobby Workshop to be strengthened

1.7 Teacher-Student & Student-Student Relationships

Activities have been designed and taken up relating to the important aspect of improving human relationships among teachers and students.

1.8 Teacher Evaluation/Performance

A Cafeteria system of Teacher Evaluation/ Feedback has been introduced for an effective feedback on lecture-based courses to the teacher. A separate format has been introduced for feedback on laboratory courses.

EXECUTIVE SUMMARY

The primary objective of the Indian Institutes of Technology is to provide scientists and technologists of the highest calibre who would engage in research, design and development to help building the nation towards self-reliance in her technological needs ... Pandit Jawaharlal Nehru.

I. INTRODUCTION

The Indian Institutes of Technology (IITs), were established by the Government of India, as institutions of National importance. Their primary objective in the words of Pandit Jawaharlal Nehru was, “to provide scientists and technologists of the highest calibre who would engage in research, design and development to help building the nation towards self-reliance in her technological needs”. The activities of the Institute in various fields of Technology and Science are now being carried out by thirteen Departments and ten Academic Centres. The Institute has about a hundred well-equipped laboratories attached to the different Departments. It is spread over an area of 256 hectares of forest land, and houses a campus community of about 10,000 people. The Institute offers several course-based undergraduate (UG) and postgraduate (PG) programmes, as well as research-based postgraduate and doctoral programmes. It has, over the years, responded to environmental changes and user needs by redesigning curricula, offering new UG and PG programmes, and organising Continuing Education Programmes. It also undertakes a large number of Researches, Development and Consultancy projects sponsored by a variety of funding agencies, including the Government and Industry. Indian Institute of Technology Madras (IITM) has active linkages with leading Academic and Research organizations around the world.

Since its inception, the Institute has concentrated on academic and infrastructure development, and on recruitment of faculty and staff, towards achieving excellence in Education, Research and Services. In the past decade the technological, economic and policy environment of IITM has changed rapidly and hence, the Institute is presently at important crossroads. It needs to identify strategic directions for its future.

The Board of IITM set up a Strategic Planning Committee in 1996 and the Institute initiated the Strategic Management Project in May 1996 to build up internal capability for change. The processes of this institute-wide project were developmental, participative and learning in nature. The Project consisted of a series of coordinated interventions to bring about changes in the Institute’s directions, structure, interfaces and performance. Several Workshops and discussions were held with various stakeholders to develop a knowledge base and a consensus around key issues, in a cumulative, learning approach. The following seven areas of strategic importance to the Institute were identified for intensive study through internal taskforces and external consultants:

- Scenario Building
- Restructuring and Governance
- Quality of Support Services
- Human Resources
- Infrastructure Development
- Resource Assessment, Funds Mobilisation and Accountability Systems
- Marketing of IITM's Products

The Reports on these areas were widely discussed and debated to build a consensus. The Strategic Plan incorporates a variety of inputs and outlines the strategy recommendations and action plans to implement the strategy. These are summarized below.

II. ENVIRONMENTAL CONTEXT

The Strategic Management Project of IITM has been launched to respond to the recent radical changes in the Institute's environment such as:

The Knowledge Revolutions: The Information Technology (IT) revolution that is radically altering the whole world at an ever-accelerating pace touches every aspect of IIT life. It has a significant impact on the core of IIT's mission viz., the generation, preservation, dissemination, and application of knowledge. A second revolution is the Bio-Technology revolution with significant consequences to the engineering of life itself (including people), technologies that self-replicate and technologies that evolve. The bio-technology revolution, made possible in part by the information technology revolution, has indeed affected areas central to humanity - food, medicine and reproduction. The engineer of the twenty-first century can no longer afford to be ignorant of the fundamentals of the life sciences any more than he can be ignorant of Newton's laws and Maxwell's laws. Curricular changes are warranted in every field of engineering to enable students to cope with these knowledge revolutions.

The Need for Sustainable Development: Another important development is the beginning of an acute awareness of the need for proactive steps to make life sustainable on our planet. Engineering education for a sustainable future is central to this awareness. Future scientists, engineers, and managers must design technology and economic activities that sustain the natural environment, enhance human health and well-being, and live within the limits of natural systems. This calls for a long-term societal effort to make environmental and sustainability concerns a central theme in all education, particularly for engineers, economists and managers.

Shifts in Government policy: Recent Government policies reflect sharply changing budgetary support, encouragement of private funding in higher education, and regulatory mechanisms for upholding standards and quality in higher technical education.

Growing competition in higher technical education: Compared to the past, the Institute is in a fiercely competitive environment in all its activities: Education, Research and Services. There is competition to attract the best students; to recruit and retain faculty; to provide educational and research funding; to secure consulting assignments; and to offer technology as well as knowledge-based services.

Rapid and complex changes in Markets and Technology: Changes in the markets for living space/environment, health-care, educational services, consumer goods, transport and recreation have been rapid and complex in the last twenty years. Fundamental changes are also taking place in materials, information, medical, aerospace, ocean, energy and environment technologies.

Unprecedented growth in the service sector: The tertiary sector of the economy (services) contributes close to half of the Gross National Product, and has assumed ascendancy over the primary (agriculture) and the secondary (industry) sectors. The growing diversity of students, choice of courses, institutions, modes of delivery and location, the increasing role of alliances, and the increasing

concern towards value for money among educational clients, all contribute to the fundamental changes that are taking place in the markets for educational services.

Multiple dimensions of institutional accountability: In the recent past, parents and students, faculty and staff, and the Government were our main stakeholders. Presently, new groups like funding agencies, clients for services, industry, contracting organizations, local communities, and other international/national educational institutions also influence the nature of accountability of IITM.

New Forms of Knowledge Delivery: The open, democratic and un-edited nature of access to the World Wide Web has revolutionized earlier concepts of using computers and networks to create, store and disseminate information as well as to manage intellectual property rights, and to create viable economic models for Digital Library services. There is an urgent need to exploit the rapid advances in Information and Communication Technologies to meet the demand for unprecedented access to and enhancement in the quality of technical education in the nation.

The cultural context of the Institute is also undergoing a rapid transformation. The convergence of styles of operation between industry and the academe [e.g.: perception of change and its effects on organisational performance, orientation to market/customer needs, attitudes towards risk and uncertainty, and preferences for certain types of organizational structures and processes] is a significant feature of this transformation. It is, therefore, important that the Institute's strategic response to such major environmental changes must consider:

The utilization, performance and productivity of its resources.

The need for value addition or value creation for clients through altering the product mix, restructuring present activities and launching new initiatives.

The benefit from environmental opportunities in specific technologies by choosing areas of immediate relevance for research and technology development.

The strategies that could be adopted by the Institute are derived from the Institute's Mission Statement (see next section). A summary of the influences of the change strategies on Institute Mission outcomes follows this Executive Summary.

III. VISION, MISSION AND QUALITY POLICY

IITM's Vision statement is

"Our Vision is to be an academic institution in dynamic equilibrium with its social, ecological and economic environment striving continuously for excellence in education, research and technological service to the nation".

Our Mission is to :

Create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with due consideration for ethical, ecological, and economic issues.

Pursue research and disseminate research findings.

Provide knowledge-based technological services to satisfy the needs of society and the industry.

Help in building national capabilities in technology, education and research.

The Quality Policy talks about the manner of execution of the Mission. Our Quality Policy is to pursue global standards of excellence in all our endeavours namely teaching, research, consultancy and continuing education and to remain accountable in our core and support functions, through processes of self-evaluation and continuous improvement.

IV. EDUCATIONAL PROCESSES

Educational Processes are at the core of the Institute's functions, the main goals of which can be stated as:

Undergraduate Education: To provide an excellent under-graduate (UG) education that includes mastery of the fundamentals of Engineering, Science and Technology, an ability to conceptualize and formulate technical problems, and to find effective solutions for them.

Postgraduate Education: To provide an excellent post-graduate (PG) education (through course as well as research based programmes) that is primarily interdisciplinary, specialized, dynamic and focused on the application of advanced concepts and skills.

Research: To pursue, basic and user-driven research largely characterized by interdisciplinary inquiry to generate knowledge, develop technology and discover new and meaningful applications.

Continuing Education: To provide timely and relevant continuing education, imparting state-of-the-art knowledge and skills to diverse clients, enabling them to make superior professional contributions.

The design of an effective academic system is crucial to support the strategic activity mix of the Institute, proposed as a response to environmental changes. The key recommendations concerning Educational Processes are given below:

Academic reorganization: The structure of academic programmes at the Institute needs review and changes wherever necessary.

- The UG programmes need to be reorganised to focus on broad-based engineering education and on traditional disciplines. These programmes should continue to be offered by the Departments. A few interdisciplinary UG programmes, viz., Biotechnology, Engineering Physics, may also be offered.
- The PG programmes of the Institute should focus on specialized areas of knowledge, reflecting the research priorities of the Institute, the emerging frontier areas of Science and Technology and human resource manpower needs in the fast-changing professional S&T market. These should be offered as institute-wide programmes, wherever necessary.
- The faculty of the Institute should be placed in a matrix structure with dual coordinates: one in a Department dimension and another in a Research dimension.

Creation of New Departments: New Departments need to be created in response to emerging demands in frontier areas. For instance, a separate department of Biotechnology should be created with faculty strength of about 15, offering course-based as well as research-based programmes.

Flexible learning options and multiple pedagogical methods: The Institute, should consider offering new programmes/courses with flexible learning options, such as self-learning modules using modern educational technology, dual-degree programmes, lateral entry opportunities, and cross registration of students across institutions located close to each other. These will enrich the academic atmosphere and will also enable the Institute to reach out to a more diverse group of potential students.

Creation of specialized Schools: In the next five years, the Institute should create specialized Schools in selected areas such as Management, Information Technology, Energy, Environment and Manufacturing. These 'Schools' may be granted considerable administrative, financial and academic autonomy with corresponding accountability. Such autonomy is necessary if the Institute has to address the changing environmental needs effectively.

PG Education in select, frontier areas: The Institute should focus its research and its PG education efforts on select, frontier areas. Sixteen such areas have been identified in the Strategic Plan. These areas are :

1. Biotechnology
2. Chemical Physics and Molecular Biology
3. Communication Technology
4. Complex Systems
5. Computational Engineering
6. Development Studies
7. Energy Technology
8. Environmental Technology
9. Infrastructure Technology
10. Instrumentation and Control
11. Materials Technology
12. Measurement, Testing and Diagnostics
13. MEMS
14. Methodologies
15. Quality assured Design and Manufacturing
16. Transportation Engineering

The research programmes should be user-driven and performance-oriented, aimed at obtaining results in the medium-term. This will induce a more professional approach to research and enable the Institute to gain distinct competitive advantages in niche areas.

Building strategic alliances: Strategic alliances between the Institute and leading academic/research institutions and enterprises will be necessary for globalizing institutional activities. Some useful possibilities for deriving synergy from alliances include: (i) dual and joint degree programmes, (ii) student and faculty exchange programmes, (iii) joint research programmes, (iv) foreign or overseas campus programmes, and (v) specialized continuing education programmes.

Continuing education and Open-learning programmes: In keeping with the contemporary trends of internationalization of education, the Institute should develop and offer flexible, learner-centered, open-learning programmes using advanced educational technology. This will significantly enhance the outreach of the Institute and further strengthen its position as a leader in providing higher technical education to a variety of groups, besides the traditional focus of high school students and engineering/technology graduates.

V. HUMAN RESOURCES

Human resources are the most important among all the resources of the Institute. The goal of Human Resources Management (HRM) in IITM is to develop its human potential, consistent with the Vision and Mission of the Institute. The main recommendations on HRM are the following:

Developing a heterogeneous academic community: The Institute must aim to develop a heterogeneous academic community, which is necessary for technological innovation and excellence in learning. Such an academic community can generate diversity in academic/administrative thought and practice; and develop a cosmopolitan ambience in the campus.

Recruiting top-class faculty and staff: The Institute must bear in mind the current and projected need of well-qualified/experienced faculty and staff. In recruiting high-quality human resources it faces tough competition from various sources. The Institute's HRM policies (recruitment, compensation, career advancement, appraisal, etc.) must be such that they are able to attract and retain high quality human resources at various levels. This is an important challenge for the Institute.

Training of Employees: In order for the Institute to remain a world-class organization, its employees must have state-of-the-art knowledge and skills. The Institute must focus on training and improving quality through imparting new skills, and redesigning staff jobs. It should commit at least 2% of its salary budget (a norm among leading educational and R & D institutions around the world) for continuous improvement of human resources. HRM efforts must enable the employees to perform multiple tasks, in multiple roles.

Incentives for good performance: The Institute must offer an attractive monetary and non-monetary compensation package. The current performance appraisal norms and practices in the Institute need to be strengthened. The incentive structure associated with performance appraisal is currently weak. Major reforms in appraisal and career development are needed to retain and motivate qualified faculty and staff.

Outsourcing human resources in specific areas: The Institute should evolve policies to identify tasks that require outsourcing of human resources, without compromising on high quality.

Deploying technology for enhancing productivity and efficiency: Experience elsewhere in the world shows that Information / Educational Technology, strong complementary alliances, and improvement in productivity and efficiency can facilitate growth without a significant increase in manpower.

Rightsizing: This is the most crucial action to be performed by the Institute. The additional level of manpower needs to be only 20% higher than the present level even for doubling the level of present activities. The need to rationalize the use of human resources and rightsizing are in tune with the government policies.

VI. PHYSICAL RESOURCES

The infrastructure of the Institute consists of classrooms, laboratories, workshops, library, computing and communication facilities, educational technology facilities, and campus amenities for living, health-care, security and recreation. The quantity and quality of infrastructure are crucial for the competitiveness of the Institute in higher technological education and research, and also for its work culture and organizational climate. The Institute has to develop an action plan for maintenance, efficient utilization and up-gradation of existing infrastructure and creation of new infrastructure, within the bounds of emerging technological options and funding sources. This would enable IITM to become and remain a world-class institution in education, research and services. The main recommendations for infrastructure development follow:

Developing state-of-the-art facilities: Most of the physical infrastructure of IITM is three to four decades old. Therefore, significant new investments would be required for developing state-of-the-art academic and administrative facilities. The facilities must support the Institute's efforts to widen its reach among potential customers and firmly establish its image as a global leader in higher technical education and research.

Prioritizing infrastructural investment options: The initiative on infrastructure development is linked with the other initiatives in many ways. The notable linkages include: (i) the positive effects of high-quality infrastructure in attracting the best talent to serve as faculty and staff; (ii) the use of educational technology for augmenting teaching; (iii) the benefits of having a digital library enabling faculty and students to add value to the Institute's information/knowledge resources and raise finances there from; (iv) the impact of computing and communication networks on performance improvement, in terms of quality, delivery and flexibility, of academic and administrative activities. Such beneficial linkages must be considered in determining priorities for investments in infrastructure.

Adopting project management practices: The Institute must adopt proven project management methods to ensure that its infrastructure development projects meet the general requirements of timely completion, tight cost control and high quality of work. Well-executed infrastructure development projects at the Institute will strengthen its world-class status and give it a distinct competitive edge.

Developing strategic alliances for infrastructure development: The increasing emergence of specialised hi-tech organizations, the advantage of the Institute's location, the availability of excellent human resources at the Institute, and the aesthetic and functional features of the campus, can be leveraged by the Institute to develop strategic alliances with selected organizations for infrastructure development and use.

Ensuring effective utilization and maintenance of infrastructure: In order to achieve higher levels of productivity in the Institute, management control systems [e.g. computer-based Management Information System (MIS), Integrated Computing Environment (ICE)] have been evolved. They must ensure effective utilization and maintenance of all the infrastructural facilities.

Benchmarking: The availability and quality of infrastructural facilities are key criteria used in determining an institution's status in the world of higher technical education. They also have a profound effect on the ambience at the Institute. Therefore, periodic benchmarking of institutional infrastructure (and performance) is imperative, especially in a competitive situation.

VII. GOVERNANCE

The objectives of governance strategies are: to identify new tasks/roles; to design organizational arrangements for the smooth functioning of the Institute; and to develop policies for strategic alliances, for ensuring congruence between structure and strategy. The Institute's governance influences the agenda for all the other strategic initiatives. The key recommendations on governance are:

Implement the strategic activity mix: IITM's activities for the next decade should become a more productive mix of Education, Research and Services, while maintaining the current average faculty work-load mix of 40-25-25-10 for Teaching, Research, Services and Administration. Each of the activities in the new strategic mix should be chosen to maximize effective utilization of physical and

human resources, value addition and resource generation. Individual faculty members may be permitted to trade-off time among their tasks according to a mutually agreed, flexible, annual work plan.

Make the organization leaner, more professional and more focused: In order to achieve and sustain the new strategic activity mix, the Institute's structure must be reorganized to become leaner and more focused. In managing the increasingly complex affairs of the Institute, the Director should be supported by upto two Deputy Directors, Six Deans, with the following designations: Dean (Academic Courses), Dean (Academic Research), Dean (Administration), Dean (IC&SR), Dean (Students) and Dean (Planning). All support services (HRM, Infrastructure, Finance, Marketing etc.) should be strengthened with professional expertise and be designed to become leaner and more effective.

Redesign organizational processes: The structural changes in the organization will have to be accompanied by process changes for transactions within the Institute. These process changes have to be related to: effecting decentralization, increasing transparency, and establishing accountability, at all levels.

Strengthening the IPR role: In the current context, IITM while performing a predominantly academic role, should include a business role, nationally and internationally. With increasing emphasis on marketing and revenue generation, the activities of IITM should reflect an economic orientation. The organizational features for meeting the new goals should include greater customer responsiveness, higher flexibility, less bureaucracy and more professionalism. The SMP, therefore, recommends that a company, called The TechNovator be formed under Section 25 of the Indian Companies Act. 'The TechNovator', may be managed by professionals to (i) market Institute's products and services and (ii) to outsource services needed by the Institute. This company will thus act as an outreach arm of the Centre for Industrial Consultancy and Sponsored Research.

Forming strategic alliances: IITM must form selective strategic alliances with academic, research and industrial organisations for: (i) benefiting from the comparative advantage (e.g. lower cost, higher quality), (ii) securing attractive returns from larger projects that can be implemented only through a strategic alliance, (iii) leveraging resources for mutual benefit, and (iv) reaping the rewards that will accrue from establishing long-term partnerships founded on the principles of mutuality, synergy and complementarity.

Instituting conflict prevention and resolution mechanisms: The existing systems and procedures for conflict resolution and redressal of grievances need to be strengthened. An Office of Ombudsman should be established for redressing grievances and resolving conflicts.

VIII. BUILDING RELATIONSHIPS

Competition in the field of higher technical education is becoming increasingly significant. There is competition for attracting the best students; finding the best placement opportunities; recruiting the best faculty; securing project funding and consultancy work; getting suitable participants for continuing education; for entering into strategic alliances and for marketing the Institute's technology, products and services. To ensure a dedicated process for exploiting its Intellectual Property, the goals of the Institute ought to be:

To identify usable products and services of the Institute.

To adopt a promotional strategy, best suited for each in terms of:

- Reaching potential customers to meet their needs.
- Developing effective customer relations and services.
- Refining and expanding the customer base.

The following recommendations are made in relation to these goals:

Development of a knowledge base: Promoting IITM's value added products and services in a competitive environment require the development of a knowledge base. It should involve several linked databases on areas such as:

- External customers (needs, preferences, past transactions).
- Technologies (morphologies, life cycle status, developers and suppliers, patents).
- Funding agencies (programmes, priorities, past interactions).
- Internal effort and output (human resources, equipment and facilities, products and service accomplishments/capabilities).
- Related institutions and enterprises (objectives, programmes, performance).

A comprehensive knowledge base will provide the foundation for evolving appropriate promoting strategies to enlarge the Institute's reach.

Creation of IP arm of the Institute as a limited company (TechNovator): The Institute can keep in touch with market realities and be responsive to market changes only through a dedicated marketing organization. The TechNovator will have considerable flexibility and autonomy to pursue and conclude commercial transactions.

Development of product/service focused strategy: The Institute's range of products and services has expanded considerably, and the range and location of customers is also wider now. It is only a matter of time before the Institute's reach will have to significantly extend beyond India. A product/service-focused marketing strategy with customer/user orientation is necessary to develop and sustain the Institute's competitive advantage as a provider of hi-tech products and services.

Building strategic alliances: The faculty can concentrate on their professional work, while creating IP by effectively utilizing the Institute's resources, if strategic alliances are built with professional marketing organizations and commercial consulting firms. This will offer significant advantages to the Institute in terms of: (i) increased sales of its technology, products and hi-tech services; (ii) commercialization of the software produced; and (iii) productive involvement in contract/turnkey assignments and (iv) feedback for identification and choice of R & D projects.

Value addition and commercialization of software: Much of the software produced in the Institute is intrinsically valuable to Industry but does not feature the necessary operational packaging to make them user-friendly in the context of field use. Commercialization of this software, including user-friendly documentation, could be achieved through alliances with top-grade software houses which may also be given the marketing rights and the Institute can benefit through royalties.

Setting up a Technology Park in collaboration with alumni and industry: The idea of an Institute-promoted Technology Park presents a cost-effective opportunity for collaborative R&D. The Institute and industry will benefit mutually through the synergy between the knowledge and creative inputs of the former with the financial and professional inputs of the latter. This synergy is of great importance in the current context of intellectual property rights for technological innovations and patents.

IX. FINANCIAL RESOURCES

The Government of India is the primary source of funds for IITM. Other sources include student fees, research funding, consultancy and continuing education revenues, fees for various services, alumni contributions and grants. The expenditure trends indicate a shortfall in the availability of funds in the coming years. In keeping with the policies of the government, IITM will have to become increasingly self-reliant and utilize resources optimally. IITM has implemented the Fifth Pay Commission recommendations and has increased the student strength significantly in the recent past. These will increase the operating costs of the Institute.

The total investment in all the physical facilities of IITM, over the last forty years, estimated conservatively on a current cost basis, amounts to Rs.10000 million. Intensive efforts of fund-raising over the next few years will be needed to meet the capital expenditure for replacement, up gradation and creation of assets as well as meeting their operating costs. Hence the strengthening and the restructuring of the finance function are important. In this context, the goals of the Institute's financial system have been identified as the following:

Review the existing accounting system and its ability to support IITM's needs..

Recommend an accountability model (including systems and structural implications).

Assess the resource requirements for the future and formulate a resource-mobilization strategy for IITM.

Develop an implementation plan for the proposed strategy.

The main recommendations concerning finance are outlined here:

Implement activity-based costing: The Institute should develop activity-based costing systems for achieving cost control, performance measurement, budget preparation and pricing of services. The system will also enable the Institute to improve operational efficiencies when coupled with MIS and ICE.

Create responsibility centres: The activity-based costing systems will provide the basis to create and operate Cost/Profit/Responsibility Centres. The creation of these centres will lay the foundation for effective decentralization of financial and administrative powers. These centres will also facilitate the practice of Zero Base Budgeting (ZBB) to ensure de novo assessment of activities and cost control. The budgets, if prepared on a quarterly basis, will enable the close monitoring of actual expenditure and timely reporting for action. A conscious attempt should be made to move to budgetary control from the present practice of expenditure control.

Develop rational pricing practices: All the activities of the Institute should be priced based on full costs. This measure will increase income considerably. It will also enable the Institute to position itself competitively in the market for knowledge-based services.

Levy user charges: This basic principle should be adopted in all but a few selected activities. The user charges must reflect the cost of providing a service, especially for non-educational activities. The Institute should maintain a comprehensive list of services it can provide and their respective charges. This should be regularly updated.

Provide targeted, explicit and short-term subsidies: Subsidies should be provided only on a short-term and specifically targeted basis, where the activities involve the larger socio-economic issues of access, equity and

development. Objective criteria should be developed, to decide on cross-subsidies to Departments and Programmes that are not self-sustainable. The Institute should offer support to basic activities such as UG/PG education and long-term basic research.

Mobilise Resources: Initiatives for resource-mobilisation need to be undertaken. Various external sources of funds, within and outside the country. Their potential for support and their terms and conditions should be explored. A systematic effort should be made towards identifying opportunities for creating synergy through strategic alliances. This should be strongly linked with the marketing efforts of the Institute.

Reorganize the finance function: The finance function should provide the key inputs for resource-mobilisation from external sources. It should use expert advice to perform a variety of functions including fund-raising, treasury, financial accounting, budgetary control, and costing. This reform is necessary in order to develop the requisite skills/culture for dynamic financial management.

X. PLAN IMPLEMENTATION

Most of the proposed strategic change measures can be implemented internally. However, a few strategies may also require enabling provisions in the Institute's Statutes or Government policy.

During the implementation of the Strategic plan, IITM needs to make a major effort in benchmarking its activities. It will place IITM in relation to the best practices around the world, which are hallmarks of excellence. The benchmarking study will carefully analyze the processes and outcomes and present a set of meaningful goals for continuous improvement of IITM in the next decade.

To achieve the IITM mission outcomes, these external changes need to be pursued actively and accomplished over time. The implementation of the strategic change will be the responsibility of the Committee of Deans and needs to be monitored by an independent

Committee of five members (three external and two internal) who will provide quarterly reviews to the Institute community.

The plan envisions an Institute that has a reactive academic ambience and is intellectually stimulating. It should be administratively and academically autonomous, where all its activities are characterised by sustainable competitive advantage. The implementation of this Strategic Plan will enable IITM to achieve its Vision and enhance its status globally in the community of higher technical education by the next decade.

For the benefit of those readers, who are familiar with the management jargon, the influences of Change Strategies on Institute Mission Outcomes are indicated in a matrix format in the next Section.

XI. INFLUENCE OF CHANGE STRATEGIES ON INSTITUTE MISSION OUTCOMES

The influences of Change Strategies on Institute Mission Outcomes are indicated in a matrix format. They are derived from the Report, "The Strategic Plan of IIT Madras: Vision 2010", containing recommendations in six major areas of the Institute's operations: Educational Processes, Human Resources, Physical Resources, Building Relationships, Governance and Financial Resources.

The rows in the matrices contain the key recommendations on Change Strategies to be implemented in each of the six major areas. The columns contain the Institute Mission Outcomes that are sought to be pursued. The entry in each cell of a matrix indicates:

The strength of influence of a Change Strategy on the Institute Mission Outcome as:

+	=>	mild influence
++	=>	moderate influence
+++	=>	strong influence

The temporal manifestation of influence, specified in terms of short-run (S) [< 5 years] or long-run (L) [> 5 years] impact.

For example, in the case of Chapter VII - Governance, one of the key recommendations is, "Making the organization leaner and more focused". The expected influence of this Change Strategy on the Institute Mission Outcome, "Sustainable Competitive Advantage", is indicated as ++L; this means the influence is expected to be moderate and will manifest in the long-run.

The other influences indicated in all the matrices can be interpreted in a similar manner.