

The Changing phase of research: Opportunities and challenges

A. Subrahmanyam
Department of Physics
Indian Institute of Technology Madras, Chennai
Email : manu@iitm.ac.in

The globalization and liberalization of the economy has brought in significant changes in the life styles of the common man. The notable changes that took place is in the educational sector. Many new Universities, Educational and Research Institutes have been established both in the public and the private sectors. Research has been rapidly changed its stand from passion to profession. Research and development (R&D) has been identified as the key factor not only for the growth but also for the sustenance of the achieved growth. Innovation, creativity and analytical approach are the key factors for a quality research. The information technology has given an added dimension to the conventional educational perspective in general and research in particular.

The present article confines to the research and development efforts in basic science and engineering and technology disciplines. Without going much into the statistics, one can easily visualize that the funding for research and the personnel involved in research as professionals has increased many fold compared to the situation about ten fifteen years ago. Also it is note worthy that a research degree is now mandatory for entry into many teaching positions in universities / educational institutions and for mid-level scientist positions in research institutes. The research work carried out may conveniently be divided into : Degree mode, Project mode and Mission mode. In Degree mode, the objective is training for independent thinking, good analysis, logic and rationale; this is the familiar Doctoral Degree mode in many Universities and national institutes for teaching and research. The project mode addresses specific problems with a logical methodology of work in a fixed time frame; this project mode co-exists along with Degree mode. The mission mode is an execution of

well defined problem with an equally well defined result in a well planned manner with almost milli second precision and bulls eye accuracy in goals. The common factor in all the three modes of research is the planning and execution through technical manpower.

In the present day scenario, the funding possibilities for research in all the three modes have opened up widely. Simultaneously, the accountability also has been increased enormously. The sponsoring agencies, both private and Governmental, are devising checks and balances in terms of periodic monitoring not only to have mid course corrections but also to culminate projects which have severe road blocks. Another important dimension to this research scenario is the establishment of research centers by the multi nationals attracting the cream of talent in research with unbelievable salaries.

There are three important aspects arise in the changing face of research: (i) how to secure trained manpower to implement the projects (ii) how do the investigators cope up with the higher pressures in executing the work as per the time schedules and as per the stated goals of the project and (iii) what are the real processes and procedures for evaluation of the success of the projects.

In the Degree mode, the main task is to train manpower for professional research. There have been detailed regulations both for admissions and execution methodology by the Ministry of Human resource development and the University Grants commission. The admission is through a selection test at the national level. Once the student (known as "Research Scholar") is admitted to an institute, he has to qualify another test (called "Qualifying exam" or similar) may be after a year, in order to be eligible to submit his "Thesis" on a research problem suggested by a "Supervisor". The progress of the scholar is monitored periodically with a provision for mid course correction for either the research problem or for the methodology or for both. In general, the time taken to complete a Doctoral program ranges between four to six years depending upon

the infrastructure, nature of the research problem, motivation levels etc. These Research scholars are the main supply of the Trained Personnel for the other modes of research. At this stage, the teacher and the taught will have a one to one interaction (may be similar to Gurukul system except for evaluation / monitoring methodology). The taught has to be in complete consonance with the teacher.

In the project mode, the involved personnel are expected to analyze the problem methodically and systematize the methodology adopted to execute the work elements. This requires analytical capacity, sufficient information and knowledge base and skill in implementing the work schedule efficiently. If the project is being executed by a group, one is expected to express his ideas / methodology as clearly as possible to the team members and also to the other scientists. One of the main criteria is to work in a group but valuing individual contribution. Some Institutes provide an incentive to the Project staff, if qualified, to register for a Ph D degree.

Mission mode demands thorough knowledge of the subject and highest caliber and professionalism of the team to execute in cohesion for success. If the mission fails, the team also should be capable of failure analyses and has to re-do the project again on mission mode.

The investigators under the Degree Mode and Project modes, mostly, are the Faculty in Institutes of higher learning and universities. From among the many disciplines of the Institutes and Universities, the basic sciences and engineering departments attract much of the research funding. The promotion / selection for a position (Assistant /Associate/Professor) in most of the Universities made it mandatory for the faculty to muster a minimum number of guidance of Ph Ds along with a prescribed number of minimum research publications in peer reviewed journals. The student who joins under this program (after the requisite selection process) is awarded a Half time Teaching and Research Assistantship

(HTRA) mainly to cope up with his living expenses and also to gain experience in the teaching and research methodologies. However, he / she may have to pay for the tuition fee. The Ph D guidance demands considerable time from the faculty.

It is very interesting to note that there is a necessity rather than an urge among the younger faculty to apply for project grants and to implement them as efficiently as they can in order to climb the ladder in their careers. And winning a project grant in itself is an achievement under the present most competitive conditions. These faculty now have to find a balance in their work schedule to deliver their teaching commitments as well as to reach the set goals in the project. In the process of executing projects, one has an additional advantage of building a good laboratory / algorithm / analyses techniques which is an asset to the basic infrastructure of the Institute and the country. The research component automatically enhances the teaching power of the faculty.

The real implementation of the ideas in the project (or a topic in the Degree mode) is by the Research Scholars. How competent and professional are these Research Scholars? These are the students who are fresh from colleges: many of them are very raw in their ideas, approach and vision. These people are also the commodity in global demand. The supply for this global demand is expected to be met from India, China and to some extent Korea.

The present day scenario is rather dismal: the research scholars are totally dependant on the faculty. The spoon feeding of the topic of research, the methodology, analytical methods and in short every thing they expect from the Faculty. What they have is a pair of hands and in some cases a little brain. Most of the Project Personnel are not in a position even to write a technical report. This dependence on the Faculty imposes severe constraints of time and responsibility on the part of faculty.

The present day Research Scholar (and the Project Associate) lack: communication skills, analytical and rational thinking, pro-active nature to approach the research problem and the time management. His/her dependence on the “Research Guide” most of the times turn out to be a burden than an active interaction. Many Institutes prescribe a first level course on research methodology: a way to approach the research problem, a technique to sharpen the available skills or to acquire new skills required for the topic. But much needs to be done. One of the possible solutions is to catch the research minded or research oriented students at pre- Research level (may be Masters in Science and Engineering and Technology) and impart research methodology. These “pre-research brains” may be exposed to Summer training camps in prospective Institutes (these practices are in use but limited to a selected a few Institutes). The Project component of the Master’s Degree needs to be strengthened with the help of the Research Institutes and Universities. A program similar to that of “Orientation” (which is well thought and well implemented) as followed by most of the Multinationals for their research staff needs to be prescribed for all the research scholars. There should be more awareness of research frontiers in the colleges through lecture series by eminent researchers on a regular basis.

In the project mode, the investigators in Educational Institutes and Universities have different challenges. So far, the time to be invested for project work, per se, is not being accounted in their regular “Load”. Thus, there is an inequality in the work load among the faculty who work on projects from those who do not opt for any projects. The stringent monitoring mechanism (which requires periodic technical reports to be submitted), particularly from the projects sanctioned by the Multinationals, leaves an enormous burden on many investigators. Though many Institutes have streamlined approach towards the financial and accounting of transactions and purchase procedures, still a lot more is to be done in relieving these work elements from the investigator. As an investigator, one has to be knowledgeable in the rules and regulations of not only the funding agency but also of the implementing Institute. The faculty in US, Europe and Singapore

count their time spent towards the execution of Project in terms of finances, also give a value for the equipment available with them; which is not the trend in our country. They can opt for help in their teaching and the required finances are built into the project costs. The other important point about building infrastructure (equipment) from project funds require a maintenance grant even after the project is closed; generally, these funds are to be committed by the implementing institutes but it is not done in our country. Thus, the infrastructure at many places is becoming a burden instead of asset.

The evaluation mechanism of research needs a closer look. For example, once the PhD degree is awarded, it is treated equally from among the several Institutes. Rarely, the PhD theses are rejected or asked for a rewriting. There are enough cases of plagiarism both in ideas and in content. A sincere faculty slogs for five to six years to produce a quality work and another produces a theses in almost one year but both are awarded the same Degree. Some Institutes stipulate two examiners for the thesis and one examiner invariably should be from abroad; some Institutes assess the quality of the thesis within their own Institute. There are also instances where the thesis can be “purchased”. These evaluation problems arise if the Research Scholar applies for a Post Doctoral positions abroad. The question is how to bench mark and what yard sticks can measure the quality. One of the measures may be is to depend upon the published work in peer reviewed journals.

The important message is that a lot needs to be done in fostering and nurturing research in our country in spite of the fact there was a lot of effort is being made in streamlining the Research efforts. We should make our research more pragmatic and we should be able to attract diverse talents and cultures so that a true “ coherent synergy” (as coined by Dr Chidambaram, Principle Scientific Advisor to the Cabinet) can be achieved.