CHAPTER 4

SPECIAL INTEREST GROUP MODEL FOR RESEARCH AND DEVELOPMENT

4.1 INTRODUCTION

Engineering education and engineering research have played important roles in shaping the destiny of different countries. Engineering research involves the acquisition of new knowledge and its application in creating novel artifacts namely devices, structures, procedures and processes (Clark 1997). Engineering research is becoming more complex in that it is increasingly inter and multi-disciplinary. The value of engineering research lies in its capacity to solve real-world problems. Engineering research has provided the systematic underpinning's for the design, analysis, production & operation of products and systems (Gottlieb et al 1997).

Engineering Institutions and Universities play major roles in streamlining and supporting research leading to knowledge transfer to the stakeholders namely the students, Public and Industries. A relevant and appropriate research in an area could help the teachers present their view points to the students explicitly (Stallings 2001). A teacher carrying out contemporary research could do so by involving undergraduate and post graduate students. The students in turn would be exposed to recent developments and current trends in their respective fields. Hence, there is an urgent need for incorporating research culture in second level engineering institutions, which primarily concentrate on teaching only (Streveler et al 2006).
4.2 THE SCENARIO

4.2.1 Global Scenario

Currently, higher education is drawing tremendous attention in both developing and developed countries. In the developed countries the emphasis is on maintaining their edge in innovation and generation of knowledge (Stallings 2001). To maintain their competitive superiority, the developed countries are investing heavily in Research and Development (R&D) both in the private as well as the state universities.

Almost all the western universities have federally funded R&D centers charted to apply advanced technologies for the betterment of humanities. The R&D activities in such institutions focus on long term technology development, prototyping and demonstration of the outcome. Problem based interdisciplinary research to produce innovation and taking the outcome, the market has been made as a standard practice. These universities are particularly noted for their openness to multi disciplinary research at every level, from the lab to centers. Concentrated and well defined efforts and smooth and efficient networking with outside world have been the hallmark of universities such as Massachusetts Institute of Technology (MIT), Stanford, UC Berkeley, Georgia Tech, Kungliga Tekniska Hogskolan (KTH) and Stockholm.

4.2.2 Indian Scenario

India faces enormous social challenges as well as opportunities for rapid development in the new millennium. Our unprecedented economic growth, the values of knowledge and education shared by a billion diverse people, and the investments made over the last half century, all point to India’s potential future as a knowledge economy with high level human resources in science and technology driven global village (Patil 1997).
The main thrust is to facilitate development of human resource that is capable of utilizing available knowledge to create wealth and of generating new knowledge and innovations. This is sought to be done by improving the higher education and research profiles of universities and institutes (Bayley et al 2003).

The Prime Minister of India, Dr. Manmohan Singh, spelt out succinctly the challenges and directions for our future as a knowledge economy while launching the Knowledge Commission in the year 2007. He said “At the bottom of the knowledge pyramid, the challenge is one of improving access to primary education. At the top of the pyramid, there is need to make our institutions of higher education and research world class. The time has come for India to embark on a second wave of nation building. Denied this investment; the youth will become a social and economic liability”.

Higher Learning Institutions like Indian Institute of Science, Indian Institutes of Technologies, University of Managements, Indian Institute of Information Technologies, National Institute of Technologies and few long serving institutions have addressed the issue of research and development for the nation building through quality systems in their own respective ways. The alumni of Indian Institute of Technologies have come together to form a forum called “panIIT” which addresses among other things the mechanism for conducting appropriate R&D and the process to take them to common.

4.3 ACADEMIC AND SPONSORED RESEARCH IN ACHIEVING EXCELLENCE

Academic research is multifaceted. It serves to expand the engineering knowledge base; contributes to the exploration and application of specific areas of technology; provides systematic contexts and infrastructure for the diffusion and transfer of engineering and technological information; and provides training for most of the future leaders in engineering across the spectrum of research,
development, design, and other engineering functions. Research helps to connect practice to teaching. The research relates both current and likely future real-world problems (Robert 1995).

The sponsored research is that research work which receives grant from any private or government institution or industry. Sponsored research is one major aspect of the whole research activity. In order to carry out meaningful technological research, one may need large-scale, capital-intensive infrastructure. For providing such an environment, several funding agencies sponsor small, medium or large scale projects (Creswell 2004). Through these sponsored projects, faculty members are able to achieve their research and development goals. In some cases, the knowledge or expertise of faculty members can be used effectively for technology development in industry. These projects not only provide a meaningful real-world experience to faculty members but also provide new ideas and problems. Besides sponsored research and consultancy projects, the Institute also provides testing services to the agencies outside. These services provide certification in some cases (Norman et al 2005). The whole of academic and sponsored research efforts in an institution would inculcate a sense of pride among the faculty and students leading to excellence.

4.4 PRESENT APPROACHES

All over the world, Institutes of higher learning and universities have established their own models for sustained research in pursuit of knowledge for the betterment of the society. The institutes have unique research policies for academic research and sponsored research (Karl Smith 2006). Their research efforts are well defined and focused. In these institutes, the domain areas of research are multiple in numbers. In domains where experts are not available, these institutes hire research professors from elsewhere. The students joining these institutions are either from international poll or best at the national level.
The federal governments fund these institutes liberally for infrastructure as they are generally identified as research institutions. Utilizing of the infrastructure and expertise available in these institutions. Fundamental research and applied research in respective areas are being carried out. The outcome includes publications in conferences or journals and products meeting the specification of sponsoring industry. Further, the ambience is such that inter and multi disciplinary researches are promoted. Institutes such as MIT, Stanford, UC Berkeley, Georgia Tech, KTH and many universities have succeeded in synthesizing research and teaching.

In the Indian Context, higher learning institutions such as IISc and IITs have established good research approaches. In the recent past, research professors of different IITs have come together to form networks so that their research knowledge is shared. This has been done in areas like telematics, Communications and image processing. Researchers of these institutes have attempted to disseminate the knowledge gained in electronic system design and mixed signal circuits to university colleges. Consortium initiative by IIT Chennai in the area of Network Security is another effort to elevate the research potentials of smaller institutions. Research support to institutions and training of faculty from university colleges have been the mile stones of Indian higher learning institutions (Sdefuni et al 1999).

4.5 **ISSUES**

- Institute funds are no longer sufficient for development of R&D infrastructure and, that sponsored research is not simply a desirable option but provides the indispensable core for all R&D activities.
- One major difficulty is the manpower problem. Several projects have provision for hiring project staff on a full-time basis. However, the manpower available for carrying out research is
usually ad-hoc in nature and is not of desirable quality. This situation is serious. At present, the Institute allows post-graduate students to work in some projects on part-time basis. However, even in such cases, the efforts are limited and the quality of the output is far from satisfactory.

- The Institute has some positions of Research Scientists and Engineers. This group is expected to devote full-time for R&D activities. However, this cadre is small and the impact of this cadre on the overall R&D profile of the Institute is still limited.
- The new R&D infrastructure requires an entirely different kind of profile. In short, a faculty member is able to write an excellent research proposal but is not able to carry out the plans due to a lack of sustained quality manpower. On the other hand, there is considerable unemployment of semi-skilled or unskilled labor around the campus. There is always pressure on research investigators to absorb this kind of manpower.
- Lack of teams working on a project is one such factor. Setting up goals which themselves are mediocre in nature is another aspect. Poor remuneration as well as compensation package for research staff is also a reason why the quality of research staff is not up to a desired level.
- The research equipment is not maintained properly and not replaced quickly if it has become obsolete. Furthermore, some new equipment need to be added every year. These facilities do provide some infrastructural support. However, it cannot fully meet the needs of faculty. In short, providing state of the art research equipment and maintaining it are essential for a good research environment.
• Space is another issue. Even though it may look trivial, it has been found that laboratory space required for carrying out research, in general, and sponsored research, in particular, is not sufficient. In some cases, faculty members need sufficient space to set up experiments or provide space for research staff. Faculty is likely to get some financial rewards from this activity. In fact, an associated issue is that of faculty members becoming entrepreneurs (Patil.1997).

Advance the development of education research capacity within the engineering community is the need of the hour.

This thesis addresses the role of research and development initiatives that can propel university colleges in attaining excellence. The issues with these institutions are multifold, but interrelated. As a Unit, most of these institutions lack focused approach. Research has not been considered as integral part of the growth process. The administration, faculty and students have a mindset that the institution is primarily teaching institution and research is optional. In the context of globalization an institute without research base will not be able to survive the market pressure. The salability of the students will also come down.

Unlike institutes of higher learning, these institutes may not be able to pursue research in all areas and spread thin. Identifying few areas and maximizing the outcome will be the better way. These institutes cannot adopt the models and approaches of higher learning literally, though customized model based on their experiences could be the way. Sustainability is another issue which needs to be addressed along with the concept of deliverables as per specification.
4.6 METHODOLOGY

4.6.1 Survey

This section presents a methodology adopted to identify the ingredients required to enhance the Research and Development and in the process of quality of engineering education. A study was carried out so as to collect primary data from the stakeholders of engineering education. The stakeholders included students, teachers, parents, industry professionals and managements of colleges. While perceptions of all the stakeholders are important, teachers have a major role to play with regard to Research and Development.

Respondents were faculty members randomly selected from various Engineering Colleges like Autonomous, Government, Government Aided, Self financing institutions. They have the knowledge and experience to identify the factors in order to enhance the quality of engineering education. It can be assumed that this sample selection provided openness, randomness as well as quality awareness in the response. Two hundred and Forty (240) members representing opinions from various parts of Southern District of Tamil Nadu were personally collected for data collection.

The interest here is to find out the impediments currently existing in the engineering education sector and to prioritize the initiatives needed for the improvement of quality of education. A Survey among the teachers resulted in the short listing of Thirty nine (39) factors that are to be addressed to achieve excellence in technical education. The factors relevant to Research and Development were Ten (10). Among them, Four (4) factors are relevant to Academic Research of the institution. The rest Six (6) factors are relevant to Sponsored Research. In critical, influencing factor for Academic Research and Sponsored Research are shown in the Figure 4.1 and Figure 4.2.
4.6.2 Analytical Hierarchy Process

The overall objective of the thesis is to propose a model to achieve excellence or enhance quality in education. The AHP was implemented in two stages. The first stage was to identify the major areas for overall objective namely, Teaching and Learning Process, Research and Development and Industry Institute Interaction. In the second stage each of the above areas was independently analyzed based on the responses of the stakeholders. The aim of this analysis was to prioritize these influencing factors with respect to each of the four areas identified. In the area of Research and Development, prioritizing was done among the four (4) factors pertaining to academic research and among six (6) factors pertaining to Sponsored Research.

4.6.3 Local Priorities and Consistency of Comparisons

The stakeholders were requested to rank the factors with respect to their importance in improving the performance of the engineering education.
Then, they were asked to compare the relative importance of these factors with each other and to mark them on a given 1-9 scale. The same procedure was repeated for all the factors coming under each area. Respondents were requested to note two points while filling up the questionnaire.

Sample Questionnaire is attached in the Appendix 1 and 2. The ranking of alternatives and the individual attention of the researcher to each of the responses assured consistency of response. The details of the Judgmental matrix, priority vectors, Maximum Eigen value (\(\lambda_{\text{max}}\)), Consistency Index (CI) and Consistency Ratio (CR) for the two levels of the hierarchy are exhibited in Table 4.1 and 4.2 respectively.

**Table 4.1 Analytical Hierarchy Process for Academic Research**

<table>
<thead>
<tr>
<th>Academic Research</th>
<th>SIG Based</th>
<th>Resource and Knowledge Sharing</th>
<th>Interaction with Similar groups</th>
<th>Attending and Organizing Conferences</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIG Based</td>
<td>1.0000</td>
<td>3.0779</td>
<td>3.1620</td>
<td>4.8893</td>
<td>52.35%</td>
</tr>
<tr>
<td>Resource and Knowledge Sharing</td>
<td>0.3249</td>
<td>1.0000</td>
<td>1.2631</td>
<td>2.9353</td>
<td>20.87%</td>
</tr>
<tr>
<td>Interaction with Similar groups</td>
<td>0.3163</td>
<td>0.7917</td>
<td>1.0000</td>
<td>3.0419</td>
<td>18.84%</td>
</tr>
<tr>
<td>Attending &amp; Organizing Conferences</td>
<td>0.2045</td>
<td>0.3407</td>
<td>0.3287</td>
<td>1.0000</td>
<td>7.94%</td>
</tr>
</tbody>
</table>

It is observed that \(\lambda_{\text{max}} = 4.0598\), C.I. = 0.0222, R.I. = 0.9 and C.R. = 2.22% for the identified factors that could influence engineering education.

There are four variables influencing academic research. Stakeholders rated specialization based research topics’ (52.35%) as the main for academic research. The other preferences are given to Resource and Knowledge Sharing
(20.87%), Interaction with similar groups (18.84%), and Attending and Organizing Conferences (7.94%) respectively as mentioned in Table 4.1. The above factors are to be considered in the respective order for achieving quality in engineering education.

**Table 4.2 Analytical Hierarchy Process for Sponsored Research**

<table>
<thead>
<tr>
<th>Sponsored Research</th>
<th>Visits to Institute/Industry</th>
<th>Open house</th>
<th>Proposals</th>
<th>Presentation</th>
<th>Professional Society membership</th>
<th>Alumni Interaction</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visits to Institute/Industry</td>
<td>1.0000</td>
<td>4.9729</td>
<td>3.0779</td>
<td>6.7437</td>
<td>8.4143</td>
<td>6.7099</td>
<td>43.93%</td>
</tr>
<tr>
<td>Open house</td>
<td>0.2011</td>
<td>1.0000</td>
<td>0.3141</td>
<td>5.0834</td>
<td>6.4214</td>
<td>3.2161</td>
<td>15.10%</td>
</tr>
<tr>
<td>Proposals</td>
<td>0.3249</td>
<td>3.1837</td>
<td>1.0000</td>
<td>7.0113</td>
<td>8.5283</td>
<td>4.8893</td>
<td>26.50%</td>
</tr>
<tr>
<td>Presentation</td>
<td>0.1483</td>
<td>0.1967</td>
<td>0.1426</td>
<td>1.0000</td>
<td>3.2378</td>
<td>1.2631</td>
<td>5.85%</td>
</tr>
<tr>
<td>Professional Society membership</td>
<td>0.1188</td>
<td>0.1557</td>
<td>0.1173</td>
<td>0.3089</td>
<td>1.0000</td>
<td>0.3105</td>
<td>2.77%</td>
</tr>
<tr>
<td>Alumni Interaction</td>
<td>0.1490</td>
<td>0.3109</td>
<td>0.2045</td>
<td>0.7917</td>
<td>3.2206</td>
<td>1.0000</td>
<td>5.84%</td>
</tr>
</tbody>
</table>

It is observed that $\lambda_{\text{max}} = 6.4376$, C.I. =0.0875, R.I. = 1.24 and C.R. = 7.06% for the identified factors that could influence engineering education.

There are six variables influencing Sponsored Research. Stakeholders rated ‘Visits to Institute/Industry’ (43.93%) as the main for Sponsored Research. The other preferences are given to Proposals (26.50%), Open house (15.10%), Presentation (5.85%), Alumni interaction (5.84%), and Professional society membership (2.77%) respectively as mentioned in Table 4.2. The above factors are to be considered in the respective order for achieving quality in engineering education.
4.7 SIG MODEL FOR RESEARCH AND DEVELOPMENT

In order to increase the rigor of engineering education research, engineering practitioners need to be introduced to the literature and methods of educational research. This thesis provides an opportunity to establish the structure and mechanism for training faculty to conduct rigorous engineering education research through a collaboration of engineering educators, learning scientists, and faculty developers (those who assist faculty enhance their teaching).

Institutions continue to play a role in the systematic organization, extension, and explication of engineering knowledge. Through the involvement of graduates and faculty, and via the influence of published research, institutes will remain important in many industrial sectors long after early stage academic research has found its way into an industrial product.

This SIG model aims at improving the Quality Excellence of any institution. This quality excellence is achieved by continual improvement in the three most important areas of teaching and learning, research and development and industry institute interaction. To start with the theme area of the department is identified. This theme area is chosen in such a way that it is multi disciplinary and is an emerging trend in that area. As our theme area is multi disciplinary, it may also involve some specialization from other department. So the sub areas involving the same department are identified, as we are at present concentrating on one particular engineering department of the institution.

Now the proposed idea of the formation of the special interest group is carried out. These groups are formed in such a way that they cover all the sub areas of the department. Each group will now concentrate only on one particular
area, and the group tries developing itself as a specialist in that particular area. And this group will include both faculty and students. They may either be specialist in that area or might be interested in that particular area to join up with that special interest group. Identifying the theme area is common for any theme-based learning system. The Table 4.3 shows the different SIGs of the department to analyze the Academic and Sponsored research process in Engineering Institution.

In these groups various research works are carried out on the theme area of the group. The researchers are basically of two types: academic research and sponsored research. The academic research may either involve projects that are a part of the engineering curriculum of the students or may be the doctorate research work of the faculties. All faculty members participate enthusiastically in these SIG activities. One sees a professional growth and advantage in pursuing these activities.

The academic research also involves publication in national and international journals and conferences on their area. This will also help them to update their knowledge on the current trends in their theme. In order to obtain research supervisorship there are certain norms to be satisfied and also the requirements of facilities are to be available.

These specifications are very easily satisfied in the SIG model as the faculties will have expertise in the area and the required infrastructure is also provided for the group. There are also similar norms for Ph.D and MS admissions which can also be easily achieved by means of the SIG model. When faculties and students involve themselves in research they also get to interact with the experts in the theme area. Once in a small group the progress of the research scholars can also be regularly monitored. The publication of any research bulletin also becomes easier once inside a specialized group.
Table 4.3 Factors and Justification of Academic Research

<table>
<thead>
<tr>
<th>Factors</th>
<th>Departments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Research</td>
<td>SIGs</td>
</tr>
<tr>
<td>Research Topics – SIG</td>
<td>The research work of a student or a teacher is based carried out in the area of their specialization and interest.</td>
</tr>
<tr>
<td>Resources and knowledge</td>
<td>Performing research involves sharing resource sharing and knowledge with other experts and organizations expanding the knowledge pool</td>
</tr>
<tr>
<td>Interaction with similar</td>
<td>Having discussions with other groups and groups working on same area provide a greater degree of exposure.</td>
</tr>
<tr>
<td>Attending and organizing</td>
<td>Attending and organizing conferences on their conferences. special interest groups help in diversifying their knowledge and also paves way for meeting with experts in that area.</td>
</tr>
</tbody>
</table>

These are the Academic Research factors with justification of all the influencing factors to analyze the SIGs in all the departments explained in Table 4.3.

The formation of special interest groups helps greatly in carrying out sponsored research. Researchers are usually sponsored based on the capability of the faculties and students in the institution. The researchers are also granted based on the effectiveness of the project proposal. The specialization in the area helps in submitting an impressive project proposal.

In order to carry out academic research effectively, the faculty members need large-scale, capital-intensive infrastructure. For providing such an environment, several funding agencies sponsor small, medium or large scale
projects. The sponsored research gives grant from any private or government institution or industry to develop infrastructure to the SIG laboratory. It also provides solutions for the practical problems faced by industries.

Through this sponsored research and consultancy projects the knowledge or expertise of faculty members can be used effectively for technology development in industry. Consultancy projects not only provide a meaningful real-world experience to faculty members but also provide new ideas and problems for further research.

The infrastructure of the group is also very effectively utilized and they can also be developed by the funding provided by the sponsoring organization. The reviews to check the progress of the research will also be conducted by personnel from the organization. So there may be a lot of informative interaction with the experts.

Conferences can be organized with the aid of the industries. Workshops and STTP’s can also be conducted in combination with the organization. The group can also do consultancy work for organization in their theme area. Thus, we make sure that we provide expert consultancy.

Faculty is likely to get some financial rewards from this activity. In fact, an associated advantage is that of faculty members becoming entrepreneurs. One can also develop testing facilities and can carry out product development in collaboration with other organizations. All the above said can be implemented with continuous interaction with the sponsoring organization and also with the grants received from them.
### Table 4.4 Factors and Justification of Sponsored Research

<table>
<thead>
<tr>
<th>Factors</th>
<th>Departments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponsored Research</td>
<td>SIGs</td>
</tr>
<tr>
<td>Visits to Institute / Industry</td>
<td>Visits to industries and undergoing training in the industries providing research funds related to their interest subject.</td>
</tr>
<tr>
<td>Open House</td>
<td>Various industries and organizations visit the laboratory facilities of the college, making room for more developments and suggestions.</td>
</tr>
<tr>
<td>Proposals</td>
<td>Request for various projects and facilities are made to companies to establish relationship and to obtain grants.</td>
</tr>
<tr>
<td>Presentations</td>
<td>Presenting the various research works done in an area helps in obtaining more research and suggestions in that area.</td>
</tr>
<tr>
<td>Professional Society membership</td>
<td>Membership in various professional societies helps in working on project sponsored by those societies and also to participate in contests and conferences.</td>
</tr>
<tr>
<td>Alumni Interaction</td>
<td>The college alumni working in various organizations join hands with the college in raising the students to greater heights</td>
</tr>
</tbody>
</table>

These are the Sponsored Research factors with justification of all the influencing factors to analyze the SIGs in all the departments explained in Table 4.4.
There are many factors that greatly improve academic research. Some of them are listed below. A proper topic choosing plays a great role in any research. This topic is now selected on the basis of SIG. Thereby both the faculty and the students will actively involve themselves in the research in their group.
Within a group resource and knowledge sharing improve thereby improving the intensity of academic research. By interacting with similar groups in various other institutions new research ideas will develop. Attending and organizing conferences based on the theme area result in improved interaction with experts which in turn results in improved research activity, for both faculty and students within the group.

By laying out excellent proposals to sponsoring organizations we can receive grants from any public or private organizations for doing research. By performing visits to the industry or organization, we can identify what sort of research the organization is working on and eventually we can request for grant in that area. Open house of our laboratories can be conducted which will enable the industries and organizations to have a clear picture about the resources and infrastructure in our institution. The SIGs can impress the organization by giving out an interesting presentation about the college and its facilities. Becoming a part of any professional society will help us in acquiring up-to-date knowledge on their theme area and also to open up new ventures in research. By interacting with the college alumni, they get to know details about the sponsorship that are offered by different companies.

Eventually, there will be a considerable increase in both the academic and the sponsored research. With respect to academic research, the number of journals and conference publications increase. Students will start showing greater interest in higher studies as well as in procuring Ph.D. degrees. Researches in collaboration with other organization and institution will also substantially improve.

There will also be an increase in the number of sponsored projects. The quality and quantity of collaborative projects are also increased. Internship
can also be received from organizations for both students and staff. The group can also involve itself in product development in that group. And any new product will result in patent and IPR. And they can also involve in MoU’s with companies.

Thus, an overall development of academic research and sponsored research result in enhanced research and development eventually leading to Quality research. The proposed SIG model is shown in Figure 4.3.

4.8 IMPACT OF THE MODEL

The impact of SIGs on research and development in the college are presented here in respect of faculty, students, industry and society.

4.8.1 Faculty

Few years back there used to be myth that affiliated engineering institutions are primarily teaching institutions. In the post globalization era, there is a paradigm shift among educators and administrators that teaching without research back can never produce employable graduates. Promotion of research in affiliated institution should start with faculty members not with infrastructure, though it is also needed. Though there had been sporadic efforts to promote R&D activities in these institutions, the major issue is that there are no focused research groups, like the ones in institutions of higher learning. The SIG model proposed by author has made an impact in R&D in respect of academic and sponsored research. The SIGs were able to identify and work in sub areas of theme areas. The diversification was smooth. The SIG in vision systems has identified Image processing, Image Analysis, pattern recognition, Remote sensing, RADAR and medicine and machine vision applications. The novel
techniques applied in appropriate applications lead to contributory publications. Further, these outcomes have been presented to the funding agencies like DRDO and ISRO to receive sponsored research projects. Staff and students of this SIG have become the working group for the project. The exposure to real time projects has helped teachers to evolve novel teaching methodologies. The author strongly believes that these were possible to this extent only because of the formation of SIGs, the focused research group. The college right now has around ten SIGs.

4.8.2 Students

Becoming part of academic and sponsored research projects has provided them exposure in beyond curriculum applications. Few of them have been provided with stipend as part of earn while you learn scheme. Joint publications with teachers on a focused area have given them a chance to plan their higher studies. The hands on experience of working with high end equipment and software have lead to excellent placement.

4.8.3 Department

The department is able to project its strength better and the road map for growth is drawn along the lines of SIGs. End to end infrastructure is planned and established. The SIG on RF systems have planned and evolved such a way that the R&D infrastructure available in RF lab will allow a staff or student to model, analyze, design fabricate, test and measure majority of RF systems. These ends to end facilities have lead to the establishment of centers of excellence and could be shared with other institutions as well.

4.8.4 Industries

The Industries in India are now looking at educational institutions to carryout research in their area of interest. This is because the work pressure in
industries and the infrastructure investment constraints. However, they are interested in interacting with institutions have focused research groups that their research support in respect of infrastructure and faculty internship becomes useful to both the industry and institution.

M/S TVS interconnect Support in their base station antenna design and testing. Up on interaction, the focus research and the infrastructure built, through SIG model impressed them and hence have come forward to support the department further. Though affiliated institutions may not be able to replicate the institute of higher learning, the special interest Group model has the potential to emulate the growth in identified areas.

4.8.5 Society

The academic research by the vision group in pattern recognition using remotely sensed data has been conceived as change detection in urban areas. The water, shelter, roads have been analyzed in Madurai district with the help of students, staff and N.G.O. The report has stated information for micro and macro planners.

4.9 RESULTS AND DISCUSSION

The publications are an essential part of the research activity of an institution. The Figure 4.4 and Table 4.5 show the number of books and journals published and also the publications in conferences from the year 1998 to 2008. We find that there is a sudden rise in the number of publications in the year 2003, the year in which SIG was implemented. We see that both students and teachers show increased interest in their area of specialization resulting in increased publication. The increase is more prominent in the years 2006, 2007 and 2008.
Table 4.5 List of Publications (1998-2008)

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td>6</td>
<td>15</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>15</td>
<td>14</td>
<td>18</td>
</tr>
<tr>
<td>Journals</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>10</td>
<td>11</td>
<td>19</td>
<td>28</td>
<td>32</td>
<td>38</td>
<td>42</td>
</tr>
<tr>
<td>Conferences</td>
<td>38</td>
<td>45</td>
<td>61</td>
<td>41</td>
<td>52</td>
<td>82</td>
<td>165</td>
<td>169</td>
<td>168</td>
<td>175</td>
<td>189</td>
</tr>
</tbody>
</table>

Figure 4.5 Doctorates
Apart from publications and sponsored projects more improvement in research is seen in pursuing the doctorate. The number of faculties who obtained their doctorates has increased over the year and the number of faculties pursuing doctorate has also increased after the implementation of SIG in the year 2003 as shown in Table 4.6. This proves that there is an increase in the research activity as shown in Figure 4.5.

At the beginning of the SIG formation, one can see some new trends emerging in the R&D work of the Institute. Funding agencies are sponsoring several interdisciplinary and integrated schemes. The group is working closely with the faculty. It provides sustained funding for research in the thrust areas.

A modernized Communication Laboratory was established with the support of Agilent Technologies and College Management. A center for innovation and incubation (Thiagarajar Advanced Research Centre (TARC)) was established with the assistance of TIFAC-CORE. This facility will encourage entrepreneurial activities in the emerging areas of RF systems; machine Vision, digital Signal processing and Thin Film Technology. New initiatives for establishing an Antenna Measurement research center in the field of RF systems, NI (National Instruments) supported Electronics Laboratory and Advanced TI (Texas Instruments) supported Signal Processing laboratory have also been taken up by Institute. These are the outcome of the proposed SIG model as shown in Table 4.7 and Radar diagram shows the outcome of the Research and Development activities during the year 1999–2008.
Table 4.7 Outcome of Research and Development

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Publication – Books, Journals and Conference</th>
<th>Ph.D Degree*</th>
<th>Collaborative Research*</th>
<th>Projects Independent*</th>
<th>Internship*</th>
<th>IPR / Patent*</th>
<th>Product*</th>
<th>Consortium projects and MoUs*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>27</td>
<td>15</td>
<td>23</td>
<td>15</td>
<td>20</td>
<td>Nil</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>2000</td>
<td>29</td>
<td>15</td>
<td>25</td>
<td>14</td>
<td>24</td>
<td>Nil</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>2001</td>
<td>28</td>
<td>15</td>
<td>21</td>
<td>17</td>
<td>28</td>
<td>Nil</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>2002</td>
<td>37</td>
<td>15</td>
<td>24</td>
<td>19</td>
<td>34</td>
<td>3</td>
<td>13</td>
<td>26</td>
</tr>
<tr>
<td>2003</td>
<td>42</td>
<td>21</td>
<td>26</td>
<td>20</td>
<td>38</td>
<td>6</td>
<td>24</td>
<td>31</td>
</tr>
<tr>
<td>2004</td>
<td>46</td>
<td>21</td>
<td>25</td>
<td>24</td>
<td>42</td>
<td>4</td>
<td>29</td>
<td>37</td>
</tr>
<tr>
<td>2005</td>
<td>49</td>
<td>21</td>
<td>27</td>
<td>28</td>
<td>46</td>
<td>6</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>2006</td>
<td>58</td>
<td>51</td>
<td>29</td>
<td>33</td>
<td>59</td>
<td>7</td>
<td>43</td>
<td>64</td>
</tr>
<tr>
<td>2007</td>
<td>65</td>
<td>51</td>
<td>34</td>
<td>38</td>
<td>62</td>
<td>10</td>
<td>48</td>
<td>73</td>
</tr>
<tr>
<td>2008</td>
<td>74</td>
<td>51</td>
<td>46</td>
<td>44</td>
<td>66</td>
<td>14</td>
<td>70</td>
<td>45</td>
</tr>
</tbody>
</table>

*Percentile

Figure 4.6 Outcome of Research and Development – 1999 Data
Table 4.6 shows the different outcome of the research and development and also each outcome is numbered as shown in Figure 4.6–4.15. Before implementing the SIG concept, in the year 1999, the Publications of Books and Journals were about 27 percentile, at the same time the IPR/Patent was not done during this year because of not focused for particular Area.

**2000**

![Figure 4.7 Outcome of Research and Development – 2000 Data](image)

Because of resource persons interaction is very minimum during the year 2000, The Publications of Books and Journals were about 29 percentile, at the same time the IPR/Patent was not done during this year.

**2001**

![Figure 4.8 Outcome of Research and Development – 2001 Data](image)
During the year 2001, the Publications of Books and Journals and Internship were about 28 percentile at the same time the IPR/Patent was not done during this year.

**2002**

![Diagram](image)

**Figure 4.9 Outcome of Research and Development – 2002 Data**

During the year 2002, the Publications of Books and Journals were about 37 percentile, and also internship percentile were increased to 34 percentile at the same time the IPR / Patent was about 3 percentile.

**2003**

![Diagram](image)

**Figure 4.10 Outcome of Research and Development – 2003 Data**
During the year 2003, the Publication of Books and Journals were about 42 percentile and that was the period SIG was formed, further its AHP weightages also corroborated to 56%, which results higher because of Resource and Knowledge Sharing (AHP 20.87%). IPR/Patent was about 6 percentile since the faculty initiatives on the presentation (AHP 5.85%) to the industries on various proposals are minimal and also faculty members are least aware about becoming the professional society membership (AHP 2.77%).

2004

![Figure 4.11 Outcome of Research and Development – 2004 Data](image)

During the year 2004, SIG was implemented. The Publications of Books and Journals and Collaborative Researches were improved to 46 percentile because of (AHP 52.35%) focused research (SIG based research topic) had initiated. At the same time the IPR/Patents were about 4 percentile. Attending various Conferences for the faculty was minimal and also faculty members are least aware about Attending Conferences (AHP 7.94%) and Alumni Interaction (AHP 5.84%) are minimal.
During the year 2005, after implementation of this SIG model, the Publications of Books and Journals and Collaborative Research were improved to 52 percentile, because of (AHP 52.35%) focused research (SIG based research topic) has initiated and Visits to Industry/Institute (43.93%). At the same time the IPR/Patents were about 6 percentile because of Open house (AHP 15.10%) is minimal.

Figure 4.12 Outcome of Research and Development – 2005 Data

Figure 4.13 Outcome of Research and Development – 2006 Data
During the year 2006, SIG was implemented, after implementation of this model, Consortium projects & MoUs were about 64 percentile. Because of (AHP 43.93%) visiting to industry, proposals (26.50%) have started. At the same time the IPR / Patent was about 7 percentile because Alumni Interaction (AHP 5.84%) is minimal.

![2007](image)

**Figure 4.14 Outcome of Research and Development – 2007 Data**

During the year 2007, after implementation of this model, Consortium projects & MoUs were about 73 percentile, because of Interaction with similar groups (AHP 18.84%) has started. At the same time the IPR/Patent was about 10 percentile. To the industries on various proposals are minimal and also faculty members are least aware about becoming the professional society membership (AHP 2.77%).
During the year 2008, the Publication of Books and Journals were about 74 percentile and that was the period SIG was fully implemented, because of continuous improvement in SIG based research (AHP 52.35%) and Resource and Knowledge sharing (AHP 20.87%). IPR/Patent was about 14 percentile, because continuous Interaction with Alumni (AHP 5.84%) is minimal.

The graph depicts a clear picture of the gradual improvement in Publication – Books, Journals and Conference, Ph.D Degree, Collaborative Research, Projects Independent, Internship, IPR/Patent, Product, and Consortium projects & MoUs from the year 1999-2002, during which SIGs were not implemented. As a result of the implementation of SIG from the year 2003-2008, there has been a drastic increase in all these parameters. Where 1 to 8 co-ordinates shown in the graph corresponds to Publication – Books, Journals and Conference, Ph.D Degree, Collaborative Research, Projects Independent, Internship, IPR/Patent, Product, Consortium projects and MoUs respectively.
4.10 SUMMARY

Technology is forever changing. New areas are continually evolving. As new areas become relevant and important, they need to be developed. This aspect of R&D planning needs to be done by faculty members in groups. Special Interest Group activity is one to plan for future R&D work, the concept of group research is vitally important. In this chapter, the influencing factors of Academic and Sponsored research were found out through Analytical Hierarchy process. As SIGs were implemented, the academic and sponsored research were increased in a great manner. As an outcome, publication, Collaborative research, product, internships are gradually increased. This results a number of companies in sponsoring and setting up of laboratories in the department and engineering institution. Thus the academic standards and research activities would be improved to a great extent and the students would get a good exposure to various technologies in progress. Because of this great improvement, it will lead the nation and society.