

TECHNOLOGY TRANSFER - GERMAN SCENARIO

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NEED AND IMPORTANCE OF TECHNOLOGY TRANSFER

Technology Transfer (TT) has become a major phenomenon in global economy. It is being considered as key to industrial competitiveness. Technology generation, dissemination, patenting, licensing from Higher Technical Education Institutes to industry, especially small and medium scale enterprise are some of the current issues before the nations. Technology level has become the key determinant of a nations economic well being. Therefore efficient organisation, and management of technology transfer, Technology development, in any nation, more so in India, where there are ambitious plans of industrialization, technical education and research, is the need of the hour.

Nearly development of Technology in laboratories and dissemination through usual methods of education, training, publication is not enough, although essential. The new technologies need to be transfered quickly, efficiently to industry to increase their productivity. Effective partnership between academics and industry in tech-

nology transfer is found to revitalise both the industry and institute. They both thrive on each others support.

Today, in India there exist no technology transfer department in most of the academic and research institutes. However, the consciousness to set up such department is increasing. Technology transfer, usually known as Extension, however exists only in agriculture Universities, in India.

The aim of this survey and study is therefore to draw lessons of experience from Germany and indentify models which could be adopted in Indian environment to build a healthy and regenerative relationship between its industry and technical education institutes.

ABOUT SURVEY-METHODOLOGY

The survey was not an exhaustive study, carefully developed and systematically administered, with carefully selected sample of respondents. Rather it was based on interviews of scientists, professors, administrators, students working at several German research Organisations, Universities, Polytechnics, industry etc. Most of the respondents were from Karlsruhe region and a few

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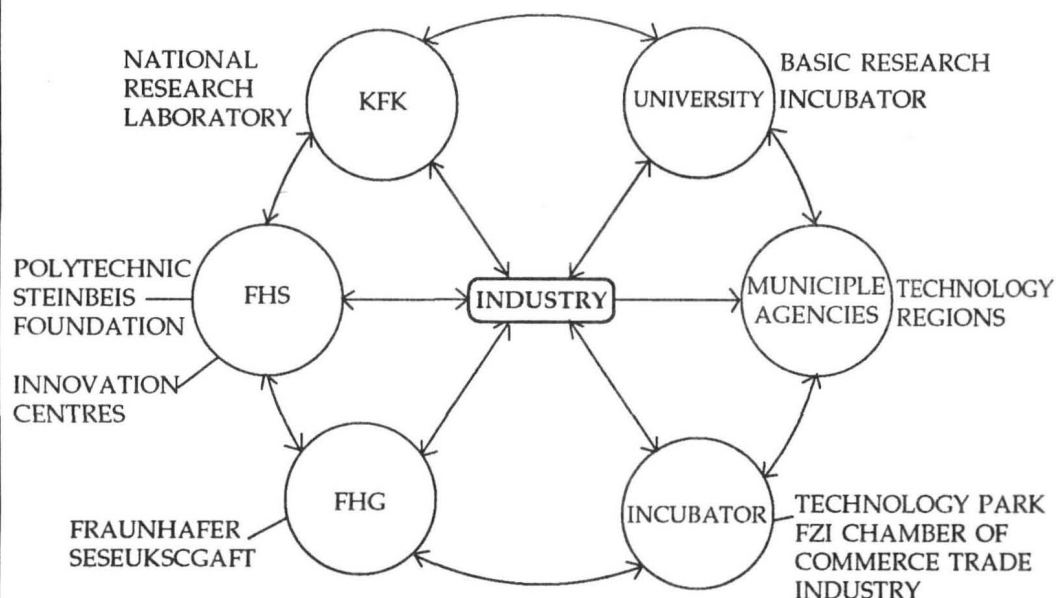


Fig. No. 1 SHOWS VARIOUS AGENCIES IN TECHNOLOGY REGION KARLRUHE AND THEIR CONNECTIONS WITH EACH OTHER

were from Berlin, Stuttgart, Hamburg and Braunschweig. The interviews and discussions were conducted by the author himself.

Some obvious themes and trends emerged from this study. They would be very useful to Engineering Colleges, Polytechnics, and other research institutes, which are contemplating to work in research besides teaching and be a major player in regional development. The way technology transfer is organised, supported and carried out in Germany, in an integrated manner by research laboratories, Universities, Polytechnics, Innovation centres, technology

parks, steinbeis centres, chamber of commerce have many positive aspects.

POSITIVE ASPECTS :

German Government, both federal and State, have taken a positive view and supported research at national laboratories, Universities, inhouse research in industry, Polytechnics, chamber of commerce etc. and installed organisation to transfer research findings to industry, to develop new products processes, so as to maintain Germany as a Leading player in world economy. The government have sanctioned significant financial resources about 3% of GDP and

human resources and put at the disposal of research institutes in both the public and private sector. Government believes in "Public good" through applied research leading to new products, processes and techniques. Such innovations although at the cost of public resources are no doubt of significant value to the private companies or industry, but they also ultimately benefit the consumers and people at large. Innovation is the key to progress and prosperity so is understood by common man. They believe that those who innovate will lead, and those who do not will lag behind. It is this attitude and respect for scientific research which is reflected in funding scientific institutions and other actions to promote research and its transfer to society.

The European commission with head quarter in Brussels has also been laying emphasis on R&D and technology transfer for maintaining competitiveness of European industry. They have devised a number of programmes like Erasmus, Esprit, COMETT Leonkardo-da-vinci for research education, training in new technology, and to avoid technological obsolescence. Germany being a member country has been also implementing a number of projects funded by European commission in various Universities and Laboratories.

It will thus be seen that there is full support from top i.e. Govt. of Germany, and European commission for technology development and technology transfer which is positive factor.

MULTIPLE APPROACHES :

The activities of technology transfer

are conducted by multiple organizations which work in a network and not in isolation. The industry interacts with appropriate organizations, one or more depending upon the type of industry, level of technology and field of specialisation. The various organizations in Karlsruhe Technology region are depicted in the form of diagram as shown in figure No. 1. It shows various agencies in Technology Region Karlsruhe, and their connections with each other.

It will be seen from the figure that there are various agencies generating and transferring technology to industry. All these agencies function in an integrated manner. They are mutually supportive to each other, and also competing. This is the second positive aspect of German system.

The university, and national laboratories largely involve in basic research, while, Stenbies centres, Innovation centres, Incubator, FHG involve more in applied research. Big companies are found by and large to interact with national laboratories, university and FHG, while small and medium interact more with steinbeis, incubator, and research companies like FZI exclusively set up in the region. There is however, no hard and fast rule. It may appear that there is duplication of effort, many organizations doing the same work. But it is purposefully designed to be so to develop a competitive spirit among themselves, and avoid monopoly.

UNIVERSITY TECHNOLOGY TRANSFER OFFICES :

There are 88 universities with science and technology discipline in Ger-

many. Majority funding to Universities is from State Government. About 20% come from Central Government especially for capital investment like construction of buildings, equipment etc.

States have been active on technology transfer and have created technology transfer offices in most of the Universities. In Baden Wurtemberg State with a population of 1,02,34,000 there are nine Universities in which 2,21,000 students study, of which about 105000 are in Science and Engineering. At University of Karlsruhe there is in addition a Intellectual Property Right (IPR) and licensing office providing services to all nine Universities.

The first of such offices was set up in the late seventies. In each office there are 7 to 10 persons, consisting of technical experts and supporting staff.

The mission of this office is to maintain industrial liaison, assessment of regional needs for new technologies and management of University outreach to the commercial sector; by doing four activities, which are as under.

- a) IPR and licensing - The office consults and supports members of Universities with a view to improve commercial exploitation of scientific research results. It offers.
 - Confidential consulting to faculty in all questions relating to Intellectual Property Right applications.
 - financial support for IPR applications
 - commercial exploitation of invention
 - IPR searches in international and national data bases.
- b) Fairs and exhibitions - Inventions,

new projects and all services offered by University are presented in fairs like Hannover, to inform about the latest results in science and research.

- c) Research funding - It facilitates obtaining funds from public and private sources, like European commission, to various faculty.
- d) Advanced education and Training - It offers to companies information concerning continuing education programmes to up grade the competency of working engineers, scientists etc.

There is a history of positive working relationship between individual professor and industry. Most of the professors come from industry at middle age with their contacts, insights and influence on professions. Both academic and industrial respondents mentioned that it is this academic business relationship which is very important and valuable and adds value substantially to both. Professors coming from industry at middle age obviously relate research and teaching best to the needs of industry. Some of them while working as professors in University, work as honorary Directors in national or private research Laboratories, and some of them have their own business. This enables them to find training places for students in the industry and also jobs for outgoing students. The system is commented well by student respondents, University administrators, and professors. This relationship between professors and business has been at the back of good technology transfer in Germany. It provides professors an opportunity to do consulting in

an industry relevant to their scientific expertise, and to receive a steady flow of real world research projects, topics for graduate and doctorate students, along with funds.

Till recently it was assumed that inventions would be completed to the market needs only in company laboratory, seeds of which however would be shown in University Laboratory. Now with global pressure on competitiveness, Universities are taking projects to completion up to patenting and licensing. The trend of University Staff is towards seeing the fruits of application of research findings in industry. It is believed that there is a greater charm for researcher to make new discoveries, but his pleasure is heightened when he sees that they have a direct application to practical life.

UNIVERSITY AS INCUBATOR :

The Technology transfer office is maintaining close links with the innovators working in the University. The University is providing infrastructure to innovators to develop and carry out work on new ideas. One such case is of Dr. Sauter in mechanical Engineering which deserves mention.

Dr. Sauter has done his Ph.D. on finite element Method - application to optimization. He continued further research with a view to commercialise it, using University equipment, which he was permitted. Three more staff joined him. Now he has developed a software, which has won prizes. Companies are approaching him for his advice. He has also registered his own company and is planning to shift to Innovation centre.

He spoke very high about the role of TT office and the University which helped him crystallising his project into a innovative venture. He however, expressed about difficulties in obtaining loans from banks, which insist on security. The venture capital fund scheme is not so developed in Germany.

Similarly, in machine design. Department, it is noticed that the dept. does lot of technology transfer to companies like Diemler Benz, Bosch, through students project work, contract research etc. they have obtained seven patents and many innovative projects in association with TT offices. With the coming of Korea in market for I.C. engines, it was told that German companies have become alert and are contracting more and more research to this department.

There are many more cases of this type in University departments like chemical, electronics, civil etc.

TECHNOLOGY INNOVATION CENTRE : (INCUBATOR)

This is a scheme from regional Government. It, was introduced in the year 1984, and today there are more than 100 centres in operation in Germany. The scheme is meant for hi-Tech entrepreneurs, who have new ideas in new technologies (to give Technology Push) with high opportunities. The space and infrastructure is given on low rent, so that the entrepreneurs can concentrate more on their project ideas, rather than infrastructure and on other things.

One such centre, "Technologie fabric" is in Karlsruhe located adjacent to the University. It is managed and main-

tained by the chamber of commerce. There are about 10 persons looking after the operation of centre. The entrepreneurs are provided here central facilities like Fax, parking, meeting room besides space on low rent. They are also given management and technical advice on demand. Presently there are 45 enterprises inside, and many are wanting to move in Additional buildings which are under construction. The enterprises develop technology here and move out in a period of about 5 years.

It is reported by Dr. Stephan, manager of the chamber of commerce that the scheme is very successful. The factors which contribute to success include nearness to University. The entrepreneurs are in close contact with the University for technical support. Many of the entrepreneurs are graduates from this University.

The manager of the Technology fabric mentioned that there is a pool of scientists, knowledge workers in Karlsruhe who would like to have space in incubators. After five years, he said the enterprises have no difficulty in moving out as at that time their requirement of space is much more, and the rent in fifth year as per agreement between them is also high. Management and control of incubator is with one agency, namely the chamber of commerce. This is the other factor contributing to success. Berlin centre is found to be the best and other centres have varying degree of success depending upon leadership quality of the person incharge. This scheme is implemented in many countries and deserves to be implemented in India.

They see no difficulty on shifting from this place after 5-6 years. Then they are nursed well and need no more support from this fabric.

Similar units known as "Technology Park" were visited by the author in Braunschweig, Harburg, and Berlin. Braunschweig University has taken a lead in establishing the park adjacent to its premises. About 100 companies are functioning in this park in the buildings owned by University. It has been set up in the year 1984 and since then many companies have taken birth in this Technology Park, grown well and migrated to industrial estates. Such companies maintain links with the University professors and researchers.

The park of Harburg is also an offshoot of the technical University Harburg. This park has huge premises of about 100 acres and three buildings. With the increasing demand for space in this park, the authorities have undertaken expansion. Harburg is relatively less industrialised place. The Technical University Hamburg has been set up 15 years before along with the technology park with the aim of developing the area. It has been successful, so remarked the President of the University.

At Berlin, an authority known as WISTA has been set up after Unification of Germany to develop east park of Berlin. This authority has taken up establishment of Technology Park and Hombolt University in this area. Already Incubator of environment Technology and Electronics are completed. There are hundreds of companies in them. The programme is very ambitious aiming at transforming the economy

completely. The M.D. of WISTA who, has come from Industry, is very optimistic about the success. This project deserves to be emulated in India.

The Fraunhofer Institute for Systemtechnik and innovations vorschungs Karlsruhe have done an evaluation of this scheme in Germany. They have reported that there are about 170 centres in the country and they are doing a good work. They have added value to the industrialization and improved income and employment. The regional economy by virtue of such centre has improved. The centres are further being expanded.

STEINBEIS TECHNOLOGY TRANSFER CENTRES :

This is a scheme initiated by Baden Wurtemberg in 1983 through its ministry of science and technology. It is to function as a problem solver clearing house for SMES, utilising the existing strong network of R&D institutions, Universities as well as individual professors and experts. Its winning strategy has been total identification with individual, enterprises, tight formulation of projects which address their problems, rigorous search through its data base.

Today there are 220 centres, with about 3500 experts (full and part time) doing service to 15274 enterprises. Most of the centres are based at technical colleges.

The underlying principle being to obtain intensive co-operation between academic, commercial and Govt. institutions. It makes use of existing research infrastructure in FHS, University and other institutions. They have a financial independence but they must work as

profit centres, and not as cost centres.

The author has visited six of them in Karlsruhe in the areas of computer, refrigeration, electronics, construction and found them working successfully. The heads of centres are professors, employing 5-20 employees on full time basis. Students are also employed for whom this work is counted as project. The scheme gives a valuable feed back to professors, who in turn do more research or learn more and teach better in classes.

INSTITUTE FOR INNOVATION AND TRANSFER (IIT) :

It is a innovation centre set up in the polytechnic of Karlsruhe, as per the scheme of State Govt. It is operated in 25 other centres in the State. The unit has a head and fifteen other employees. They do only research and no teaching. The research is done mostly on projects given by companies on payment. The IIT earns the salary of 15 employees through contract research.

IIT makes utilization of polytechnic infrastructure besides, it has some equipment purchased by itself in contract research projects on grants received from State Govt. 11 Professors of the FHS are also working in this centre, for which they do not get extra but a reduction in work load. Those who work in Steinbeis Technology Transfer Centres as consultants, get feed back from industry, and to cope with industry assignments engage themselves in research in IIT, which is interdisciplinary.

IIT conducts seminars on research done and participates in fair at Hannover, presently 9 projects are in

hand of which 2 are of long term nature.

Dr. Link the head, said the success of scheme depends on the ability of the leader.

FORSCHUNGS ZENTRUM INFORMATIONATICK (FZI) :

It is a pvt. Ltd. Company, an offshoot, of the University of Karlsruhe in the area of Information Technology. It was started in University and remained there for one & half years and then moved to its own premises which is adjacent to University. It is supported by the State Government.

The company undertakes research contracts in the area of I.T. It employs 120 researchers on full time and 250 on part time. Six professors of the University are honorary research directors. It has thus close links with the University and derives its strength from it. Many students and staff work in this company on part time basis.

It has competitors like Steinbeis centres, FHG Lab, and other companies.

This is a good model worth emulation in India.

FORSCHUNGS ZENTRUM KARLSRUHE (FZK) :

It is a very big research laboratory, employing about 4000 persons of whom about 1000 are scientists, The institute is financed by Government. It is involved in fundamental research, but also undertakes contract research.

The laboratory has a Technology Transfer and Marketing Department in which 16 persons work. Dr. Just is the head. This office has granted hundreds of licences of technologies to pvt. com-

panies FZK provides licences and also training to personnel who are using licences. SMEs normally do not go to FSK, It is only the big hi-Tech companies who go for licensing of FZK.

The Lab has very close links with the University. A few professors from Karlsruhe and other Universities work here as head of research departments. Many Ph.D. and Diploma students visit this lab for project work.

This is a unique feature of German system bringing about integration of Universities and research laboratories. It is missing in India and deserves emulation.

FRAUNHOFER SOCIETY :

The fraunhofer Society for promotion of applied research (Fraunhofer - Gesellschaft - FhG) was founded in 1949 to "pursue research and development in the spheres of natural Sciences and engineering on behalf of industry." FhG maintains 36 research labs at various locations in Germany, one of which is in Karlsruhe, covered in the survey. FhG has a staff of 5000, of whom 1500 are scientists and engineers. About 30% budget comes from Government about (20% from central, 10% State) the balance 70% is earned through contract research sponsored by agencies of the federal Government, the state and by private industry. Over the past ten years, industry sponsored project research has been the major growth factor for the society, while support from Government as a percentage has decreased from 45 to 30, the total FhG budget increased almost two times.

Expansion of Grant funds through

Federal Ministry for Research and Technology (BMFT - Bundes Ministerium Fur Forschung and Technology) for projects that jointly involve industry and academic for Market oriented technologies.

Applied research is supported by federal Government principally through BMFT, and to a lesser extent, through ministries. Approximately 40% BMFT's grant go to applied research and collaborative projects in research areas of high economic priority, known as Market oriented technology promotion. Such projects are implemented in co-operation with many Universities.

RECOMMENDATIONS :

In India, there are Indian institutes of technology (six), council of scientific and industrial research laboratories (30), regional engineering colleges (17) and about 200 Universities, which engage in education and research. Only a few of them have in the recent past, from (1990) started Technology Transfer foundations / Offices. There are 12 Science and Technology Parks and six incubators installed at the initiation of the Department of Science and Technology, Government of India. The schemes are however going slow. Universities and Engineering Colleges do not have Technology Transfer Department. However, all the Agriculture Universities have Extension Departments, carrying technology from Lab to land.

Most of the engineering Collèges (400) are like FachkochSchule which are teaching oriented and have very little research. About half are in private and the other half in public sector. There are

hundreds of polytechnics, which offer 3 years course and they are also teaching oriented.

Industries in India, traditionally do not do research. They mostly make more profit by improving marketing, management and saving on taxes and importing technology. Innovation in technology by and large is not seen as a means of increasing profit.

Many industries are sick for various reasons. Many industries depend on foreign collaboration for diversification and progress rather than on any academic or research institution within the country. It can be said that it is more the foreign collaborators who have propelled the industrial growth.

It is however, increasingly realised in free liberal world economy, by younger generation that partnership between industry, research and technical education institutes is necessary, It is increasingly being viewed as an effective means for revitalizing both. It is the need of the time that this complementary relationship between institutes and industry be achieved for which the following recommendations are made -

1. The Indian economy and industry are suffering from a deficiency of "Innovation and Technology Transfer". To make up the same it is recommended that a State level committee consisting of experts from industry and academics under the Chairmanship of a industrialist be set up by Maharashtra govt. The author will provide the base paper. The committee should prepare an action plan for implementation.

2. Depute a team of 15-20 principals

of colleges and industry leaders to Germany for a period of 2-3 weeks to observe the Technology Transfer in Universities, research labs, innovation centers, Steinbeis centers, patenting, licensing etc. this will give deeper understanding to the key people, in India. On their return they will more forcefully design and build Technology Transfer Mechanisms for institutes and the regions.

It is necessary to make a co-operative effort through DAAD Government of Germany and University Grants Commission, Govt. of India. The private colleges, for whom it is not necessary to go through Govt., may approach the agencies in Germany like the chamber of commerce and execute projects like innovation center quickly by avoiding the usual delays in Government. There is a German Chamber of Commerce Office in Bombay, which may be approached for the purpose. It may be mentioned here that in U.S.A. also it is the private universities like MIT and Stanford which have shown the way.

3. It is necessary to integrate the efforts of technology transfer between CSIR labs, Universities, Engineering Colleges, Polytechnics etc. Government of India, SCIR Director General, considering the trends in world, should design a scheme for exchange of personnel, with incentives like in Germany that the professors have to have two hats, one in university and the other in laboratory. This will improve productivity of research expenditure. Professors should be permitted to go in CSIR labs, IITs, industry. So also industry people be invited as adjunct professor in industries.

4. Set up technology transfer offices in each colleges, polytechnic, university, Today, not many institutes have such offices. Improved methods of technology transfer like licensing, patenting, consultancy, will have to be introduced, if we have to go with the world.

5. More funding from Govt. for R.&D. and Technology Transfer is badly needed. The Govt. would have to look financial figures of R.&D. In other countries, like USA, Germany, Japan. Today, it is spending around 1% only mostly in public sector. Productivity of R.&D. expenditure in public sector is lower than in private sector, and therefore a joint project, market oriented will have to be thought of by the Govt. of India and State Govt., who may have to reconsider the industrial policy to promote R&D in engineering Colleges and not only in CSIR labs. Today no R&D money comes to college, and youths are not provided access to research. This will have to be revised to build India a technological nation.

6. Set up pvt. companies like FZI on the periphery of Universities and engineering Colleges. The model of FZI in Karlsruhe is worth emulation. Committees may be appointed to prepare project reports. With a view to propagate hi-tech and to provide opportunities to talented people within the country. Organizations as this are necessary. This will help to avoid brain drain. It will build indigenous capability in hi-Tech and import reduced.

The leading Engineering Colleges and Universities should step in this area, so as to make application of high tech at

a faster rate. The highly educated persons in subjects otherwise find it difficult to get chance to use their knowledge and they tend to migrate elsewhere. Such companies would help Universities to bring about regional development.

Alumni of the institute may be involved in setting up of such companies, by taking shares. The case of Wisconsin Alumni Research Foundation which gives grants to University for research and obtains patents on research findings, Licenses the patents to COS and earns income which is put back into research. It is a good model like FZI.

7. Establish Incubators :

Innovation centers adjacent to the higher education institutes like technologic fabrik in Karlsruhe.

8. Start scheme somewhat like Steinbeis :

The Steinbeis foundation of Germany has signed an agreement with C.I.I. for the implementation of scheme in India. This is reported in business India dt. 14.8.1995. this is a good sign.

C.I.I. has thousands of member industries in the country. A message from C.I.I. to industries to tap exercise from Engineering Colleges, Polytechnics, is very important, It is a forward step to develop "Market Pull".

Now it is for the institute to participate and cope with the requirement of industries in respect of new technolo-

gies. The technical education department, India Government, should whole heartedly co-operate, equip its staff and labs to a great extent.

The scheme empowers the professors and avoids the bureaucracy. The scheme should have -

- a) exchange of personnel - visit to Germany for 2-3 weeks 100 key people from academics, industry and Govt.
- b) Private college may be involved first who would be more working, devoted and flexible.
- c) Exchange of students should be included in this scheme.

9. Last but not the least is - Develop awareness for Market Pull amongst industries and Technology Push amongst institutes by conducting seminars and conferences jointly for industry and academic personnel. One sided effort by only industry or by only institutes is not enough. Both have to move to each other, for which it is recommended that academicians in association with confederation of Indian Industry and similar bodies should organise seminars, and invite experts from Germany, and other countries, so that the idea of TT is drilled in the minds of persons who matter most, without which it is difficult to build bridges between industry and academics.

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