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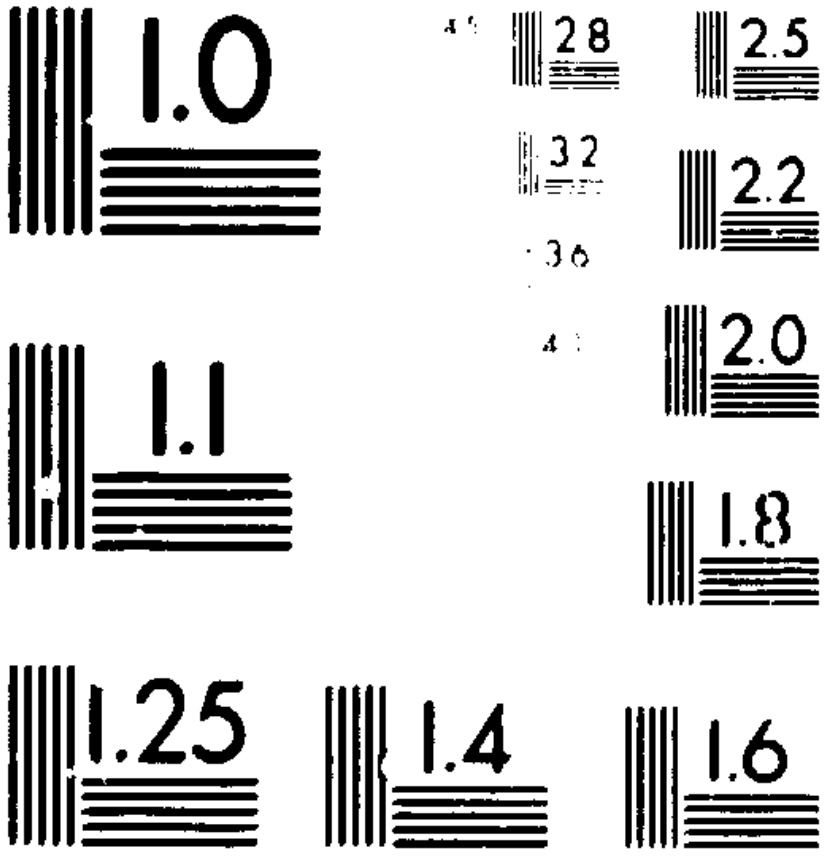

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INSTITUTION BUILDING IN A DEVELOPING COUNTRY - A CASE STUDY*.

by

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WELDING RESEARCH INSTITUTE

A CASE STUDY IN INSTITUTION BUILDING IN A DEVELOPING COUNTRY

1.0 INTRODUCTION

The process of industrialisation in a developing country has several unique characteristics and proceeds through different phases. Amongst the various inputs essential for balanced growth of industry are technology and infrastructure. Generally, industrial growth commences in order to meet growing home-demand and begins with simple processing of agricultural and mineral commodities in a vast country like India. As the industrialisation progresses the needs for advanced skills, newer technology inputs and basic facilities correspondingly require continual updating. Integrated planning at National level is usually aimed at achieving these goals.

The present paper studies the role of research institutions in industrial growth in developing countries. The Welding Research Institute (WRI) at Tiruchirapalli, India, is an example of a typical service institution acting as a catalyst in technology transfer.

2.0 INDUSTRIALISATION IN DEVELOPING COUNTRIES - SOME SPECIAL PROBLEMS

In attempting to make decisions with regard to choice of technologies in developing countries, acquisition and transfer of information on alternatives is one of the foremost difficulties. And in most cases, information about costs and returns of the alternatives is

seldom easily available or clearly understood. Policy for industrialisation would hence call for comprehensive data base at National level. Presentation of technological choices in terms of cost benefit, resource constraints and inter-se priorities is an important step in planning. Subsequent to the choice of major industrial sectors, there is a need to continually provide support to individual sectors through a variety of technical services. In developed countries, such services are available through commercial agencies, but are usually absent in developing countries.

2.1 Special Sectoral Problems:

In most of the developing countries, small and medium scale units continue to play an important role in industrialisation. The issues related to choice of technologies and services needed by these establishments require special attention in many industries. The main areas in which small and medium scale units require assistance are:-

i) Financial assistance on special terms;
ii) Technological inputs;
iii) Managerial assistance; and
iv) Development support and special services

While it is possible to obtain financial assistance and managerial support, many a times this sector is starved of technological inputs, development support and special services.

Developing countries are evolving National institutional arrangements such as industrial banks, small

scale service institutes, training schools, research centres, etc., specially to assist growth of this sector.

2.2 Modes of Technology Transfer and Organisational Support:

It is essential that to sustain the industrial growth, various means of appropriate technology transfer be available in the country. Some of the important channels of technology transfer usually adopted by developing countries are:-

1) Foreign aid programmes
2) Production licensing
3) Multinational Corporation Subsidiaries
4) Patents purchase
5) Open technical literature
6) Purchase of systems and components
7) Industrial shows and exhibits; and
8) Indigenous Research Institutions

There has been an increasing awareness amongst the developing countries to evolve an integrated approach to the technology trade. The issues related to need for restructuring the environment for technology transfer have been taken up at successive UNCTAD and UNIDO meets. The policy issues have centred around codes of conduct, international mechanisms and ways to develop technological capacity. As a result of this, there has been a growing recognition of strengthening local technical infrastructure as an aid to absorb, adopt and diffuse imported technology.

Simultaneously, efforts are being taken to carry out research at the plant, regional and national levels. These steps have resulted in setting up of in-house, regional or national information, assistance and R&D centres. The initiatives taken by developing countries have been in the following areas:-

* Improvement of technical infrastructure
* Creation of specialised education centres
* Establishing information and technical assistance agencies
* Emphasis on local development programme
* Schemes for return of skilled nationals from foreign country
* Control mechanism on technology acquisition and utilisation
* Establishment of national research organisations

To supplement the national efforts, intergovernmental initiatives have also been explored. The primary steps have been -

* Sub-regional organisations for pooling resources
* Sharing of information on technological capabilities through intergovernmental information centres
* Regional sectoral R & D centres (e.g. Rice Research Institute, Manila)

Over the years, several organisations have been taking up these activities. Some of these are

* International Bank for Reconstruction and Development
* Inter-American Development Bank
* UN Centre on Trans-NationalCorporations
* UN Development Programme
* UNCTAD
* Business School Associations

The forum where these activities are reviewed is the periodic meeting of Technical Cooperation among Developing Countries (TCDC).

The role of Government is pivotal in fostering the support and nurturing the growth of indigenous R&D and is well recognised in India. Different models in building institutions have been adopted in India depending on background and approaches. In the following, one such successful experiment and experience gained is given bringing out the elements of successful growth.

3.0 WELDING RESEARCH INSTITUTE - A CASE STUDY

3.1 Conception and Nucleation:

Joining of metals and alloys has been one of the most important techniques of fabrication. With the increasing emphasis on heavy industries during the first four 5-year plans, the need for development

of welding as a discipline was recognised.

It was felt that Indian Welding Industry lagged far behind the developed countries. By late sixties, welding had assumed an important role in Indian Engineering Industry and fabrication work in number of fields such as power generation equipment, industrial boilers, chemical and fertilizer plants, automobile industry, etc. According to the Census of Machine Tools in 1968, welding machinery and equipment constituted 37% of total machines. With the increasing applications of welding technology, this was expected to increase significantly. Similarly, a correlation was established between demand for welding consumables and total steel production.

In March 1970, an Indo-British team sponsored by the Government of United Kingdom and India surveyed the Indian process plant manufacturing industry and submitted its report to Government of India. The team amongst other recommendations suggested setting up a Welding Research Institute.

The requirements of welding technology were further analysed in 1972 by a specialist Planning Group on 'Joining Machinery' under the National Committee on Science and Technology (NCST). This apex National Committee is responsible for developing a comprehensive strategy for Science and Technology as well as identifying the inter-se priorities. The survey by this Specialist Group strongly recommended establishment of a R&D infra-structure which could serve as a nucleus for the growth and development of Welding Technology in India.

The panel envisaged that such an Institute would act as a 'close link' with the industries for introducing appropriate and newer technologies and also bridge the existing gaps in training, information dissemination and consultancy. NCST had also contemplated that besides the Central Institute, three regional centres would be set up to cater to users in different places.

It was decided that the proposed Welding Research Institute should be an application-oriented Industrial Research Centre and should have a close liaison with a large undertaking using welding as a major tool for fabrication. In the first instance, it was decided to establish the main Welding Research Institute and then subsequently take up the work on regional centres.

3.2 Initial Planning and UNDP Assistance:

In 1974, a decision was taken to locate the Welding Research Institute at a site close to the High Pressure Boiler Plant of BHEL at Tiruchirapalli. BHEL/Tiruchy is a major unit manufacturing utility steam generators and auxiliaries. The unit by its nature of products requires a wide variety of welding services and was well suited for implementation of the programme. As a first step, a detailed project report was prepared by BHEL based on an extensive visits, the study of leading Welding Research Institutions the world over and suppliers of welding equipment.

The project envisaged a capital investment of Rs.178 lakhs as Indian contribution. The programme was also included in the UNDP country programme. Subsequent to the detailed

scrutiny of the viability of the programme, UNDP approved a contribution of $ 2.022 millions. While the Indian component took care of indigenous equipment, UNDP/UNIDO assistance covered the finance for import of sophisticated equipment, training of Institute's personnel outside India and deputation of foreign experts to the Institute.

BHEL provided all the necessary support required in the initial phase. The administrative infrastructure of such a large public sector was crucial in quick establishment of facilities of WRI. The project management support was provided by an Internal Monitoring Committee. The first phase of the project has been duly completed.

3.3 Objectives of WRI:

Welding Research Institute, even though under a complete administrative control of BHEL, has a distinct status of its own. It is a National Institute to serve all Organisations in India and outside - a National contribution by BHEL and an example of cooperative research institution. To serve its prime objective of being a National Centre, it has formulated well defined objectives:

* To serve as an effective centre for the dissemination of knowledge;
* To carry out applied research in welding process and technology;
* To carry out some amount of fundamental research in weldability of metallic materials and welding metallurgy;

* To undertake design and testing of welding machinery;
* To render consultancy and Quality Control services;
* To act as a training and testing centre;
* To render assistance to the technical teaching institutions in conducting the under-graduate and post-graduate welding;
* To coordinate with professional bodies like IIS, IIW, etc;
* To render assistance in import of technology in welding;
* To exchange know-how with similar international organisations

For the effective functioning of the Institute as a Research Centre and a link with Industries, an Apex Advisory Committee has been formed to provide the guide lines and direction. The Committee has been constituted by selecting associated Members from various Ministries, Expert Technologists from equipment and consumables manufacturers, Fabricators, Inspection Agencies, Indian Standards Institution, UNDP and professional body headed by Secretary/Department of Heavy Industry of Government of India.

3.4 Growth:

The project after being sanctioned in November 1975 has been rapidly executed. The Institute is steadily building up a vast reservoir of expert manpower and sophisticated equipment. The growth of the Institute was planned over three phases. During the first phase, most of the basic welding and laboratory equipments have been procured and all the corresponding activities have been initiated in tune with the equipment and expertise

availability. Simultaneously, with satisfactory completion of Phase I, Phase II expansion was proposed and approved by UNDP/UNIDO and Government of India. In second phase expansion, advanced welding equipment, consumable pilot plant and advanced non-destructive testing equipment have been added to the already available equipment.

Due to its national character, the Institute proposes to set up three regional centres spread all over India to cater to the vast needs of the country in the third phase.

Project implementation through Indian contribution (Rs.104.62 lakhs) and UNDP assistance (US $ 2.30 million) for the Phase II is expected to be completed by March 1984, having started in December 1980. While the workshop and laboratory equipment is mostly commissioned, the manpower build-up is in progress.

Since the inception, adequate emphasis is being given on a systematic training of the Research Engineers in specialised areas at advanced centres in India and abroad. At the same time, these Engineers are exposed to the UNIDO experts deputed from time to time to the Institute. This has helped the Institute to develop a truly scientific approach towards tackling referred projects. As an overall organisational policy and for systematised logistical implementation, WRI has recently entered into a sub-contract agreement with Japanese Welding Research Institute, Osaka University, Japan, for jointly working in advanced fields, both in Japan and in India through UNIDO/UNDP to enable acquire more expertise.

3.5 Search for Excellence:

Since the start of progressive activities for the facilities and manpower build-up, WRI has undertaken vast number of research programmes in diverse fields such as process development, machine development, failure analysis, metallurgical investigations, weldability studies, etc.

Concurrent to the Research and Development, the Institute has been freely sharing its experience with the entire welding fraternity through papers and articles in various National and International forums. The Institute amongst many of its unique experiments, has been organising workshops on specific topics of interest thereby opening a direct dialogue between the manufacturers, the users, inspection agencies and other associated bodies. The Institute has been laying a strong bias on applied sponsored research projects which have already found their use directly in the Industries. In a country like India, where skilled labour is abundant, the Institute is aiming towards the optimal mix of mechanisation and labour utilisation. For the effective utilisation of the available expertise and equipment at the Institute, long term projects such as 'Weldability of Steels' have been undertaken with a tie-up with national steel industries.

The basic philosophy of the Institute has been to serve as a close link between the Industries and the latest technologies developed either at the Institute or elsewhere. Keeping this in mind, the Institute has

been undertaking extensive consultancy services of fire fighting nature and has served more than 150 industries, solving around 175 projects. Such an approach has given the Institute a pragmatic look and it has been capable of implementing various research programmes in the industries.

The Institute has a stern faith in the fact that the appropriate technology could be effectively implemented only by trained technical manpower. To cater to the evergrowing demands of the industry, the Institute has a full fledged School of Welding which undertakes extensive training programmes and conducts highly specialised training programmes for Engineers and Supervisors both in the fields of welding and non-destructive testing techniques. The School also conducts round the year tailor made training courses for highly skilled Welders for certification. The Institute has been certified by the Central Boilers Board as a 'Competent Authority' for certifying welders as per the Indian Boiler Regulations. The Institute has developed a unique 'Weld-in-Search' system for computerised storage and retrieval as a service to all the industries and individuals. For effective dissemination of the information stored, a specially designed 'Keywords' bulletin was being published and circulated all over India. This bulletin has been now converted as 'Keywords Journal' which gives wide coverage to the information on welding through technical articles, snippets, keywords, etc.

3.6 Planning in R&D:

For a research organisation like the Welding Research Institute, it is of utmost importance that all the activities are well coordinated and coherent. Systematic and planned approach is necessary to achieve the desired results within specified time frame.

The Institute has recently formed a 5-member council to critically study the project to be taken up. The projectant, after preparing the Project Initiation Report (PIR), discusses the project with this council and various aspects like application, economic viability, suitability under industrial environments, etc., are critically viewed. The project after acceptance is allotted the priority index specially designed by the Institute and is reviewed periodically for its progress. Anticipated larger demand by the industries would obtain a higher priority and a futuristic demand obtains a lower priority as at present.

Apart from project planning, manpower and budgetary planning are other important aspects in R&D Institutions which is critically viewed at WRI. The requirements of various groups are consolidated annually and proportionate allocation is done based on the priority indices. Reallocation of available funds is suitably carried out after reviewing the progress and consumption pattern at the end of six months.

Organisation for R&D is yet another important aspect of research planning. The Institute attempted a

generalised approach in structuring its manpower. In this approach, broad categorisation was done and research engineers were individually entrusted with the responsibility of various projects. This system even though simple and effective, led to a generalistic approach to various problems. The Institute, after having a relook and considering the pros and cons of various other Organisations, has formed specialist groups catering to various fields of welding technology. These groups are mostly self-sufficient with facilities and manpower and the implementation of such a system has helped the Institute in achieving specialisation in various advanced fields. The organisation chart is shown in Figure 1.

3.7 Financial Viability:

Unlike industrial organisations, R&D Institutions have little or no investment potential. Such Institutes are invariably funded by Government of large industries. However, it is essential that Institutes of this nature should aim for partial self-sufficiency through the revenue generated by sale of know-how, consultancy, training, etc.

This limited self-sufficiency, motivates the research engineers to a large extent and at the same time keeps the Institute away from being stagnant and dead investment. The Welding Research Institute has been able to meet 30% of its revenue expenditure through various services rendered and aims at meeting 60% of its revenue expenditure by the year 1989-90, while balance 40% would be met through subsidy from BHEL.

Essentially set up for rendering services to the Nation, the Institute's charging system is basically customer-oriented. The expenditure incurred for various technologies and patents developed is divided over number of years and suitably charged, this offering the Institute's services at a nominal cost.

4.0 INTERACTION

4.1 Forward and Backward Linkages:

While the Institute is on the threshold of gaining maturity, it is necessary that it has forward and backward linkages. The Institute has contemplated a strong liaison with customer - Industries, technical educational institutions and counterparts, similar National and International Research Institutes/Bodies.

To help achieve this liaison, recently, the Institute embarked on a novel experiment of going to the industries to create the awareness about the importance of R&D in Welding. The Institute's engineers on two occasions at an interval of 3 years visited over 100 medium and large industries all over India, thereby creating harmony between industries and research institutes, while at the same time creating an awareness on the Institute's activities. For the vertical integration of the technologies developed at the Institute, the Institute has been propagating and effectively implementing the "Lab to Land" concept. Sensing the need of the hour, the Institute has been

propagating the importance of welding technology and urging the educational institutes to lay higher emphasis on this subject during Diploma/ Degree courses. The Institute has been liaising with local polytechnic in conducting Post Diploma course in welding technology and also with the local Regional Engineering College in the conduct of Post Graduate Degree course in welding engineering as examples. The Institute has also been recognised as an approved centre for doctoral work in welding by the University of Madras.

To keep itself abreast with the latest technology available elsewhere and to carry out the mutual research programmes, the Institute is constantly in touch with National and International professional bodies. The Institute has been participating and presenting papers in various National, International seminars and conferences. These papers presented by the Institute based on the work carried out at the Institute have been well received and appreciated.

4.2 WRI and the developing Countries:

The Welding Research Institute, based on the experiences gained during past years, proposes to share these with the developing countries. The Institute has gained confidence and valuable experience in training, consultancy and research and development. The progress achieved by the Institute in various fields has been deeply appreciated by UNDP/UNIDO, who have recommended strong liaison of WRI with developing countries.

The Institute recently organised mini International Seminar in collaboration with UNDP/UNIDO and IIW, Tiruchy Branch for the benefit of developing countries. The Institute is now organising an Inter-Regional Workshop for 20 key personnel from developing countries, to apprise them regarding the capabilities of WRI with the assistance from UNDP/UNIDO. The Institute is in continuous touch with UNDP/UNIDO for extending its services in setting up similar infra-structure elsewhere and for transfer of know-how developed at the Institute. WRI was invited by UNIDO to take part in the Expert's Group Meeting organised at Cairo, Egypt, during 13-17 November 1983 in which a number of representatives from African countries participated. WRI is now in a position to establish in various countries appropriate infra-structures after identifying the needs through surveys to take care of this technology and allied fields as sub-contracting services through UN channels or as a packaged programme for the countries directly.

5.0 OUTLOOK FOR THE FUTURE

With the anticipated implementation of Phase II, WRI has now planned for horizontal integration. The concept of horizontal integration is contemplated to be achieved by:

a) Continuous tie-ups of long term nature for scientific cooperation with leading welding institutes in the world;

b) Effecting appropriate technology know-how transfer;

c) Setting up liaison centres at different parts of India.

Keeping this in mind, a dialogue has been opened with the E.O. Paton Electric Welding Institute, Kiev, U.S.S.R. and also first know-how transfer has been effected with one of the leading welding equipment manufacturers in India. for successful development completed at the Institute. Similarly, such efforts are in progress for know-how transfer for other developments completed at the Institute.

6.0 SALIENT FEATURES OF WRI's SUCCESS

In conclusion, the important elements that contributed to the setting up of an Institute like WRI are highlighted:

a) Decision of setting up the Institute as a result of National level planning exercise and based on needs of the industry;

b) Utilisation of basic infrastructure of a large public sector unit like BHEL during setting up stage and project management support;

c) Complete autonomy in project implementation with clearly identified objectives;

d) Linkages with United Nations and availability of resources, expert advice and training opportunities;

e) R & D projects primarily as sponsored research assuring user implementation possibilities;

f) Training programmes covering entire spectrum of skills;

g) Basic research, an important element in keeping with technology forefront;

h) Attempts on financial self-sufficiency a goal clearly identified and understood;

i) Linkages with National and International bodies to ensure acceptance of services;

j) Field directly linked with core sector and industrial growth of the country and hence of relevance to National environment;

k) Crucial linkage in technology transfer process.

Figure 1

ORGANISATION CHART