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DIFFUSION OF TECHNOLOGICAL INNOVATIONS IN MAHARASHTRA:

A Study of Technology-based Small Enterprises in Pune

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PREFACE

In 1978 the Systems Research Institute commenced work on the study of Technology Policy in India. During 1978-79 several reports were brought during the summer and monsoon of 1979; the current study was taken up to focus on an area of study - Diffusion, which has hitherto been somewhat neglected.

The present report, which has undergone extensive revision before appearing in this final form, not only describes the current situation in terms of the categories and models of Technology Policy, but also gives a brief but through overview of the relevant concepts and theories now accepted in the field.

I am glad that Dr Joshi has written this out so comprehensively for it identifies also the areas in which further research is needed in India if we are to make more effective use of Technology as a vehicle of growth.

June 1980

Prof. J. G. Krishnayya
Executive Director

FOREWORD

As one of its major concerns has been policy analysis, the Systems Research Institute has developed a program of research in Science and Technology Policy. Among the studies that have already been completed are **Communications in 2000 AD** and the **Design and Technology Assessment of a National Marketplace for Information.** This program of research consists of systematic integration of different aspects on Technology Policy, namely Import and Export of Technology, horizontal transfer and diffusion within the country within and. between industries, and from National Laboratories to industries.

In order to get a better feel for current research directions in Technology the undersigned was sent by the institute to visit a number of centres in different universities in USA and UK. These include: Centre for Policy Alternatives, MIT, Department of Industrial Engineering and Management, North-western University, Department of

Science and Technology, George Washington University, Science Policy Research Unit, University of Sussex, and the Centre for Advance Study, Manchester Institute for Science and Technology.

On the basis of discussions with Dr K Nagaraja Rao of the Centre for Policy Alternatives at MIT, a joint research project was designed to study the impact of the policies of the Government of India with respect to the formation and Technology-based Small Enterprises.

The present study is an offshoot of this research proposal. The idea was to study the nature of the diffusion process in India and see whether the factors identified and the policies suggested in the advanced countries have relevance for India. As the following pages would reveal, this study has given new insights that we hope would be of considerable interest to both researchers and policy makers. This is intended for wider circulation among researchers in the field and among policy makers. We look forward to your comments and suggestions.

Acknowedgements

We express our gratitude to Dr K Nagaraja Rao, Professor at the Centre for Policy Alternatives, MIT, Cambridge, who has shared with us from his experience and insights in this field both in personal discussions at Poona and in Boston and through literature. These helped us considerably in identifying and in formulating researchable issues for India.

Thanks are also due to Mr. Sebastian, Summer Interne from IIM, Calcutta, and Mr. Anjani Jain of SRI who carried out the field investigations and processed the raw information.

We must express our sincere thanks to all the entrepreneurs we interviewed. Without their keen enthusiasm, leading to long and frank discussions, this study could not be undertaken. Thanks are also due to the Mahratta Chamber of Commerce, whose library provided useful information on industrial activities in Poona.

Mr. Unnikrishnan, who also typed. several notes and earlier version of the draft needs to be acknowledged for his prompt and diligent work. Mr B.M. Rao, as ever, deserves the credit for the final get up of the report.

- B Joshi
Project Director

Introduction

The role of diffusion of technology as a means of promoting innovations for economic growth and social justice has been overlooked by planners and policy makers in the developing countries in favour of import of technology and promotion of indigenous technology through the National Laboratories.

Indian experience in import of technology or in the transference of technology

from National Laboratories to industry has not been altogether satisfactory (in terms of inappropriateness, repetition, inefficient absorption or input costs etc). Diffusion of technology, n the other hand, been continuously increasing and is reflected in the mushrooming of medium and small enterprises that have come into being without any formal purchase of technology. Contrasting the vast financial and human resources devoted to the import or to the promotion of indigenous technology, with the relative success in the diffusion of technology among - Indian enterprises with little governmental assistance, it becomes all the more important to examine the nature and characteristics of technological diffusion in Indian cry.

As most of the diffusion is manifested in the small enterprises, and the promotion of small enterprises is primarily the responsibility of governments, it was decided to limit the scope of the study to Maharashtra. Moreover, since it was only a pilot study, the sample of enterprises was drawn just from those in Poona, the second most industrialized city of the state.

The **objectives** of the study are; one, empirically to **discover the elements constituting the process of diffusion in India** and **to compare them** with the theoretical basis developed in the West; two, **to identify the key factors influencing the process of technological diffusion in the Indian context**; three, **to gauge the effectiveness of this diffusion process in the founding and growth of an enterprise.** (The intention was that in case the findings are encouraging then a full-fledged study would be undertaken to derive relevant technology policies.) In addition, we would look for propositions for further study, in case entirely new relationships are discovered.

Approach to the Study

This is a pilot study and is in fact the first of its kind in the country. It therefore lacks a rigorous design and to a large extent was planned on the findings of similar studies in developed countries, though these have been used with some caution. The study hypothesises a tentative behavioural model of the process of technological diffusion which utilises the systems approach. Such an approach not only gives the modeller the freedom to choose the number of factors supposedly influencing the diffusion process and to define their causal ordering, but also separates them from the exogenous influences coming from the surrounding environment.

‘The explanatory power of the model is then empirically tested against the information obtained on the diffusion process as it is found to exist in the real world.

The study was confined to the sub-group of technology-based small enterprises. The rationale for the study of technology-based small enterprises has been fully recounted elsewhere*. Out of about 40 to 50 technology-based small enterprises belonging to the sectors of industrial machinery, electrical, and electronics, chemicals and precision instruments, some 25 enterprises were selected. Of these 19 provided the required information. In each case information was obtained through personal interviews and was based on a structured questionnaire. The sample may, therefore, be taken to be quite representative of the diffusion process as occuring in the technology-based small enterprises in Maharashtra.

Scheme of the Report

Section 2 contains the summary of our findings in this pilot study. **Section 3** distinguishes the highly overlapping basic concepts of innovation, transfer of technology and diffusion in the context of less developed countries. This is followed in **Section 4** by a short description of innovation in India, resulting from the import of technology and from indigenous R & D).

** Formation and. Performance of Technology-based Small Enterprises, their local impacts and influence of Government Policy in India SRI-CPA, Research Proposal,.1979. Also See Section 5, Reference 10.*

Conclusions and Policy Recommendations

While the small sample size of this pilot study does not warrant us to draw definite policy conclusions about the subject under study, it nevertheless clearly demonstrates 'through a number of interesting research findings that great potential and need for technology policy research exists in India. Included among the tentative research findings that could be of wider interest are a number of hypotheses (available through the literature from developed countries) being negated or found insignificant. These findings have serious implications, for they suggest that existing theory of innovations may need to be modified 'or altered for their effective applications in India, if not in other less developed countries. Thus, for instance, factors describing entrepreneurial behaviour, such as (i) childhood urge for creativity, (ii) adequate level of technical education, and. (iii) foreign experience individually did little to explain success in the Indian context. Likewise empirical support on influence of family background, including caste and religion, was also found lacking in this highly caste-bound society.

Among the hypotheses that were expected to (and did) get confirmed:

(i) Relatives/friends and business contacts were found to be the most frequently utilised modes of diffusions of technological innovations, (ii) that the existing support services provided by the state government agencies are not directly beneficial to the technology-based small entrepreneurs, (iii) that climate for innovation has a strong positive influence on formation and growth of such enterprises.

Recommendations

Not only does the study suggest the need to have a full scale study to develop policies of action for the more rapid entry and growth of technology-based small enterprises, but a number of researchable issues emerge from this study. These should be studied systematically to develop and design technology policies of larger dimensions. The specific recommendations of this study are:

(1) A number of specific technology policies for promotion of the desired the from this study, could be considered by thegovernment, These are:

(a) Technological-employment protection scheme such as transferable provident

funds should be introduced to promote inter-firm and inter-industry mobility of technologists.

(b) Consultancy firms for the formation and growth of technology-based small enterprises should be encouraged.

(c) Travel concessions and communications subsidy (in the form of subsidised telephone, trunk or telex facilities), could be provided to these entrepreneurs.

(d) Select products of interest of technology-based small entrepreneurs could be brought under the list of reserved items.

(e) Temporary price protection could be granted to the new technology-based products of the small enterprises.

(f) Special technology funds to cover R&D risks could be made available for these entrepreneurs.

(g) Preferential treatment in the procurement of raw materials and. in the marketing of products (especially for exports) could be granted to the technology based small enterprises.

(h) Trips to select companies in foreign countries could be centrally organised frequently for the technology-based small enterprises.

(i) One to three years on-the-job training facilities in large organisations could be provided to young technical graduates interested in establishing their own enterprises.

(j) Industrial technology information banks should be created.

(2) Government technology and economic policies should be examined for their impact on the high-technology industrial sectors of the economy.

(3) Similar studies of low-technology industries should also be conducted to provide a better insight into the process of diffusion in the technology-intensive industries.

(4) Studies should be conducted in different States and their findings compared to develop national technology policies.

(5) The nature of formation and. growth of large industrial enterprises, their available stock of technological inventories etc. should be examined with distinction between those with and without foreign collaboration.

(6) A need to study the organisation culture of the large industrial units that act as incubators for the new technology-based entrepreneurs.

(7) As the problems in the process of diffusion or transfer are highly inter-related and form part of the larger phenomenon of innovation process, there is also need to study this larger phenomenon of innovation in all its facets. This implies need for both macro studies as well as specific micro studies.