ASSESSMENT OF NATIONAL TECHNOLOGY POLICY IN FIJI*

BY
DAVID J.C. FORSYTH

PREFACE

The terms of reference of this ILO project covered a review of Fiji's existing S&T policies with a bearing on technology import, adaptation and local innovation. In particular, the project was intended to analyse the effectiveness of current procedures for identifying, screening and controlling terms of acquisition of imported technologies, and in the light of this assessment, to recommend means of linking Fiji's technology policies with its national development strategy.

This report analyses explicit science and technology policies of the Government of Fiji and examines their effectiveness in relation to the technology problems affecting Fiji development programs. Apart from the direct policies, implicit policies dealing with economic measures refer particularly to factor proportions, fiscal and protection policies, which are also examined.

The report concludes that in Fiji, science and technology policy is not regarded as a distinct coherent sector of development policy by the Fiji Government. However, a substantial number of explicit and implicit policies are being operated with significant implications for technology choice. The main thrust of most of the explicit policies is directed at increasing the labour-intensity of plant and machinery chosen by producers wherever appropriate.

THE AIMS AND INSTRUMENTS OF SCIENCE AND TECHNOLOGY POLICY

Science and technology policy (STP) may be directed at a considerable variety of ends. The most obvious of these is that of creating, or strengthening, technological capability with a view to generating the "technological mastery" which is a prerequisite for genuinely self-sustained modern industrial and agricultural growth. Such technological mastery has many dimensions--important among which are the abilities to identify and choose "appropriate" technologies, to bargain successfully for imported technologies, to operate plant and machinery efficiently, to adapt and modify existing equipment over time, and perhaps to engage in a certain amount of original R&D (research and development) with regard to products and/or processes. Parallel to the emergence of these characteristics is the evolution of the modern industrial sector from one in which the emphasis is

*This article represents the first part of a technical report by David J. C. Forsyth of Strathclyde, Glasbow. It contains findings of an ILO technical assistance project on technology policy assessment in Fiji. This project was funded by the United Nations Financing Sytem of Science and Technology for Development (UNFSSTD) and was carried out during 1982-83.

on the successful operation of existing capacity into a flexible, innovative sector capable of initiating a continuous sequence of new projects and of generating--or, at least, specifying--the technology required.This statement of the central aim of STP should not be taken to imply that such policy is concerned with technological ends alone. In less developed countries in particular, STP must be seen in a much broader economic and social context, and the levels of employment and unemployment, the viability of small-scale and rural industry, the energy-intensity of production, the rural-urban balance of economic activity, the degree of concentration or diversification of production, the extent of dependence on external economic agents, and so on, may all be target variables.

The broad policy aims are made operational by the application of science and technology instruments (STPI). In a very small number of cases, the enunciation of the policy aim will itself amount to a policy instrument; e.g. it is conceivable, if unlikely, that the proclaiming of a policy of increased self-sufficiency as a means of protecting the value of the national currency could have the desired effect of cutting imports without necessitating the use of specific measures to reduce imports. However, in virtually all cases, specially formulated policy instruments must be used to push the economic variables in the desired direction.

Such STPI will very often take the form of legal devices, that is, the STP is embodied in legislation, regulations, formal agreements or contracts which elaborate on the simple statement of policy aims by stipulating obligations, rights, rewards and penalties connected with implementation. For practical purposes, such legal devices will usually require organizational structures. STP is usually implemented by entrusting it to one or more institutions with procedures, methodologies, decision criteria and programs. These are of an administrative and technical nature and specify the steps that must be taken to process or combine information for purposes of applying the policies.

Finally, a set of operational mechanisms--the levers, or actual means--is normally required to implement decisions on a day-to-day basis. The policy instruments themselves may take a wide variety of forms and possess a number of dimensions. Thus they may operate at different levels, from a "high" level of generality, emanating from an institution with a broad policy mandate, to a "low" level of generality, originating in institutions not having a broad mandate, and usually involving very specific functions.

Again, policy instruments may be "explicit" or "implicit". Explicit STPI comprise policies and instruments designed specifically to alter science and technology (S&T) functions and activities, while implicit STPI are aimed at targets other than S&T variables but have incidental and unintended "side effects" on these variables. Examples of the former category would be legislation on terms of technology transfer and technical cooperaton agreements. Examples of the latter category are tax, tariff, wage and interest policies.

It should be noted that science and technology variables may be influenced by factors which cannot be directly ascribed to current policy, but are better seen as the consequences of an amalgam of policies of earlier periods and underlying historical, geographical, cultural and social characteristics. Such "contextual factors" may clearly exert influence independent of present explicit and implicit policies (for example, a heavily distorted price structure may, over a period of years, profoundly affect resource allocation) and must always be given due weight in any attempt to explain a particular science and technology phenomena.

STPI may be aimed at, and affect, any one or more of three distinct aspects of behaviour (i.e. S&T functions and activities):

1. Demand: STPI may be designed to influence the nature of demand for technology by firms, enterprises and agencies, that is, they may be designed to influence the kind (in terms of capital intensity), the source (local or foreign), and the form (licences, in-house R&D, diffusion, etc.) chosen by these "demanders". They may also be aimed at influencing the capacity to choose technology (involving the abilities to identify, select and bargain for suitable technology) and the attitudes towards technical innovation (purchased, modified or locally generated);

2. Supply: STPI may be aimed at the supply side of science and technology, that is, the generation or adaption of technology (in R&D institutes and in-house R&D units, for instance), the supply of S&T services, and the supply of S&T skills (which includes training in schools, colleges, universities, etc.);

3. Linkage: the interface between supply of and demand for S&T--the "linkage" area--may also be influenced by STPI, which may be applied to extension services, engineering firms, consultants, organizations for control of technology imports, industrial information systems, and so on.

TECHNOLOGY POLICY ASSESSMENT

The basic function of Technology Policy Assessment (TPA) emerges directly from a consideration of the nature and aims of STP and the intruments associated with it. Assessment may be "policy orientated" (that is, proceeding by examining the nature and effectiveness of individual STPI, as in (1) to (5) below, or "problem orientated" (that is, proceeding by attempting to identify technology-related problems as yet unsolved by, and perhaps ignored by, existing STP, as in (6) below).

The functions of TPA are:

1. To identify, and codify the various policies, both explicit and implicit, and associated policy instruments which influence the development process through--or through their effect on--scientific and/or technological variables

2. To elucidate the ostensible aims and *modus operandi* of such policies in terms of their practicability and compatibility with overall development strategy

3. To comment on the anticipated suitability and probable effectiveness of the various STPI, relative to policy aims

4. Where possible, to investigate and evaluate the actual impact of both explicit and implicit STP on the target, and other, variables

5. To provide, in the light of the findings of (1) to (4) above, an analysis of the nature and effectiveness as an integral part of development policy

6. On the basis of a general examination of technology-related problems of the economy, to recommend additional STPI with a view to strengthening science and technology policy

CRITERIA USED IN ASSESSING POLICIES

The various elements of a TPA study outlined above are pursued partly through examination of the policies and activities of the Government and public sector agencies, partly through the use of theoretical models to generate *a priori* predictions of the probable consequences of this concentration of policies and activities, and partly, where practicable, through direct examination of the impact of policy. All of these elements of a study lend themselves to the application of orthodox analytical techniques to generate straightforward conclusions.

In one particular respect, however, the results of a general TPA exercise must, in most developing countries, remain ambiguous and open to alternative interpretations. This arises where the assessment of "appropriateness" of policy is attempted, at the borderline between positive and normative--a borderline the precise location of which, from the point of view of the interpreter of policy, is rendered uncertain by the inevitable contradictions in development policy itself. Given a comprehensive plan, with a fully articulated array of targets related to detailed and weighted policy aims, the criteria to be used in assessing the adequacy and appropriateness of existing technology policies, and recommending modifications, would be immediately apparent. It is usually the case, however, that no clear-cut set of weights is available. As a result, the construction of a set of criteria in terms

of which the appropriateness of possible policies and their related instruments can be judged

requires an interpretation of the plan and other policy documentation and pronouncements. Moreover, the range of STP and associated STPI is so wide, and the circumstances faced by different regions, sectors, industries and firms so diverse, that it is not possible to devise a single set of criteria which apply across the board.

Under these circumstances two approaches suggest themselves. The first is simply to predict the direction and strength of the impact of each STP and currently used STPI (and practicable alternatives and additions) on key variables--and leave it at that. Policy-makers and planners may then judge the desirability, or otherwise, of anticipated outcomes. It may be thought helpful, however, to provide additional information by indicating the relative desirability--i.e. "appropriateness"--of given effects for the economy as a whole, or for subsections of it, relative to a particular interpretation of plan priorities.

EVALUATING THE IMPACT AND EFFECTIVENESS OF STP

The measurement of the actual impact and effectiveness of STP is often a difficult matter. In a small number of cases, a policy will have a clear-cut, quantified goal (e.g. an X% increase in expenditure on technical education designed to generate a Y% increase in the supply of certain skills). More often, the goals will be couched in qualitative or, at best, order of magnitude, terms. Moreover, many STP are designed to influence one or more variables in the long run and are part of a package of measures. This being so, it is often difficult to isolate the specific contribution of a given policy and instrument combination, even if access to data and other information is unlimited, especially since there may be no obvious theoretical underpinning for precise prediction. In such cases, a qualitative judgement may again be all that can be offered.

More generally, given the problems encountered in applying absolute measures of "performance" and "effectiveness" to STP/STPI, it is found to be necessary to evaluate policies and their instruments in terms of an amalgam of information on actual effects on the target variables and *a priori* reasoning regarding certain characteristics of the policy instruments. With regard to the latter, it seems reasonable to expect an STPI to be more efficient if:

1. It affects a wide range of scientific/technological activities
2. It covers a wide range of firms and other production units
3. It has "leverage"--in the sense of having a large expected impact relative to the cost and effort of implementing

4. Its effects fall fairly evenly over all units affected, or it can be targeted very precisely

5. It has effect quickly, and these effects are desirable

6. It requires relatively little information for effective application

But an analysis based on these considerations alone is obviously incomplete, and must be supplemented by an examination of such relevant micro- and macro-level data as are available, coupled with field investigation.

Finally, while assessing the impact of various STP and STPI, both *a priori* and in practice, it is important not to overlook the role that background or "contextual" factors often play in conditioning the effectiveness of policy. Examples of contextual factors which can be expected to modify, damp down, or completely eliminate, the effects of policy initiatives are:

1. Technological dualism
2. Excess capacity
3. Seriously distorted price structures
4. Conservative attitudes - possibly borne of monopoly power - of entrepreneurs
5. High unemployment
6. Very unequal income distribution
7. Small size of the economy and/or of firms
8. Dependence on a very few export items
9. Lack of technological alternatives
10. Heavy reliance on foreign technology

In the event of particular STPI proving ineffectual, or counter-productive, it is as well to examine the possibility that contextual factors may be responsible, and that they may be susceptible to manipulation as an adjunct to STP. Put another way, it is very likely that the STPI target-variable relationship is not a bivariate one, and that the precise configuration of various underlying economic and social characteristics can have a profound effect on the performance of a given STPI. Clearly, such factors must be allowed for in formulating and assessing a science and technology policy. The precise relationship between relevant contextual factors and the impact of science and technology policy in Fiji is discussed in relation to actual experience in the appropriate sections of this report.

[Editor's Note: The balance of Forsyth's report, discussing the import of S&T policies in Fiji, follows in Chapter 6.]