

# **technology policy study centres in africa**

Report on the IDRC/ECA meeting on the creation of centres for  
technology policy studies in Africa, Ile-Ife, Nigeria, 5-10 December 1973



## **Abstract**

A meeting was held in Nigeria in response to the interest of some African countries in setting up centres for technology policy research. Papers were presented outlining the role of technology policy and planning in development, and reviewing the experiences of Europe, North America, and Latin America in this area. It was pointed out that the study of technology policy and planning would allow developing countries to achieve an enlarged technological capacity in a short period of time, while still integrating this development with the economic, social, and cultural development goals of their society. A discussion on technology policy and planning in Africa followed the presentation of the papers, and representatives from Tanzania, Ethiopia, Ghana, and Nigeria summarized their country's present level of development in this area. Finally, a list of recommendations was prepared calling for: the establishment of national, multidisciplinary groups to carry out technology policy studies; the presentation of a travelling seminar to assist in the formation of these groups; and the creation of a regional program to encourage cooperation between national groups.

## **Résumé**

L'intérêt manifesté par un certain nombre de pays africains pour la mise en place de centres de recherches sur les orientations technologiques s'est concrétisé par la tenue d'une réunion spéciale au Nigeria. Les textes présentés ont mis en lumière le rôle joué par l'orientation technologique et la planification sur le plan du développement et passé en revue les expériences européennes, nord-américaines et latino-américaines dans ce domaine. Il en est ressorti que l'étude des orientations technologiques et des planifications permettrait aux pays en voie de développement de disposer rapidement de capacités techniques plus étendues, tout en intégrant ces gains aux objectifs particuliers de développement économique, social et culturel des populations concernées. Les exposés ont été suivis d'échanges de vues sur l'orientation technologique et la planification en Afrique; les représentants de la Tanzanie, de l'Éthiopie, du Ghana et du Nigeria y ont fait le point sur la situation actuelle du développement de leurs pays respectifs dans ce domaine. Les résolutions adoptées recommandent: la constitution de groupes multidisciplinaires nationaux chargés d'effectuer des études sur les orientations technologiques souhaitables; la constitution d'un groupe itinérant de spécialistes qui apporterait son aide à la formation de ces groupes; et la mise en place d'un programme régional encourageant la collaboration entre les groupes nationaux.

UDC: 600

© 1974 International Development Research Centre  
Head Office: Box 8500, Ottawa, Canada. K1G 3H9  
Microfiche Edition \$1

# **Technology Policy Study Centres in Africa**

**Report on the IDRC/ECA meeting on the creation of  
centres for technology policy studies in Africa,  
Ile-Ife, Nigeria, 5–10 December 1973**

## **Contents**

INTRODUCTION	5
THE ROLE OF TECHNOLOGY POLICY AND PLANNING IN DEVELOPMENT	7
TECHNOLOGY POLICY RESEARCH IN EUROPE AND NORTH AMERICA	15
TECHNOLOGY POLICY AND PLANNING IN LATIN AMERICA	23
DISCUSSIONS ON TECHNOLOGY POLICY AND PLANNING IN SOME AFRICAN COUNTRIES	29
RECOMMENDATIONS	31
APPENDIX A. OPENING ADDRESS	32
APPENDIX B. LIST OF PARTICIPANTS	35



## Introduction

The world is becoming increasingly aware that technology is inevitably an instrument of social change. An examination of technological development in Western Europe during the last 200 years reflects many changes in the quality of life as a result. A steadily rising standard of living has been accompanied by mass urbanization, a proliferation of poor housing, and increased pollution with the rapid expansion of the great industries. In addition to this, there have been social effects of a more subtle nature.

In response to these changes a new area of enquiry has developed, the systematic study of science and technology. Among the aims of this study is the discovery of the effects of technology on society and the maximization of the benefits of its development from an economic, technological, and sociological standpoint. By making use of technology policy studies it is possible for the planners of developing countries to achieve a much broader awareness of the problems than Europe and North America could during the throes of industrialization. For this reason the International Development Research Centre has supported research projects concerned with technology policy problems in the developing world. In the early years of IDRC's existence, almost all requests for assistance in this area came from Latin America and Asia. Recently, however, the Economic Commission for Africa identified a few African countries that were interested in the possibility of creating technology policy research groups. Since the activities of such groups had proved to be valuable to policymaking in Latin America and Asia, the IDRC agreed to co-sponsor this meeting along with the ECA. The purposes of the meeting were to review the

situation in other countries, to assess the facilities already in existence in African countries, and to determine the extent of interest in technology policy studies in Africa.

It is clear that interest in this area is growing, as many African countries have found it impossible to implement national development plans because of a lack of technological capacity. If this situation is to be remedied within a reasonable lapse of time, it is necessary to take deliberate and planned action to promote technological development. This demands careful formulation of technology policies and plans in all African countries.

As an example of current concern in this area, the University of Ife is convinced of the need for organized effort to increase the knowledge of how to acquire and utilize technology, and to this end is setting up a Unit for Technological Planning and Development in the Faculty of Technology. The unit is planned as a multidisciplinary body and will be actively involved in the economic, sociological, and technological aspects of the production and utilization of technology.

The meeting was attended by 26 participants, including nine from outside the University of Ife (see Appendix B for a list of participants). The full text of the papers presented, and highlights of the discussions following each presentation are reproduced in this report. During a summary discussion of a regional program for technology policy studies in Africa, a number of recommendations were proposed for continuing action both at national and regional levels. These recommendations are also included at the end of this report.





# **The Role of Technology Policy and Planning in Development**

**Ademola Banjo**

*Chief, Science and Technology Section  
Economic Commission for Africa*

## **Introduction**

Policy is normally formulated as a guide to behaviour or action and is usually characterized by two major components. First, the objectives to be aimed at or realized by the action need to be defined, and second, a number of considerations or boundary conditions must be observed during the course of action.

Planning should ideally be undertaken after decisions have been made on policy. This enables the process of planning to be guided by clear objectives about both the ends of the action as well as the timing of those ends. Planning is a more complex and extensive activity than defining policy, involving the breakdown of global objectives into more detailed objectives appropriate to the stages of action. The organization and procedures of the action to be undertaken need to be selected and defined; resources must be determined and mobilized; the agents, that is trained manpower in the specifications and amounts necessary for the enterprise, must also be determined; and the strategy for bringing them into action must be established. Finally, all the various stages of action, including the contributions by agents, must be set in a time frame. This is what planning is about.

A good plan will also provide for indicators of achievement at each stage, so that

performance can be monitored and any necessary corrections or interventions can be made at appropriate times during the implementation of the plan.

## **The Role of Technology in Development**

In considering the role of technology policy and planning in development, we need to start with some clear ideas as to the role of technology itself.

Technology can be looked upon as the motor or tool of development. Properly applied and directed, it provides us with the capacity to utilize the resources available in the material world to promote our well-being and security, and it enables us to alter the physical environment to make it more congenial to human society.

It is important to bear in mind that technology is not a recent factor in human development. The history of mankind illustrates abundantly that the ability to develop and use technology has always distinguished man from other members of the animal world, and has been responsible for his survival as well as the development of his civilization. Technology is thus present in every society at all the different stages in the evolution of that society.



However, this is not to say that the development and use of technology has been uniform in all communities. During the course of history, the technology developed by human communities has continuously changed, and the capacity and scope of the technology available at any time has determined the basic nature of human civilization.

When technology was at a stage where man relied on the production and use of stone tools, human communities depended on hunting for their livelihood, and lived in a precarious battle with the environment for survival. Settled communities became possible with the discovery of the technology of agriculture. When two communities came into conflict, either through competition for survival or for the material resources available to sustain economic needs, the community with the best technology of warfare usually emerged victorious. Sometimes, the less technologically capable community perished completely.

The history of technology is the history of the change and progress of human civilization. As that history demonstrates, with temporary setbacks, the development of technology has been continuous, while the focus of this progress has shifted from one community or nation to another. The biggest strides in technological development were made during the last 200 years, and this development was largely based in Europe. During this period, for reasons which I shall mention next, there was a remarkable increase in the capacity of the communities in this part of the world to develop and utilize technology.

Up to the 18th century, technology was primarily craft-based. Knowledge of the properties and behaviour of materials and of the physical world was obtained through the slow process of trial and error, as much aided by accidents of circumstance as by foresight. In such an environment, the progress of technology was slow and painful, and its possession could be kept secret for long periods. However, progress on a different

front gradually began to have an impact on technology. The pursuit of science, the systematic study of the properties and behaviour of the physical world, began to provide insights as to possible new types of technology. By the middle of the 19th century, this trend was already well-established. Increasingly, scientific knowledge enabled existing technologies to be improved and their scope extended, and suggested the possibility of new technologies.

Within our present century, this process has become well-established and has been responsible for an unprecedented technological development in many parts of the world, notably Europe and North America. Through the methodology and procedures of research and experimental development, it has gradually become possible to create technologies to order for different purposes. This has given mankind a control and mastery over the physical world which is quite comprehensive in its scope. The nature of production, of economic, and of social life can now be selected and fashioned by deliberate decision in any modern society that possesses the capacity to create or use the technology it needs.

### **The Promotion of Technological Development**

The elements that make up the technological capability of any community are known. The process and prerequisites for the acquisition of technology by a community can also be determined. In juxtaposition to this, the practically universal technological backwardness of the African countries is responsible for low standards of material living, misery and poor health, and often, as recent events have demonstrated in the drought-stricken areas of the continent, the precariousness of human survival itself.

The question before us in Africa is this — where do we go from here? The knowledge and the possibility of changing the destiny

of our people are within our reach. However, we have to take conscious action to acquire and utilize that knowledge. We must start with a determination of the objectives we wish to promote or achieve through the use of technology. Some objectives can be selected directly in relation to the nature of technology itself and to the prerequisites for acquiring and using it.

Direct objectives will be concerned with the creation or reinforcement of the technological capability in our communities. The subject matter of this category of objectives will include such issues as:

- (1) the content, methods, location and timing of science education in schools;
- (2) the training of scientific and technological manpower;
- (3) the promotion and support of scientific and technological research, and research institutions; and
- (4) the creation or strengthening of scientific and technological service organizations and institutions.

The objectives we select in these areas will determine how much technology will be at our disposal, and when, where, and how effectively we can use it.

The wider group of objectives for technology relate to the purposes for which we wish to use it, namely, social, economic, and sometimes military ends. They will embody our vision of the type of society we are trying to create and the quality of life we want for our people. When this approach is not observed, we become obsessed with technology as an end in itself; instead of technology serving man, we then create the circumstances where man serves technology and is in bondage to it.

Two examples will illustrate this point. The University of Science and Technology in Kumasi has been trying to utilize its technological resources to assist in rural development. Two years ago when I first went there, among

the activities going on was one related to the weaving of kente cloth. There was a unit in the university that was concerned with developing new mechanisms for weaving kente cloth. I felt a little uneasy about their objectives at that time because, when we visited the village that was the focus of their assistance, the villagers did not seem very enthusiastic about all this help that was coming from the university. They were not sure why the university wanted to get involved in kente cloth weaving and design a new machine to do the work, and were somewhat hostile to the idea of introducing improved machinery to do what they were doing by hand.

When I visited Kumasi again last year, we went to the same village. This time I think those who were in charge of the project had taken some trouble to look beyond what we might call the machine aspects of their task. They had become a little wiser. They had carried out some social research and had realized that they were doing much more than mechanizing kente cloth production, and so had modified their objectives. They had realized that the value of kente cloth lay in the fact that it was woven by hand, and that if machinery was introduced to produce kente cloth in large quantities, it would become just as cheap as any other cloth. This would destroy the economic advantages of this village.

The researchers had also realized that while a machine would take much of the drudgery out of kente weaving, it would disrupt what we might call the social status system of the village. The machine would make kente weaving an easy process for any young man to learn, and would displace the need for a long apprenticeship in order to acquire the skill and knowledge to produce the intricate handwoven designs that characterize high-grade kente cloth. Now there is a status system in the village based on this apprenticeship system. The men who can do the most complicated designs are people who have taken several years to acquire their knowledge and skill, and because relatively few



men can weave these high-grade kente designs, it gives them a certain status and economic position in the life of the society. So, many inadvertent changes were set in motion by this very well-meaning effort directed at producing a machine to weave kente cloth.

Perhaps what was needed was not to produce a sophisticated machine as the technologists had done, but something less sophisticated that would still provide a role for the skilled man who has been on the job for many years.

The second example is the Gari Project. I think this project was begun here because a number of engineers and food technologists felt that this provided an attractive opportunity to introduce machinery into production. In Nigeria, gari is a staple food and there is a big market for it. I personally do not think that the technological problems of making gari are considerable, but there are some features of the gari production system that, on further reflection, should make us re-examine the objectives of the Gari Project. The first point is that gari is produced as a rural small-scale industry, and I would say that there is no serious shortage of it. At present, as much of it as is required can be produced by small-scale industry in rural areas.

Introducing machinery will not at the moment increase the amount of gari that is available on the market, since the limitation on production at all times is the supply of cassava. In any case, increasing the supply of gari beyond the demand has no real social value unless there is an export market. I think that this is one of the reasons why it has been difficult to introduce large-scale gari production by machines in Nigeria. In a country where it was not already a rural industry, it might have been easier to change the scale of production. In Gambia, where gari production has been set up as a large-scale industry, it is a new food to them.

The real issue in introducing technology for rural development, as in the case of the gari mechanization project, seems to be the social implications of the changes. If this development implies transferring a small-scale, but widespread, rural industry away from rural areas into urban areas, we may not be doing the right thing. In fact, one of the elements of the stability of the Nigerian food production economy may be that a staple food like gari, which is consumed in urban areas, is produced almost exclusively in rural areas. This is a desirable situation which many developing countries are trying to create artificially.

Perhaps what the technologists should do, as far as gari production is concerned, is to establish the scientific basis for the gari-making processes — what takes place at each stage and what the product, gari, actually is. Is it one product or different kinds of products? I think the reality is that gari is a product with a very wide range of variability, which exists in different types. If the technological parameters of these different varieties can be ascertained and recorded so that they can be produced whenever required on the machine, this would be a valid contribution. The issue of mechanizing gari production may not be a question of industrialization but a question of rural development.

I believe that these examples should be kept in mind so that we remember to ask ourselves, at all stages, what we want to use technology for before we start taking action.

### **Technology Policy and Planning**

The above examples indicate the importance of defining objectives or policies for technology as a guide for rational and consistent action.

When the objectives have been defined, it becomes necessary to determine how to translate them into action. The greatest part of the task of technological development in all African countries is the creation or reinforcement of national technological capability.

This is a multi-component objective which requires action in such disparate areas as education and training, institutional development for research and training, fiscal policy in relation to industry and foreign trade, and legislation on the use and protection of intellectual property.

For continued and steady progress in technological development, it is necessary that action be taken on these many disparate yet contributing subjects to be consistent with the main objective of enhancing national technological capacity. This can only be done through a plan of action that will establish the necessary contributions from different sectors, and will ensure that a time frame is provided for contributions from the separate sectors.

Within the Economic Commission for Africa, this complex question of the promotion of technological capability in African countries has been under study during the past 5 years. The studies have resulted in the preparation of a volume entitled, *African Regional Plan of Action for Science and Technology Development*.<sup>1</sup> This plan has been scrutinized and approved by various bodies and organs in the UN including the Economic and Social Council. Most important of all, the plan has been reviewed by

the African countries and adopted as a guide to technological development in the region by the Conference of African Ministers concerned with social and economic development in February 1973.

Apart from being a guide to the many problems posed by the objective of developing technological capability, the African Regional Plan enables one to have a realistic appreciation of the complexity of actions necessary to promote technological development. It provides an awareness of the dimensions of the task before us. No regional plan can, of course, take the place of a national plan when action is required at a country level. Hence a further stage of planning will be necessary at the government level of individual African countries in order to derive the full benefits from the African Regional Plan. Because of the multiplicity of fronts on which action is necessary concurrently, it is clear that without a plan, technological development in Africa may be a mirage and may never attain any significant level of progress within our lifetime.

The role of technology in development is that of a tool and an agency. With technology we can fashion the type of society and the quality of life we envisage for our people. The role of technology policy and planning is to enable us to create the necessary technological capability within a realistic time scale, and to apply it as and where necessary in the shaping of human destiny.

<sup>1</sup> African Regional Plan, U.N. Document E/CN.14/L.407.



## Discussion

■ Some participants raised the issue of technological determinism; according to this viewpoint, if a technology is discovered it must be used or will propagate itself somehow. This is inevitable social change which cannot be stopped. In the case of gari, for example, some aspects of its production are physically laborious; village women who are mainly responsible for the production would be pleased to transfer the difficult operations to a machine.

At the same time, cultural transfer between developed and developing countries is being continuously promoted by mass communications media. Hence people will demand the introduction of technologies used elsewhere which they read or learn about through books, the cinema, television, radio and other means. People will not accept a lower level of technology which may be intended through planning.

■ Attention was drawn to the problem of defining development. A yardstick for measuring development is necessary so that the tasks for technology can be accurately set. One of the main factors to be kept in mind in technology policy and planning is that developing countries are trying to do in a few years what took over a century in Europe.

■ Change in society due to technology can be positive or negative. It was felt that technological development is a necessity and only through proper guidance can its effects be controlled. Issues such as the magnitude of change that can be absorbed at each application should be taken into consideration in policymaking and planning.

■ An important question for technology policy is how to get technology that is rural-oriented. Technology has a role in rural development and this could be a large one. However, special care is needed in producing technology for rural development and in introducing it. Technology cannot be satisfactorily introduced in isolation; an integrated approach is necessary which will take into consideration social consequences and minimize social dislocation.

There is also a role for the survival of a few handicraft methods of production. Technology

should not be introduced with a view to displacing all old methods of production.

■ One participant believed that large-scale urbanization is an inevitable process. Delaying the introduction of technology from advanced countries in an effort to arrest it will be futile. He thought that efforts to develop special rural technologies may only retard progress.

■ Technology policy and planning should be preceded by the determination of the specific problems that we wish technology to solve. Most of Africa consists of rural communities whose basic needs must still be met by technology. They require improved housing, more satisfactory supplies of clothing, clean water, sanitation, and so forth. A great deal of attention should be focused on these needs in technological planning.

■ A part of the problem in African countries hitherto is that in planning for development, science and technology have not been taken into consideration in the process. Eventually the absence of this component makes it difficult to implement plans. People who are experienced in what technology can do and how it can be utilized should be brought into planning right at the beginning of the process.

■ Who should concern himself with technology policy? One participant suggested that the social role and consequences of technology are the responsibility of the social scientist. It may be argued that the natural scientist or technologist already has enough on his hands producing technology. His responsibility should end there. The responsibility for what to do with technology should rest with political leaders, and social scientists should worry about consequences.

Most participants felt, however, that this attitude is now outdated. The responsibility for the consequences of using technology has to be shared by all those involved in producing and using it, as well as those deciding the purposes for applying technology. Hence, scientists and technologists must be involved together with social scientists and political leaders in setting the objectives for science and technology. Technology policy and planning is a multidisciplinary activity and should be organized as such.





## Technology Policy Research in Europe and North America

**C. H. G. Oldham**

*Associate Director, Science and Technology Policy Program  
International Development Research Centre, and  
Deputy Director, Science Policy Research Unit  
University of Sussex*

Technology policy is primarily concerned with the ways in which science and technology can be used to achieve national goals. These goals usually include a combination of economic growth, a more equitable distribution of the nation's wealth, improvement of the health and welfare of the people, and national defence. The particular balance between these objectives obviously varies from country to country depending on the local social and political circumstances.

The precise ways in which technology influences the achievement of these goals is very complex. Most of us have hunches about why one technology may be better than another, or what sort of government policies are likely to influence an entrepreneur or manager of a state enterprise, or what the costs and benefits of importing a particular technology may be. But the truth of the matter is that we do not, in most instances, really know. A recent bibliographic search for empirical studies relating to the choice of technology revealed only a handful of studies and detailed case histories, yet the literature is flooded with "conventional wisdom" and economic theory.

And yet decisions about technology are made every day by a spectrum of decision-makers, from entrepreneurs on one hand to

cabinet ministers on the other. These decisions can affect the lives of millions of people, not only today but also for future generations. It is, therefore, simply a logical conclusion that multidisciplinary research using all the techniques of the social sciences should be carried out to understand the different facets of the problem, and in the last analysis to enable the decision-makers to make better decisions.

The purpose of this meeting is to consider how such studies can be carried out in Africa. In preparation for this discussion I have been asked to review the experience of such research in Europe and North America, and Mr Halty-Carrère will summarize the Latin American experience. Neither of us will claim that our experience is transferable to Africa. However, we think it is worthwhile reviewing the experience, and leave it with the participants to assess its relevance to their own countries.

The field of enquiry that we collectively call science and technology policy research, is evolving rapidly. If I were to have surveyed the scene only 5 years ago I would have reported a very different picture. The present situation can best be explained by developing three different threads, which in the last year or so have tended to converge and intertwine.

The first thread is the *academic thread*, the research that is carried out mainly in universities. This is made up of a number of different strands which for the most part have remained separate; in only a few institutions have they been successfully intertwined.

The first of these strands is the *economic strand*. Several of the earlier economists were interested in the role of technology in the economy. Marx, for example, clearly wrote about the subject and in more recent years Schumpeter and many others have made contributions. Interest has grown rapidly since the Second World War and now the economics of research and development, and the economics of innovation are very respectable branches with their own literature and specialists.

Second, there is the *sociological strand*. In parallel with the economists but working in separate departments, have been a group of sociologists developing the sociology of science. They look at science as a social system, examining the communication pattern between scientists, and the sociological behaviour of scientists themselves. There are now many leading sociologists who have established their reputations by working on the sociology of science — Shils, Merton, and Barber are examples.

Third, there is the *political science of science strand*. The political scientists turned their attention to the political science of science more recently than the other strands. Their work largely began in the 1950s and Don Price at Harvard is one of the pioneers in this area. Now many political science departments in universities of North America and Europe are carrying out research on this aspect.

Fourth, there is the *social history of science*. Historians of science are divided into two schools: the internalists examine the history of science as something quite separate from society and are more concerned with the evolution of the branches of science itself; the externalists believe science affects

society and vice versa, and think that the history of one cannot be considered without the other. In recent years, the social historians of science have grown in number, and I believe, in importance.

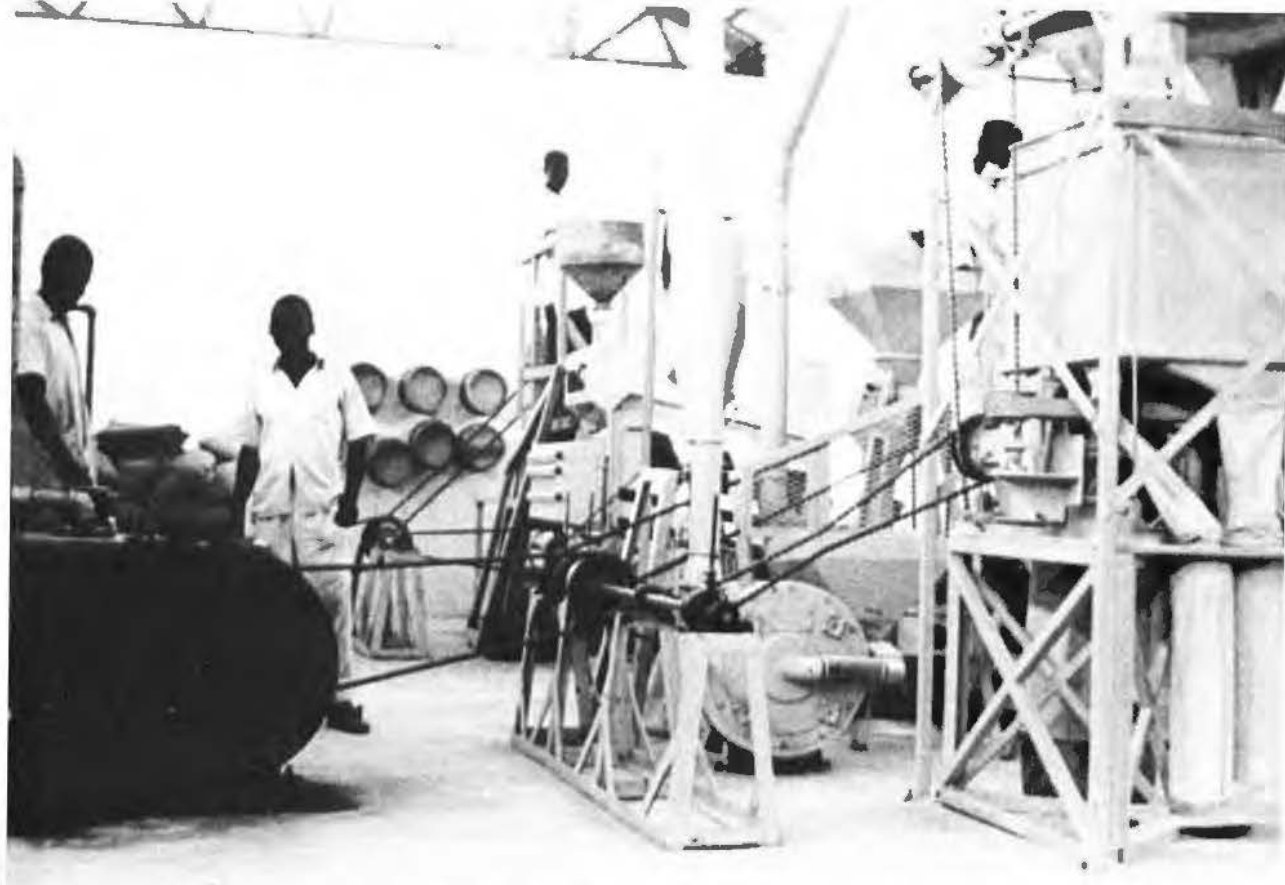
And finally, there is the *anthropological strand*. A number of anthropologists have been interested in the introduction and diffusion of technology in different societies, and this area too seems to be one which is growing in importance in anthropology.

But all these are narrow studies. There have been a few attempts to bring the threads together and one of the first attempts was carried out, not by a social scientist, but by a natural scientist. This was the famous crystallographer, J. D. Bernal, who, just prior to the Second World War, published his now classic "Social Functions of Science." For the social scientists, however, it seemed that professional respectability was guaranteed only if they stayed in their own separate disciplines.

About 5–7 years ago the situation changed slightly when a number of universities in Europe and North America created institutions aimed at bringing together the different disciplines. This approach was tried at Columbia and Harvard universities in the United States; at Sussex, Manchester, and Edinburgh in Britain; at Grenoble in France; Kiev in the Soviet Union; and several others. In some cases the experiment has not been a success; although the strands were intertwined for awhile the thread has become frayed and the disciplines are branching out on their own again.

To understand the forces which led to the creation of these interdisciplinary university groups it is necessary to develop the second thread — the *government thread*.

Growth of government interest in science and technology policy, and related studies was a logical outcome of growth in government spending on science and technology during and after the Second World War. For several years expenditures on research and develop-



ment have exceeded 2% of the gross national product (GNP) in many European and North American countries, and in some, they have exceeded 3%.

This government concern for science can be characterized as having taken place in three distinct phases:

- (1) There was a dominant concern with the strictly military aspects of science and technology. This was particularly true in Europe and North America, in the 1940s and 1950s.
- (2) The second phase is marked by continued government spending on military and prestige projects, but with a new and growing interest (and hence spending) on research and development in order to achieve economic growth. This was particularly true of the 1960s.
- (3) The third phase is the present one. Government concern has broadened to include more aspects of society. The approach was articulated in the Brook's

report prepared for the last OECD ministerial meeting in 1970 of ministers concerned with science and education. In essence, this report said two things. First of all, it suggested that governments should in future use science and technology for the social benefit of mankind and not just for arms and economic growth. Second, it said that in order to be effective, science and technology policy must be more than just research policy. It should include all aspects of scientific and technical services, the transfer and diffusion of technology, and the whole aspect of innovation. It should also be concerned with the training of scientists and engineers, and with the international search for technology. All these are part and parcel of what we now lump together as science and technology policy.

As the growth in need for policymaking grew in government, so too did the number of bodies set up to make policy. At first, these were largely peopled with eminent

scientists, but it was soon found that there was a need for a broader base. Scientists alone were not enough. As the complexity of the issue was recognized, efforts were made to establish research groups to help produce the needed knowledge—these were created in government departments and/or by government funding of work of international organizations such as the UN and OECD. By and large the groups that were set up were multidisciplinary, and worked on relatively short term objectives that were of immediate concern to the government of the day. It was the growth in government spending on science that led to the creation of government research groups, and was largely responsible for the new university interest in science policy.

This leads me back to the first thread—the *academic thread*. I mentioned that 5 or so years ago, a number of groups were established which tried to be multidisciplinary. I now propose to use some examples to see what lessons we can learn from the experience of these multidisciplinary approaches. The institutional arrangements fall broadly into two groups, one approach which seems to have worked and the other which does not.

My first category is the less successful group. These all started with a rather large endowment (which in most cases seems to have been an encumbrance rather than a help). Their principal characteristic was that these new units or institutions were to serve as focal points within the university, to bring faculty members together to work on projects. The research personnel continued to have their main base in their own disciplinary departments. Some very interesting work was done by these groups, but the two principal examples, at Columbia University and Harvard University, never became integrated within their respective universities, and in 1972 both were discontinued. In one case \$1 million was returned to the original donor and in the other, the money is now being used to endow two professorial chairs. Why were they failures? I have discussed this with

many people and two main factors seem to stand out.

First, the directors of the institutes were never given academic status (professorships) or tenure. As a result they tended to be regarded with suspicion by their colleagues, who had tenure and status, and who never gave the institutes their full support.

Second, the careers of the participants in the new interdisciplinary groups continued to depend on recognition by their colleagues in their own disciplines. In order to be promoted, their work was judged by people in their own discipline, not by the technology policy community.

The approach taken by some of the other groups was very different. Let me describe the experience of my own group at the University of Sussex—the Science Policy Research Unit. In the first place we were established as a research group with full-time commitment to research and with three tenure positions within the University of Sussex. We are autonomous, but we have a supervisory committee made up of faculty within the university which links us as a research unit to the university itself.

Second, the university provides funds for the three posts from University Grants Committee Funds, but everyone else in the unit (30–35 research fellows) is supported by research grants or contracts from outside the university. These sources may be government departments, international organizations, research councils, etc. This means that we must work on problems for which people are prepared to pay money, i.e. we must convince research councils of the academic merit of our proposals, or the international organizations, government departments or business enterprises of the usefulness of our work. This means that we have to spend much of our time working on “real life” problems, and our continued existence is dependent on being able to meet the requirements of our sponsors.

Third, we have always tried to work as multidisciplinary teams. We have about an equal mixture of natural and social scientists working in the unit and we usually include both in each team.

Fourth, the areas we have selected for work have been related both to problems of industrialized societies and to problems relating to developing societies.

Finally, an important point that has helped maintain goodwill between the unit and the university is that we have been involved in a good deal of teaching within the university. In the first instances, this was usually a case of the research worker teaching courses in his own discipline, but more recently we have been called upon to teach courses on "science and society" to both undergraduates and graduates.

I will now switch to what I will call the third thread, or *futures thread*, which seems to have brought the university groups and government groups much closer together. This thread has been very recent in its development. A few years ago, people began to realize that the year 2000 was approaching. This led to the creation of several groups concerned with forecasting the future. These groups came to public and government attention with the publicity given by the Club of Rome to the MIT's work on "Limits to Growth." The MIT (Massachusetts Institute of Technology) Group used complex systems dynamics computer modelling and showed that the physical limits to growth were such that unless countries restricted drastically their rates of economic growth, the world would collapse in 60–100 years.

The Club of Rome circulated copies of this report to members of most of the governments in the world. They spoke with cabinets and urged government action to restrict growth. Unfortunately, the MIT work was full of errors and wrong assumptions, and in the eyes of many it has now been largely discredited. But it did two very important things.

First, it made governments much more aware of the long-term implications of current decisions, and the need to think about the world in 30–60 years. Second, it showed there was some value for decision-makers in using complex systems modelling. The result has been the creation of several governmental research teams doing their own systems dynamics modelling.

This leads us back to the need for university groups also to be involved in this sort of study. We know that technological change governs the future. The investments and decisions made today in science and technology policy greatly influence the future. It was for this reason that a program of social and technological forecasting was started at Sussex. We believe that the principal role of people working in this area is to present the decision-maker with the alternative economic, social, and political implications of the technological decisions which he is going to be called upon to make. We have received government grants to do this, and it seems very likely that in the next few years there will be considerable effort in this sort of science and technology policy work, both in university groups and in government groups.

To summarize, a new area of enquiry has emerged in the last 5 years. According to a recent Unesco survey there are some 100 government groups and 150 academic groups currently doing research on some aspect of science and technology policy in Europe and North America. There are now two news magazines devoted entirely to reporting news about science and technology policy: (1) *Science Policy* is published by the Science Policy Foundation in London and contains information on science and technology policy from around the world; and (2) *Public Science* is published bimonthly in the US. There are three new journals that publish articles related to the field and several other journals that cater to forecasting and future studies. There is even a new branch of the History and Philosophy of Science Union of ICSU (International Council Scientific Union),

which was set up last year entirely for science and technology policy. The number of full time practitioners must be well over 1000.

Finally, a question I am often asked is — why should a university be involved? Isn't it more logical for these studies to be carried out by industry and government?

My answer usually includes the following components. First, the knowledge gained by these studies is knowledge about how society works. It is one of the functions of a university to do this sort of research. Second, universities not only have a responsibility for training the specialists who are going to be involved in science and technology policy-making and research, they also have a responsibility for promoting an awareness in all

their students about the role of science in society.

A third reason why universities should be involved in this type of work is because the methods of analysis are getting so complex. Governments are making extremely important decisions using computer simulation techniques and it is important for non-government groups, especially university groups, to be able to check government analysis and challenge their methodology.

And fourth, universities have a responsibility to generate knowledge not only for the decision-maker, but also to keep the general public informed about the ways in which technology is going to affect their lives and their children's lives.

## Discussion

■ Several issues were identified concerning the relevance of the European and North American experience to the African situation. Two principal questions were raised.

- (1) Is there any point in creating a university group before there is any government "demand" for the results of its research? In some African countries, there appears to be little government interest in science and technology policy. Why therefore create units to do research?

In answer to this, it was pointed out that it is often difficult to specify which should come first — supply or demand. Some examples illustrate that the results of research have made politicians and policymakers much more aware of the economic and social implications of their decisions about technology, and have led to the creation of a "demand" for more knowledge. On the other hand, there are many other examples where research results have only gathered dust on library shelves. It is a question of where this vicious circle should, and can, be broken.

- (2) Should industry do its own technology policy research?

It was pointed out that in most large industrial companies in Europe and North America, there are groups that carry out studies to provide information for the company policymakers. They are not always listened to. But neither do government policymakers always act on the advice provided by their research teams. In the UK the larger firms often make contracts with university groups even though they have their own in-house teams. They claim that the university teams provide new insights which the company teams have missed. It was not clear whether industry in Africa would similarly commission research in African universities.

■ Other questions related more specifically to the points raised in the paper. For example, how important is the fact that the research institutes that failed had large endowments; and if contract research is an essential characteristic of success, what chance have African university research units of succeeding?

Dr Oldham thought that in the two American units that have now been disbanded, large endowments may have contributed to their downfall because generous external funding to one unit creates university jealousies which are not easily resolved. This is especially true when the subject matter of the grant (in this case science and society) cuts across almost all facets of a university's life. At the same time, it is not a healthy situation for a university group to have to depend entirely on contract research. A balance between internal and external funding is required. If the research group in an African university is really concerned about technology

and development, in one sense a measure of that unit's success would be the extent to which federal and state governments, as well as private companies, are prepared to place contracts with it.

■ Another question was raised about the relative objectivity of university and government groups. It was suggested that in practice, neither has turned out to be more objective than the other. A strong case, however, can be made for a pluralistic approach to this kind of research. University and government groups are both necessary.





# Technology Policy and Planning in Latin America

**Máximo Halty-Carrère**

*Research Fellow, International Development Research Centre  
(formerly head of the Technological Planning and Studies Division,  
Organization of American States)*

This paper attempts first to clarify what is meant by technology policy and planning in Latin America by providing its conceptual framework. Technical development is a process of production, distribution, consumption, and international trade of a special commodity: technology. The purpose of the technology policy and planning effort is to formulate policies, strategies, and plans to establish a continuous process of technical development within the general framework of economic, social, and cultural development goals of each society. The scope of this field in Latin America is therefore significantly different from that which prevails in developed countries, where science policy was initially a synonym for research policy, and, later, a policy to develop the scientific and technological infrastructure.

A review of what has been done in this field in Latin America stresses the complementarity of the action undertaken at national and regional levels. A Regional Project of Science and Technology Policy and Planning was set up by the Organization of American States, (1) to promote an awareness of the need to formulate national and sub-regional technology policies and plans; (2) to undertake the necessary basic studies required for their formulation; and (3) to provide technical and financial assistance to establish adequate institutional mechanisms for these

studies. Since its inception in 1968, almost \$2 million was invested in this regional program. A decentralized approach was taken from the beginning in the sense that all studies and research were conducted at the national level by national teams. The Regional Secretariat was given the role of promoting the participation of new national teams, facilitating the exchange of information and experiences through seminars and meetings, and providing the methodological support for a common approach. The program started in two countries and gradually expanded to include most of the countries in the region.

The studies were carried out at two levels. Basic research dealt with the analysis of the factors that affect the global process of technical development, and a study of its components; and applied research prepared the groundwork for the formulation of policies and plans. These studies can be summarized in note form as follows:

## *Basic Research*

- (1) the process of production of knowledge (analysis of the industrial research and development effort)
- (2) the process of diffusion (analysis of the role of "intermediaries," i.e. information and technical extension services, technical consultants, etc.)

- (3) the process of application (analysis of the economic, psycho-sociological, and cultural factors which affect the process of technical change and innovation)

#### *Applied Research*

- (1) analysis of the scientific and technological system (research and development, information, technical services, etc.) in terms of human, financial, and institutional resources; definition of existing technical capability using the local supply of technology
- (2) analysis of the process of international transfer of technology ("visible" and "invisible" costs, restrictive conditions, adaptability of imported technology, etc.) to define the conditions for the supply of foreign technology
- (3) analysis of the requirements for science and technology for national development; definition of the potential demand in accordance with national priorities



An analysis of the relative advantages and disadvantages of the various possible institutions to undertake these studies showed that, (1) universities and independent research organizations are better suited to undertake basic research in the field; (2) government agencies must formulate policies and strategies, and implement them; and (3) universities, independent or government research organizations, and government institutions could all be concerned with applied research activities, provided that a strong link with government is established. International organizations should play a promotional, catalytic, and supporting role to facilitate international comparison and exchange of experiences.

A summary of the results achieved in the Latin American region follows.

#### *At the national level:*

- Institutions for technology policy studies were established and reinforced (e.g., national research councils, national policy councils, royalty commissions, transfer of technology registries, etc.).
- Institutions capable of undertaking sound research work in the field were also established and supported (e.g., universities, independent research organizations, national research councils, planning commissions, etc.).
- A "body of knowledge" about the subject was developed.
- A small but influential group of professionals were trained in the field.
- A first attempt was made to formulate national policies for scientific and technological development.
- A very preliminary attempt was made to implement national policies and plans.

#### *At the sub-regional and regional levels:*

- The Regional Science and Technology Policy and Planning Program was developed by the OAS.

- Common policies, strategies, and regulations for technical development, and for controlling the transfer of technology were formulated and adopted (Andean Pact sub-region).
- (3) Too much relative emphasis has been placed on studies required for "micro-planning" of the effort (e.g., inventory studies), compared with studies which could be used directly to define policies and formulate strategies.

### **Evaluation of Technology Policy and Planning Research**

An evaluation of the Latin American experience in technology policy and planning research should include an analysis of the successes and failures of both methodology and results.

#### *Methodology*

Two methodologies have been developed for research into technology policy and planning: (1) the methodology for compiling inventories of scientific and technological systems (although they do not include the technological capabilities of industry); and (2) the methodology for analyzing the process of importing technology, and the conditions of the international technology market.

There is still no suitable methodology for determining the *demand* for science and technology. The "sectoral" approaches are too expensive and time-consuming, and the "global" approaches proved to be unsatisfactory.

#### *Results*

Three criticisms can be levelled:

- (1) Too much emphasis has been given to the methodologies for compiling inventories of the science and technology system, without the necessary preliminary effort of defining how to use the information for generating policy measures.
- (2) Too much emphasis has been put on the problem of determining the supply, and too little on defining the potential and actual demand.

However, much of the research (mainly the transfer of technology studies) did have a strong impact at political decision-making levels and did influence the formulation of policies and strategies. Also the research effort gradually built up a "body of knowledge" which placed Latin American work in the forefront of world-wide research in the field. It may be noted that research material prepared for CACTAL (Conference on the Application of Science and Technology for the Development of Latin America, Brasilia, May 1972) and other Latin American conferences has been quoted in many international conferences and seminars.

In only a few years the research effort has created an awareness of the problems faced by Latin America in science and technology.

### **Evaluation of Science and Technology Policy and Planning**

An assessment of the Latin American experience in science and technology policy and planning during the last decade reflects a chronological parallelism between the advances in Latin American thinking on the problem and the accomplishments attained at the national, sub-regional, and regional levels.

Three definite stages can be identified in the progress of the policies adopted in several countries of the region, in groups of countries, and in the region as a whole.

The first stage corresponds to a policy which only concerns itself with reinforcing the scientific and technological infrastructure. When the thinking on science policy was restricted to technical research and education policy, several countries established national research councils to coordinate research and

## Local Science and Technology System:      External Flow of Technology:

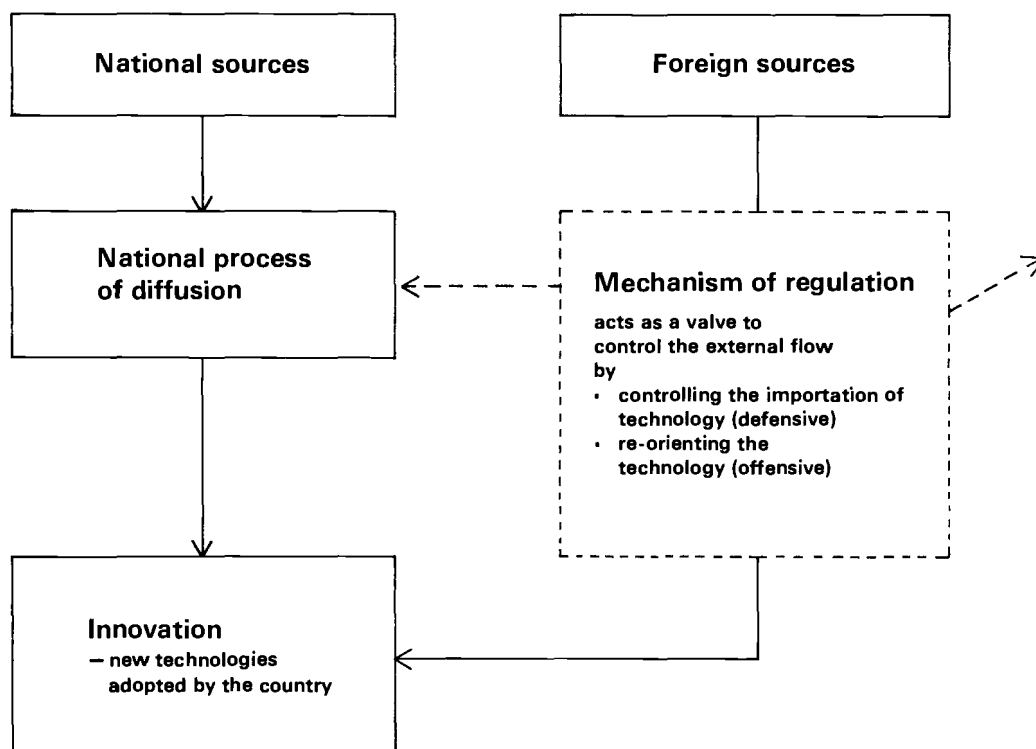


FIG. 1. Chart showing the need for a regulating mechanism to control the bypass of local science and technology policy systems by the flow of external technologies.

promote scientific education. At the regional level, the OAS Regional Program for Science and Technology Development was created to develop and reinforce the technical infrastructure through regional cooperative research and educational projects.

The second stage is a "defensive" strategy which aims to control the flow of external technologies to improve the process of technology importation. This strategy arose from a series of research studies undertaken with support from the OAS Regional Program and the IDRC, in several Latin American countries. These studies called attention to the imperfections of the international market of technology and the various problems developing countries face in importing technology.

Among these problems are:

- the explicit and implicit cost of the imported technology;
- the restrictive conditions attached to it;
- the fact that imported technology is often not adapted to local conditions;
- the lack of proper information on, or evaluation of, alternative technologies; and
- the lack of development and utilization of local technologies.

Most of these problems are due to the "bypass" of the *local* science and technology policy system by the flow of *external* technologies (see Fig. 1).

Most countries reacted to this bypass by creating a national control mechanism for regulating the flow of external technology (e.g., registries of licensing arrangements, patents, etc.), and by uniting in the Andean Pact to lay down common defensive regulations.

This third stage could be called an "offensive" strategy. It involves the establishment of a mechanism to regulate the flow of external technologies in order to increase the utilization of local technologies, and encourage their development and gradual export. This approach follows the analysis made at CACTAL of the orientation to be given to technical development in Latin American countries, by trying to overcome the present "marginality" of their scientific and technological systems. The mechanism of regulation acts as a

"valve" to control the external flow, thereby increasing the level of technological self-reliance in accordance with national policy and sectoral technical development.

This strategy of dynamic, "offensive" regulation is being applied effectively only in one country, but the Andean Pact countries (Bolivia, Ecuador, Chile, Peru, Colombia, and Venezuela) are now defining a common technological policy along these lines.

The Latin American countries are at various stages in policy development, depending on their present degree of technical advancement. However, their progress generally seems to follow the three levels outlined above to attain the proclaimed objective of reduced technological dependence.

## Discussion

■ Several questions and comments centred on the offensive and defensive strategies adopted in some Latin American countries, and the mechanism of control of technology importation. It was first noted that in order, for instance, to be able to follow Japan's offensive strategy of importing technology, modifying it and re-exporting it, countries must have the required technological and organizational infrastructure. It was also felt that as part of any defensive strategy, careful attention should be given to a proper selection of imported equipment and imported technology.

■ Answering a specific request for more information on the measures for control of imported technology, Mr Halty-Carrère gave some examples of how the first institutions established in Latin America (royalty commissions) were controlling and approving licensing arrangements only out of concern for the conservation of foreign currency. A new dimension has gradually been added by requiring them to take into consideration technological policy matters. In other cases, new bodies have been established for mandatory registration of these contracts. Some of these new bodies have tried recently to con-

trol the external flow in a way that would ensure that national scientific and technological institutions participate in the process of transfer. In Brazil, for instance, before approving the licensing agreements, the controlling body tries to find out if there is similar technical knowledge in local industry or in the local industrial research system.

■ A comment was made on the advisability of taking a political decision to cut external contracts for the purchase of technologies to encourage technical self-reliance. A policy of isolation would tend to create a climate of hardship which could stimulate the development of local sources of technology.

With respect to this suggestion, it was felt that this policy could be adopted in those sectors where there is an adequate local technological infrastructure. The regulation of the external flow of technology could, in some sectors, follow a policy of self-reliance; in others, the regulation mechanism could follow a policy of relying mostly on foreign technology, while gradually incorporating an increasing share of local technology.





## **Discussions on Technology Policy and Planning in some African Countries**

Dr Oldham, who was chairman of this session, asked each of the participants to summarize the experience of their own countries with regard to technology policy and planning, and asked them to indicate whether there was a unit carrying out technology policy research.

### **Tanzania**

Mr Kaduma and Dr Wasawo reported that a National Scientific Research Council has been established in Tanzania with a number of specialized committees. The committees are concerned with agriculture, medical science, food science and technology, building and construction, industry, scientific manpower development, social sciences, scientific and technical documentation, natural resources, natural sciences, and standards.

There is also an Institute of Development Studies which is a part of the University of Dar-es-Salaam. This institute is primarily an interdisciplinary teaching institute aimed at giving all students a better understanding of their role in building socialism in Tanzania. An important element of this program is the teaching of how science and technology contribute to development within the context of a policy of self-reliance. Although the institute has not yet begun to do research, it is intending to do so. Technology policy research could be one of its activities.

### **Ethiopia**

Mr Tebicke explained that the Ethiopian government had recently established a National Scientific Research Advisory Committee. This committee is in the process of setting up an Institute of Scientific and Technological Research and Development within the Haile Selassie I University. Among other things, the institute will be involved in the process of formulating scientific and technological policy, and it is expected to carry out technology policy research. As a part of the process of science policy formulation, a science sector review will take place early in 1974.

### **Ghana**

The organization of scientific and technological research in Ghana was described by Prof Kwami. The principal government organization is the Council for Scientific and Industrial Research which runs its own research institutes. There is also an Atomic Energy Research Commission. In addition, research is being carried out in the universities and a Technology Consultancy Centre has been established at the University of Science and Technology in Kumasi. This centre enables the country to tap the potential of university faculty members, and is used by both large industrial organizations and small-scale businessmen. There is, however, no group in

Ghana working specifically on technology policy research.

### **Nigeria**

Prof Olaniyan and Prof Oyawoye gave brief accounts of the history of the Nigerian Council for Science and Technology. In this council, there are representatives of three different groups: scientists, administrators, and state representatives. The council was established in 1970 and four research councils were created to deal with industry, agriculture, health, and natural sciences. It was proposed that the existing research insti-

tutes previously connected with different ministries should be transferred to the appropriate councils. This move has been resisted by some ministries.

At the moment, the council does not have a unit for carrying out technology policy research, but it would be a logical place for a Nigerian government research group to be formed.

Finally, Prof Howat gave the background to the creation of the University of Ife Technology Policy Research Unit.

## Recommendations

The final working session, chaired by Prof Ojo, was devoted to a discussion of the relative importance and timing of action at national and regional levels. The possibility of the IDRC providing financial assistance for technology policy research was welcomed with appreciation by the participants. Out of the discussions the following recommendations emerged:

- (1) Emphasis should be placed on establishing national groups for technology policy studies. These groups could be connected with either government institutions or universities. If they are established in universities an effort should be made to ensure that there is close consultation with governments in order to ascertain the problems which governments consider important. The different universities working in this field should also cooperate among themselves.
- (2) Once a few national groups have been established, there should be an attempt to create links between the different groups. These links may arise from a regional program which might be promoted by the OAU or the ECA. Alternatively, they may be developed by direct cooperation between national groups. This cooperation is most likely to be useful when the national groups are carrying out research in similar topics, and in this case they may form a regional research network.
- (3) In order to assist in the creation of national groups, a travelling seminar should be arranged to visit those countries which request it. In such a scheme, two or three experts would travel to the different countries and would spend a few days in each. They would make presentations about the value of technology policy studies to a group of participants from government and universities. The principal function of such a seminar would be to create an environment within which the establishment of a national group could be discussed.
- (4) Technology policy research should be carried out by groups which contain an interdisciplinary mixture of technologists, natural scientists, and social scientists.

## Appendix A

### Opening Address

*by the Vice-Chancellor of the University of Ife, Dr H. A. Oluwasanmi  
(read by Prof A. A. Adegbola, Deputy Vice-Chancellor)*

It is with great pleasure that I welcome you all to this university for the IDRC/ECA meeting on the creation of centres for technology policy studies in Africa.

Those who comprise this seminar are well aware that technology is inevitably an instrument of social change. Usually the changes initiated by technology produce, as a first result, some improvement in the quality of life to some sections of the community. But this improvement often brings with it, as a secondary effect, deterioration in some other way.

When one considers the development of technology in Western Europe in the latter part of the 18th century and throughout the 19th century, these changes are evident, both the good and the bad. A rising standard of living, in terms of income, for most of the urban population went hand in hand with a proliferation of poor housing and a countryside littered with the by-products of great industries.

We now know with the benefit of experience in this century that some, or indeed all, of the desirable changes could have been effected with less disturbance to the community and fewer social costs for later generations. The lesson of how to handle technological changes has been learned, but the cost of learning the lesson was high.

Countries such as Nigeria that have been late in entering the technological age, have the advantage of being able to learn from the past and, hopefully, to avoid some of the worst mistakes that other countries have made.

The fact that well-defined national plans covering a fixed span of years have been developed and published by the federal government

is an indication of official awareness of the dangers to society that are inherent in a rapidly developing country. Although the development plans are devised primarily to ensure optimum economic growth and full utilization of natural resources, they can also provide some indication of where dangers and technological limitations lie. Such plans are an integral part of economic forecasting in all countries.

Three points about such plans must, however, be kept in mind. First, those who are responsible for national planning are not necessarily aware of all the technological and social factors that need to be considered for the well-being of the whole community. Second, the effectiveness of the best plans can be limited when one part of the development program lags behind schedule and thereby distorts the whole picture. Third, new factors may evolve during the execution of the plan which can cause unexpected difficulties.

For example, the establishment in the Lagos conurbation of industrial estates at Apapa, Ikeja, and Ilupeju must have involved much detailed planning, and a whole host of industrial, social and economic factors would need to be considered. From all indications, the work was done thoroughly.

What could not have been foreseen — or at least not clearly foreseen — was the enormous development of motor traffic to and from, and through these areas. Consequently, the transport of workers, supply of raw materials, and dispatch of finished goods in these areas now present very serious transportation problems, so serious that much of the good work of planning is in danger.

It is against this background of the needs of a developing country that the University of Ife has

decided to establish an organization especially oriented to study the economic, social and technological factors involved in industrial development. Sometimes it is thought that this kind of study need only be made in the planning and establishment of large projects where many millions of Naira are immediately involved. This, however, is not necessarily true.

Naturally, large projects involving heavy capital expenditures do merit much detailed study. For example, if the federal government, in conjunction with some industrial body, decides to increase the production capacity of cement in this country, various important considerations have to be examined.

One fundamental factor to be decided is whether to establish a single very large production unit or to set up several smaller ones. The former course will probably provide cement at a lower price than the second one. That is a considerable economic advantage which cannot easily be ignored. But technologically there is a risk. If a breakdown occurs in the large plant and a vital part has to be replaced, *all* cement production will be at a standstill until this is done. And experience tells us this will sometimes happen. Two, or even three, factories will spread the risk of stopping production, but this will result in an increase in the price of cement.

Then there is the question of locating the factories. Should they be established near the raw material source even in a low population area, so that labour has to be imported, trained, and housed? Or is it better to transport the raw material to an area where skilled and unskilled labour is already available in established communities? This latter question involves the present and future carrying capacity of the roads for transporting raw materials to the factory. It will also involve government proposals for roads in the future.

There are other technological questions too. Should the factory use a well-tried process and the plant that goes with it, or should it adopt a new process, not so well-tried but giving a lower cost per production unit, and possibly a slightly better product for special purposes.

These are some — and only some — of the factors to be considered in establishing a large industrial project.

But it is not only large projects where such technological and economic planning needs to be done. This university has already embarked on one project in collaboration with the University of Sussex, England, where these factors are important. It is financed partly by the University of Ife and partly by the International Development Research Centre.

This project deals not with cement but with the foodstuff called gari. For the benefit of those who do not know what it is, gari is the predominant carbohydrate staple food in the southern parts of Nigeria, and it has been a staple food for well over a century. It is prepared from cassava tubers which are first washed, peeled, and grated. The grated material is allowed to ferment for 2–3 days in some closed vessel which will allow excess liquid to drip out. It is then dried (sometimes called “frying”) with or without the addition of a small amount of palm oil. The finished gari is eaten after moistening with water, usually as a side dish with soup or stew. The purpose of the somewhat cumbersome preparation technique is to develop its characteristic acid flavour and to break down some cyanogenic glycosides present in the raw tuber.

Making gari is a heavy, tedious job, and at the final drying stages it is usually hot and smoky as well. It is traditionally women’s work and the product is prepared in villages all over the southern part of Nigeria. As is the case in most village industries variations occur in the method of preparation, and consequently in the final flavour.

In the past two decades much attention has been given to the possibility of mechanizing the process and, at present, three different types of machines have been developed which will produce gari commercially. One of these machines is a large well-engineered production unit available in several sizes, including one size capable of producing up to 10 tons of gari per day, using 40 tons of cassava tuber. The prototype of this machine is in Oshodi, Lagos, and at least one other has been ordered for use in the Western State. A third is in commercial production in Gambia.

The other two types of machines are, in part, linked adaptations of existing food processing equipment. They are available only in units with smaller outputs than the previous one and are

very much less expensive. Until now, neither type has been in commercial production, except for short periods.

The interest shown in these different machines suggests that Nigeria is on the brink of a substantial change in the method of making gari. However various important questions arise about this development. There are technological questions. For instance, do the different types of machine, as currently developed, produce gari of the same texture and in the same flavour range as gari produced in the villages? If not, could they be modified to do so? Alternatively, would the consumers accept a different flavoured gari? Another question is the dependability of the machines. Will they fail in use frequently and need expensive replacement parts, possibly with long periods of standing idle?

Then there are supply and labour questions. Where are the large growing areas? And what is the annual yield per acre? How many women are employed in making gari, and what income do they get from their labour? What would happen to them if commercial production of gari put village production out of date? Finally, there is the all-important question — is producing gari this way an economic proposition? Could it be sold at a lower price than village production?

These are the questions that a multidisciplinary group of economists, extension workers, geographers, and food technologists has been examining during the past nine months. The work has already yielded much new knowledge. We believe and hope that when this part of the project — Phase 1 — has been completed we will have enough information to warrant an extension of the work into a larger field — Phase 2.

These two widely different examples indicate the range of work that can be examined in a unit like the one we have decided to establish. In some cases we anticipate that the staff will initiate studies into known problems. In other cases, when an approach from outside is made, the problem will need to be defined and quantified from available data. Then ways of solving it will be suggested, and finally the proposed solutions suggested by the unit will be assessed critically.

One other aspect of the unit's work will be to examine the problems that arise in the transfer of technology to developing countries. This is a

subject of great importance. We are all too well aware of the disappointments that have been experienced both by donor organizations, and those who receive technological aid, when the expected result fails to appear. Questions arise to which no satisfactory answers can be given.

It is because we believe that sometimes the answers are sociological rather than technical that we want our unit to be actively involved in sociological and economic as well as technological aspects of transfer of technology.

The involvement of students, at postgraduate and undergraduate levels, in the work of the unit is likely to be considerable. We know that there is a valuable stimulus to staff in having teaching responsibilities as well as research work. But, in addition, experiences in other universities with similar units have shown that student interest is likely to develop and formal courses of instruction in technological planning may be requested.

Fortunately we can benefit from the experience of other universities who have set up similar organizations. In particular, we are indebted to the University of Sussex for guidance from their Science Policy Research Unit.

The types of problems we face will be similar to those that have arisen elsewhere, since the principles of technology and economics are universal. But we may need to bear in mind some special factors that may not be significant in other countries. As a result, our conclusions might not necessarily coincide with those arrived at in another country with a different social and climatic background.

One thing is clear to us. That is the need for the unit in its early years to build up for itself a reputation for accurately defining the nature of technological, social, and economic problems, for assessing their dimensions, and for providing meaningful solutions.

We do not underestimate the difficulties inherent in establishing such a unit but we believe that it will be of considerable value to the country. So we propose to make the attempt.

We hope that our deliberations in the next few days will enable us to see more clearly the way forward and I wish you much success in your labours.

## **Appendix B**

### **List of Participants**

#### *Representatives from the University of Ife, Ile-Ife, Nigeria*

Prof A. A. Adegbola	Dr L. E. Rosenthal
Prof D. F. Ojo	Dr A. A. Akiwowo
Prof G. R. Howat	Dr A. O. Lewis
Prof A. A. Igun	Dr I. E. Owolabi
Prof A. M. A. Imevbore	Dr G. A. Makanjuola
Prof V. A. Williams	Dr P. O. Ngoddy
Prof A. A. Afansiev	Mr J. K. A. Wahab
Dr S. A. Sanni	Dr S. R. A. Macaulay
	Dr I. A. Odeyemi

#### *Representatives from Other Institutions*

Dr A. Banjo Economic Commission for Africa Addis Ababa, Ethiopia	Mr H. L. Tebicke Haile Selassie I University Addis Ababa, Ethiopia
Dr D. P. S. Wasawo Economic Commission for Africa Addis Ababa, Ethiopia	Prof F. O. Kwami University of Science and Technology Kumasi, Ghana
Dr M. Halty-Carrère International Development Research Centre Ottawa, Canada	Prof M. O. Oyawoye University of Ibadan Ibadan, Nigeria
Mr I. M. Kaduma University of Dar-es-Salaam Dar-es-Salaam, Tanzania	Prof C. I. O. Olaniyan University of Lagos Lagos, Nigeria
Dr C. H. G. Oldham International Development Research Centre University of Sussex Brighton, England	



## **Credits**

*Editor:* Carol Thiessen

*Cover design:* Opaque, Ottawa

*Photographs:* Page 4, 14, CIRIC, Geneva; 6, 10, 12, 17, IDRC, Ottawa; 22, 24, 28, International Labour Office (ILO), Geneva.

## **technology policy study centres in africa**

Report on the IDRC/IEA meeting on the creation of centres for  
technology policy studies in Africa, Ile-Ife, Niger 4, 5-10 December 1973



IDRC-0276

## **IDRC Monographs**

- IDRC-010e** Chronic cassava toxicity: proceedings of an interdisciplinary workshop, London, England, 29-30 January 1973, Barry Nestel and Reginald MacIntyre (ed.), 162 p., 1973.
- IDRC-012e** Three strands of rope, Clyde Sanger, 24 p., 1973.
- IDRC-013e** The first 100 projects, 29 p., July 1973.
- IDRC-013f** Les 100 premiers projets, 30 p., juillet 1973.
- IDRC-014e** Research policy: eleven issues: outline statement to the Board of Governors of the International Development Research Centre at their meeting in Bogota, Colombia, March 19, 1973, W. David Hopper, 16 p., 1973.
- IDRC-014f** La recherche pour le développement: onze principes fondamentaux: récapitulation des principes fondamentaux gouvernant les activités du Centre. Discours prononcé, le 19 mars 1973, devant le Conseil des Gouverneurs réuni en Assemblée à Bogota (Colombie), W. David Hopper, 21 p., 1973.
- IDRC-015e** Aquaculture in Southeast Asia: report on a seminar at the Freshwater Fishery Research Station, Malacca, West Malaysia, 17-25 April 1973, 22 p., 1973.
- IDRC-016e** Consumer food utilization in the semi-arid tropics of Africa: report of an interdisciplinary workshop, Zaria, Nigeria, 30 April-4 May 1973, 16 p., 1973.
- IDRC-017f** Durabilité naturelle et préservation de cent bois tropicaux africains, Yves Fortin et Jean Poliquin, 143 p., 1974.
- IDRC-018f** Éducation sexuelle en Afrique tropicale, 124 p., 1973.
- IDRC-019s** Administración Universitaria: Aspectos Fundamentales sobre la Administración Académica Universitaria, Henrique Tono T., 25 p., 1973.
- IDRC-020e** Cassava utilization and potential markets, Truman P. Phillips, 184 p., 1974.
- IDRC-021e** Nutritive value of triticale protein, Joseph H. Hulse and Evangeline M. Laing, 183 p., 1974.
- IDRC-022e** Consumer preference study in grain utilization, Maiduguri, Nigeria, Jean Steckle and Linda Ewanyk, 47 p., 1974.
- IDRC-023e** Directory of food science and technology in Southeast Asia, 194 p., 1974.
- IDRC-025e** AGRIS and the developing countries/AGRIIS et les pays en voie de développement/AGRIIS y los países en desarrollo, 35 p., 1974.

