THE PROBLEMS OF LINKING SCIENTIFIC RESEARCH WITH THE PRODUCTION SYSTEM IN GHANA

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ABSTRACT

An impressive scientific research infrastructure has been built up in Ghana over the years in recognition of the important role of science and technology in economic development. It is felt, however, that the institutions engaged in research are not making significant impact on the development of the country. Some of the problems responsible for this are discussed and some ways of improving the situation are suggested. It is argued that in the absence of an explicit policy statement on science and technology and a clear definition of their place in the country's development plans the impact of the research effort is likely to remain limited. The discussion is brief and no attempt is made to cover all the complex issues involved. The object of the paper is merely to stimulate further discussion.

Keywords: scientific research, industry, commercialisation, technology policy

INTRODUCTION

In Ghana, as in most developing countries today, the critical role of science and technology in the economic development process has been recognised. The need to develop endogeneous scientific and technological capabilities is also agreed, and resources have been allocated over the years for the establishment and maintenance of institutions charged with the task of carrying out scientific and technological research. However, the output of these institutions judged by their impact on industry, in particular, and on the economy as a whole is rather poor.

In this paper some of the obstacles to the generation and industrial utilisation of research results are discussed with the object of provoking further discussion of a subject that is of crucial importance to the country's development.

THE MAIN CENTRES OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH

There is at present quite a considerable number of institutions in Ghana which are engaged in scientific research. The most prominent of these institutions are the universities, the research institutes and centres under the quasi-autonomous Council for Scientific and Industrial Research (CSIR) and other research centres under various Government Departments.

The three universities in Ghana are conventional British-modelled institutions engaged in teaching, research and the preservation of knowledge. Although the universities are funded by Government and are consequently subject to administrative control through the Ministry of Education they enjoy substantial freedom in the conduct of their academic and research work. Within the universities themselves research work is carried out in the academic depart-

ments as well as in a number of research institutes and departments established with the function of researching prescribed subject areas. Of the three universities, the University of Science and Technology in Kumasi is the best endowed in terms of its resources for scientific and technological research. It also holds the monopoly over the production of graduates in several important fields including all the major disciplines of engineering.

The CSIR, which has its origins in National Research Council created in 1958 to organise and co-ordinate scientific research in Ghana, was established in its present form in 1968. Its many statutory objectives and functions may be summarised as follows: to advise Government on science and technology matters; to establish and control scientific research institutions; to co-ordinate scientific and technological research in all its aspects; to encourage scientific and industrial research and the training of research personnel; to collate and publish research results and other useful technical information; and to perform other functions assigned by the Government. The CSIR reports to Government through the Ministry of Industries, Science and Technology. It currently maintains some thirteen research institutes, units and special projects the youngest of which is a Technology Transfer Centre.

Apart from the universities and the institutes under the CSIR there are other institutions established for research or whose work involves some amount of research. Mention may be made of institutions such as the Cocoa Research Institute (controlled by the Ghana Cocoa Board and responsible for research in all aspects of cocoa, coffee, cola and sheanut production), the Forest Products Research Institute (until 1980 directly under the CSIR), and the Centre for Scientific Research into Plant Medicine. Other examples are the Ghana Atomic Energy Commission, the Environmental Protection Council, the Ghana Standards Board and the Energy

mention must be made of the research output of non-governmental organisations working on a variety of development projects around the country. These organisations, made up of charitable groups and the Churches, have been responsible for a certain amount of experimentation and the introduction of various technologies in the execution of their projects.

SOME OBSTACLES TO THE GENERATION AND UTILIZATION OF RESEARCH RESULTS

Low demand for local R&D results

The demand for local R&D results in Ghana is very low and there are many factors contributing to this situation. First, for historical reasons a large part of the industrial sector is very strongly oriented to the importation of technology and the production of goods under license. Many industries are operating with machinery and raw materials supplied from abroad and producing goods based on imprted processes without much scope for modification or adaption. In these circumstances the need for R&D is not fully appreciated by the industry. Consequently not much is being done by the industry to open up links with the centres of scientific and technological research. The building of effective links between research centres and the production system and the ability of the production system to utilize research results depend heavily on the existence of a certain minimum level of technical capability within industry itself. Very often in Ghana this minimum capability does not exist. As a result, many industrialists would be capable of using research results only when they are in the form of complete proven packages of equipment, process and product.

Many industrial enterprises in Ghana are owned and managed by persons who know very little about science and technology and the potential of R&D. There is also a lack of credibility on the part of industrialists. The work in these institutions is seen as academic, impractical and of no commer-

most complete absence

coupled with the liberal flow of imported technology, tend to smother the spirit of

innovation among industrialists.

There appears to be a scarcity of technical entrepreneurial talent in Ghana. There is a preference for simple retailing and wholesaling as opposed to production of goods. The reasons for this are quite complex and have to do with distortions in the national economy that have made it more profitable to engage in 'buying and selling' rather than industrial production. The result is an industrial sector that is not growing in the right direction and not generating the proper demand for R&D.

Poor mangement and control of research institutions

Probably the single most important factor affecting the efficiency of the research institutions and the quantity and volume of their output is their system of management and control. An Ad-hoc Committee set up by the CSIR to examine the prospects and modalities for marking the research results of its institutes identified problems such as the following: projects initiated and executed by individuals working in isolation; research projects not relevant to the realities of the market place; lack of priority setting and performance evaluation; less emphasis placed on mission-oriented research services to industry as opposed to individual scientific capability enhancement and self advancement (1). These and other problems catalogued by the Committee are symptomatic of inherent structural deficiencies in the CSIR which call for further study and corrective action.

Weak channel of communication between CSIR and Government

The channel of communication between the CSIR and Government is so weak that one cannot expect the CSIR to fulfil its many statutory functions satisfactorily. Science and technology have implications for virtually all aspects of national development. The fact that the CSIR, which is responsible for advising Government on science and technology matters, has to report through a particular Ministry means that its influence is heavily attenuated. The CSIR has no direct way of making an input to the research work of the Universities and other research organisations which come under other Ministries and Government Departments. Under the circumstances it is no surprise that the CSIR has not been able to 'co-ordinate scientific research in all its aspects' as statutorily required.

Inapropriate promotion criteria for research staff

One of the incentives for the staff of universities and research institutions to engage in research is promotion. Until recently, work based on the application of existing knowledge for the solution of locally relevant problems was not rated highly enough for promotion purposes. This was probably due to traditional self-imposed pressures on the universities and research centres to maintain 'international standards', resulting in undue emphasis being placed on research work that is publishable in 'reputable international journals'. However, the situation appears to be changing for the better. Promotion criteria have been redefined so that credit can be given to research and development work that is not readily publishable in international journals but is nevertheless practical and relevant to local needs.

A contributory factor to the problem described above is the fact that many members of the academic staff have received their postgraduate training overseas where their research is likely to have been on a topic that is not directly relevant to Ghanaian conditions. Staff with this kind of background would find it difficult to readjust to the new circumstances when they return to Ghana. It is naturally easier for them to carry on with research in an area that they are familiar with, rather than to identify local problems and attempt to contribute intellectually toward their solution. Of course, the effects of this problem would be considerably ameliorated in Departments where the internal academic leadership is strong. Without this leadership young members of staff returning from abroad would tend to either expend scarce resources on research that is not directly relevant to local needs or give up research altogether because of 'lack of

equipment' and 'inadequate funds'.

Lack of collaboration between universities and research institutions

The problem cited most often by the scientific and technological research comunity is the inadequacy of resources in the form of personnel, equipment and funds. Unfortunately, not much effort has been made by the universities and the research institutes to pool their resources together in order to make the best use of scarce resources. The area of postgraduate research, for example, presents immense opportunites for collaboration between the universities and the research institutes, especialy those within the CSIR. These opportunities have not been exploited to any significant extent.

SOME MEASURES TO IMPROVE THE SITUATION

Need to identify inherent weaknesses of CSIR structure

The success of any measures taken to link scientific research with industry would depend considerably on the ability of research institutions to produce results that are of practical relevance to the needs of the industry. The capacity of the research institutions to produce results would depend largely on the way in which they are managed and controlled. Since a significant part of the scientific research effort in Ghana is organised under the CSIR it would be necessary to re-examine its structure in order to identify any inherent weakness that may be having an adverse effect on the output of its research institutes.

Need to split functions of CSIR between two new bodies

The statutory functions of the CSIR as outlined earlier are too broad and far-reaching to be handled by a single body. In the author's opinion, the functions of the CSIR should be split between two new bodies. One body would be responsible for advising Government on science and technology policy. This advisory body should have access to the highest level of authority in the land and should not report to Government through any Ministry. The control of the work of the research institutes should pass to a second body which should have representation from within the various institutes as well as from the universities, Government Departments and industry.

Training programme for research staff

The management of research institutes requires skills that go beyond scientific research. Institutes should maintain a training programme for their research staff which ensure that by the time the researcher reaches the higher stages of his career he has served a period of attachment to industry, worked at a good research institute (probably in another developing country), attended short courses in personnel management, project design, budgeting and costing, feasibilty studies, etc. Where the capability exists within the CSIR some of these training courses could be organised centrally for all the institutes. It is only when the research institutes are led by persons with a practical outlook and demonstrated capability in management and good human relations that one can expect to see good communications with industry.

Survey of the requirement of industry

Any attempt to make the work of the research institutions more relevant to the needs of industry should start with a comprehensive survey aimed at identifying the actual requirements of Ghanaian industry. The CSIR is probably best placed to initiate such a survey in co-operation with the universities.

The information obtained should be widely disseminated among the scientific research community. Researchers should then be encouraged to go into industry and offer their services towards the solution of their problems. At Ghana's present level of industrial development it would be found that most of industry's problems can be solved by the application of existing knowledge. Success in solving the day to day problems of the industry would help to build up credibility on the part of industrialists of the work in the research institutions.

At the same time those problems that require the acquisition of new knowledge would form the basis of research projects, thereby making research work more relevant to the needs of industry.

Control of technology imports

The need to control the importation of technology has been recognised by Government. This has led to the establishment of an Investment Centre with functions including the approval of all technology transfer agreements(2). Effective screening of technology imports would go a long way to boost up the demand for and the development of those technologies for which the country possesses the required capabilities. Unfortunately, the information base required for effective screening has not yet been built up. In the absence of this, the screening mechanism cannot be expected to go beyond the purely legal and economic aspects of technology transfer contracts. The Ghana Investments Centre and the other governmental agencies that exercise control over technology imports would not be very effective until they have an information base that facilitates analyses of possible technological alternatives.

Promoting growth of indigenous consultancy firms

The transfer of technological know-how to industry is facilitated by the existence of link institutions such as engineering design and consultancy firms. There is in Ghana today quite a number of consulting firms, but their expertise is confined almost exclusively to civil engineering. Other disciplines of engineering have not been developed to the same level. Efforts must be made by Government to encourage the establishment of consultancy firms to cover a broader spectrum of industry by the provision of fiscal and tax incentives. When technologies are being imported local consultancy firms should be compulsorily involved. This is one way of building up local capability, reducing dependence on foreign expertise and ensuring that follow-up services are readily available when needed. Moreover, consultancy firms, when well established, can be made to act as links between the research institutions and industry.

Industrial liaison units in the universities

A significant part of the country's scientific and technological expertise and facilities are located within the three universities. There is a need for the establishment of link units to bridge the gap between the universities and industry so that the resources of the former can be harnessed more effectively for economic development and social progress. The advantages to university, industry and the whole country of establishing properly organised and well-staffed liaison units have been detailed in a recent UNIDO document(3). At the University of Science and Technology in Kumasi, a Technology Consultancy Centre has been in operation for well over ten years. It is probably time to study the operations of this centre in order to assess the extent to which it has fulfilled its intended function of serving as a focal point of contact between the university departments and industry. Certainly, such a study would yield lessons for the university itself as well as other sister institutions who should be considering establishing similar units for university-industry linkage.

Consultancy by staff of research institutions

The shortage of engineering consultancy firms and the scarcity of technical manpower in the country suggest that the universities and the research institutes, where the bulk of the technical expertise is concentrated would have to play a bigger role in providing consultancy services to the industry. Individual consultancy should be encouraged. The rules governing consultancy work should ensure that consultants benefit not only financially but also in terms of recognition. Work based on the application of existing knowledge should not be shunned merely because it is not publishable in international journals.

Assessing need for new institution to promote use of research results

In some developing countries special organisations have been established with the mandate of promoting technology transfer from R&D institutions to industry. In India, for example, there is the National Research And Development Corporation which was set up by the central government in 1853 as a link between research institutions and industry and whose main function is the commercialisation of the technology developed in various research institutes and universities. Suggestions have been made for the establishment of a similar institution in Ghana. A consultation conference held in 1975 by the Government of Ghana and UNIDO recommended the setting up of a National Research Committee as a preparatory step toward the establishment of a Research and Development Corporation (4). More recently a study commissioned by the Technology Transfer Centre of the CSIR recommended the establishment of an institution outside the CSIR to be called the National Technology Development Corporation (5). This institution would have, among others, the following functions: collection of the research results from the various research institutions and assessment of their economic viability; pilot plant investigation, commeracial plant design and engineering; marketing of technological research results and unpackaging, adaptation and updating of imported technology.

An organisation of the type described above would have to be quite large and employ personnel with a very wide spectrum of skills. The variety of the skills required and the immense financial resources needed to set up and maintain such a large organisation would suggest that the orgnisation cannot become operational in the short-term. In any case, there is no evidence of the existence of any significant volume of R&D results whose application is being impeded by the absence of this type of organisation. There is a need to verify the claims often made by the research institutions that they have produced many results which are only awaiting commercial expoitation by entrepreneurs. Where the existence of applicable R&D results is established, the reasons for non-commercialisation should be thoroughly investgated. It is only when such an investigation has been concluded that a recommendation can be made as to the need for a separate institution to promote the application of research results.

Need for explicit technology policy statement

With the possible exception of the field of agriculture the scientific and technological research institutions have made only a very limited impact on the development of the country. This issue has received attention at various fora and has often been the subject of comments by highly placed Government officials (6). The fact that nothing concrete seems to have been done over the years to solve or alleviate the problem may , in the author's view, be attributed to a serious deficiency in the country's science and technology system: the absence of an explicit science and technology policy statement.

Formulation of technology policies and plans would entail, among other things, an assessment of the national technological climate, the natural and human resources, technological capabilities, technological gaps and levels and an assessment of the technological needs of the country. The policy planning process would identify priority areas of relevance so that scarce resources can be allocated more efficiently and the performance of research institutions can be measured against well-defined policy objectives. The absence of clear policy means that the various agencies of Government whose decisions influence the development of science and technology, have nothing concrete to guide them. In these circumstances, efforts made at the level of the research institutions to exert a greater impact on the country's development process are likely to yield rather limited results.

CONCLUSION

The problems involved in building an effective link between scientific research and the production system in Ghana are many and varied. Some of these problems have been briefly discussed in this paper and

some suggestions have been offered for improving the situation. However, it is thought that the main underlying problem is the absence of a science and technology policy statement and a lack of definition of the role of science and technology in the country's development planning process. Without addressing this underlying problem the country is unlikely to derive the full benefits from the work of the research institutions.

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6.See, for example, news item in PEOPLES DAILY GRAPHIC OF 29th September, 1988, entitled "Ghanaian scientists urged to be practical-oriented". In it , the Secretary for Industries, Science and Technology is reported to have urged Ghanaian scientists, engineers and technocrats to "move from the bureaucratic-scientific researches and be more pratically oriented".