National Policy Dialogue on Research and Technology for Development in Ghana

an assessment

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Executive Summary

The discussion of a policy dialogue on Research and Technology Development (RTD) in Ghana has lately gained considerable momentum for a number of reasons. The first is that the National Human Development Report 2000 focuses on "Science, Technology and Human Development", leading to discussion among human development experts about how science and technology could be used to accelerate the process of building human capital. The second is the importance attached to RTD in the Medium-Term Development Plan (2001-2005) under the long term programme of Ghana Vision 2020. RTD is highlighted as a priority area in the medium term plan, following considerable discussion among Cross-Sectoral Planning Groups put in place by the National Development Planning Commission. Also, the on-going Carnegie study into the policy dialogue has heightened awareness among a number of RTD stakeholders about the significance of the policy dialogue. Finally a diagnostic study commissioned by the European Commission in Accra encouraged open discussions among stakeholders about the policy processes even if they disagreed with policy makers on the sources of constraints to RTD in Ghana.

This document discusses the form that the policy dialogue has taken in the last decade. It highlights the processes that were followed and the role that various stakeholders played in the development of the draft S&T policy document. The discussion of the policy dialogue as an *open learning process* is derived from the broad project concept. The study is basically a follow-up to the European Commission-sponsored diagnostic study of the RTD situation in Ghana. It therefore uses relevant data from the extensive field work of the diagnostic study and supplements this with information obtained from interviews with ten major stakeholders on the policy dialogue, using an interview guide.

The focus is on the draft national science and technology policy document which was finalised in August 1998. It is a 22-page document that sets out the goals and objectives of a science and technology policy, discusses the constraints to the development and application of science and technology, provides aspirations underlying Ghana's science and technology policy. It also provides some guidelines for the effective implementation of the science and technology policy through the development of an enabling environment, the utilisation of science and technology capabilities, capacity building, improvements in the quality of R&D activities, strengthening national engineering design capacity, protection of intellectual and innovative property rights, environmental sustainability, participation of women in science and technology, generation, use and application of S&T, international and local co-operation and linkages, promoting of an S&T culture, establishment of mechanisms for the finance, management of performance monitoring science, engineering and technology. The document also discusses sector-specific issues relating to agriculture, health, education, energy, industry, commerce, environment, human settlements, natural resources, communications, building and construction, military science and technology and basic research.

On the question of whether the policy document was prepared in an open manner, the study indicates that considerable consultation was done. Whereas in the past, only the research institu-

tions basically determined what research could lead to the modernisation of the economy, there is increasing pressure from other stakeholders, particularly policy makers to have the process of research and technology development opened up for greater scrutiny and participation. It is now recognised that for effective and successful RTD, it is important that there are continuous consultations among researchers, end-users, industrialists, policy makers and all other stakeholders. Thus, while parties to the RTD agenda have traditionally been the state and the research institutions (with the government largely playing the role of the financier), there is now interest in identifying the position of the private sector. But the consultation for the draft S&T policy document was limited to representatives of institutions that were considered to be major stakeholders in RTD. This was interpreted to mean that they had to be largely linked to the sciences. Apart from the relatively small circle of disciplines involved, the institutional nature of the representation also ensured that the scope of issues was largely limited to those of interest to the institutions.

In terms of a learning capacity being present in the policy dialogue, it is suggested that the process of developing the policy document required learning from previous experience. Aside from this the dialogue has created opportunity for others to learn from it and add to it from their own experience. One activity that has recently led to more critical assessments of the S&T policy is the adoption of the theme of "science and technology" for the Human Development Report 2000. This has obliged researchers to discuss the extent to which the development of S&T affects human development in Ghana. The report looks at the process of S&T development in terms of impact (both expected and actual) on livelihoods. It also considers the interaction with the educational system as well as the health system. In this regard the policy framework is critiqued in respect of its scope and management. It considers such areas as intellectual property rights and ICT and how they fit into the current RTD framework of Ghana. The treatment of health goes beyond the consideration of the formal health system to look at other less formal arrangements, such as traditional medicine.

In terms of the policy dialogue being a continuing process, this report shows that each stage along the various stages for the development of the S&T policy document was built on the outcomes of consultations with specific groups. While this was certainly positive for the policy dialogue, there is no indication of the committee of experts going back to the groups they consulted for discussions on how earlier positions had worked out in practice. Thus, for example, while a forum was convened to discuss the draft of the policy document, there was no structure to ensure that the stakeholders who constituted that forum could influence the implementation later. Indeed they have not been brought together in any form. What is being worked out now is an implementation plan within the public sector that does not necessarily have to see participation from the earlier groups of stakeholders.

The policy dialogue has seen contributions from international agencies, including support from UNDP in 1990 to assess capacities in the RTD establishments as a prelude to re-starting the process of putting together an S&T policy document, after a long break. Other contributions have come from the Carnegie Foundation that has supported an uncompleted study into the policy dialogue itself. The diagnostic study of the RTD sector initiated by the European Commis-

sion in 1999 also led to a stakeholders' workshop that discussed the state of RTD in Ghana, including the nature of the policy dialogue and how it has evolved.

The fact that the policy dialogue led to the production of a draft S&T policy document suggests that it has had some positive outcomes. Other positive outcomes include the growing discussion within institutions about their future in the light of changing socio-economic conditions. But it is also observed that the draft document was modified significantly by the government before it received the cabinet's approval. This raises the question of the extent to which the policy document was influenced by the policy dialogue. Most stakeholders believe that the modifications were more in the letter than the spirit of the policy document. In that sense, the policy dialogue can still be regarded as having had a positive influence on the policy.

But one can also regard the non-referral of the draft document to the consultative group that put it together as an outcome of the rather ambiguous status of that group. It was an *ad hoc* group constructed for the specific purpose of producing the document. It had more or less ceased to function at the time the document was submitted to government. One may then argue that there was no body to refer the document to in a formal sense. This is what leads to the proposal for the creation of a semi-permanent consultative group that will have not only institutional representatives, but also knowledgeable individuals that can contribute to the process of putting together a policy document. It is suggested that the consultative group be serviced by the Science and Technology Policy Research Institute and be designed to embrace as many interested disciplines as possible. It should be its goal to move the debate and discussion to the cutting edge that allows Ghana to solve its developmental problems with technologies that are easily compatible with the human and other resource capacities of the country.

1. Introduction

For long, Ghana did not articulate any specific position on the development of research and technology despite the fact that the state made financial commitments to the development of the infrastructure for research and technology development (RTD) [1]. The early financial commitments to RTD were in recognition of the fact that the application of science, through sound research and technology development were essential for the modernisation of production systems.[2] Policy makers took for granted what research needed to be done, assuming that so long as the infrastructure was in place good research would follow, and that the outcomes would be applied in the production of goods and services.

The lack of appreciable outcomes forced policy makers to recognise the fact that such outcomes were not guaranteed by the mere presence of research organisations. Thus, in the last decade, such issues as the nature of the research questions, objectives of research undertakings, relevance of research, applicability of research, funding of research, etc., have led to greater discussion among stakeholders about the future of the research environment. The discussion has taken the form of different *ad hoc* committees put together by the ministries responsible for science and technology to assist in the development of national policies on RTD.

A number of events have occurred in the last decade that have influenced the discourse on RTD. The first was the creation of a full Ministry of Environment, Science and Technology (MEST) in 1992 with cabinet status for its minister. Activities by the Ministry in the direction of developing an S&T policy were helped by a project to initiate a policy dialogue from the Carnegie Corporation of New York in 1996. The project was intended to strengthen national capacities for Science and Technology (S&T) policy formulation in a number of African countries, including Ghana. The study aimed to foster an S&T policy dialogue between the RTD establishment, policy makers and the implementing agencies in order achieve a broad consensus on what actions could effectively contribute to national development. Subsequent activities from the project and other related activities, and the desire of the Ministry of Environment, Science and Technology have led to the development of a National Science and Technology Policy document. The document has only been approved by cabinet as a policy document for MEST.

In the last few months, however, dialogue on RTD has gained considerably in stature for a number of reasons. The first is that the National Human Development Report 2000 focuses on "Sci-

[1] The expression Research and Technology Development (RTD) is used in this paper to refer to the process of using scientific or technical knowledge to produce new or substantially improved materials, devices, products or services, or to install new processes or systems prior to the commencement of commercial production. RTD is also expected to lead to substantial improvements in installed capacity. Science and Technology here refers to the acquisition of knowledge as opposed to the application.

[2] These underlie the creation of a National Research Council in 1958 to take over the co-ordination of a research programme for Ghana in order to boost the rapid development of industry and ensure that research had a national orientation, as opposed to the uncoordinated sub-regional organisations that existed prior to independence in 1957.

ence, Technology and Human Development", leading to considerable discussion among human development experts about how science and technology could be used to accelerate the process of building human capital. The second is the importance attached to RTD in the Medium-Term Development Plan (2001-2005) under the long term programme of Ghana Vision 2020. RTD is highlighted as a priority area in the medium term plan, following considerable discussion among Cross-Sectoral Planning Groups put in place by the National Development Planning Commission. Also, the on-going Carnegie study into the policy dialogue has heightened awareness among a number of RTD stakeholders about the significance of the policy dialogue. Finally a diagnostic study commissioned by the European Commission in Accra encouraged open discussions among stakeholders about the policy processes even if they disagreed with policy makers on the sources of constraints to RTD in Ghana.

This document discusses the form that the policy dialogue has taken in the last decade. It highlights the processes that were followed and the role that various stakeholders played in the development of the draft S&T policy document.

2. STUDY METHODOLOGY

This study is basically a follow-up to the European Commission-sponsored diagnostic study of the RTD situation in Ghana carried out by the author. Thus, it employs relevant data from the extensive field work carried out for the diagnostic study and supplements this with information obtained from short interviews with ten major stakeholders on the policy dialogue, using an interview guide.

The approach to the study has been to establish whether there has indeed been a policy dialogue on RTD. The paper adopts the framework proposed by the project in terms of whether an "open learning process" was put in place. In determining how open the policy dialogue has been, the study discusses the varied backgrounds of the participants and how they were selected. It considers the extent to which the views they presented were either simply their personal views or encapsulated the positions of the institutions they represented. It also discusses the extent to which any such institutional positions have been prepared in a participatory manner. It was definitely important to establish whether various actors have been free to articulate particular views that conformed to their own state of knowledge and expectations, and not oblige to go on with those of the groups that were put together for developing the S&T policy document. Also, in terms of openness, the study examines the capacity of the stakeholders to take into account the demands of those who are expected to use the outcomes of RTD. Stakeholders were asked to describe ways in which such openness either existed or did not exist.

In terms of whether the policy dialogue has led to learning, the focus has been on how widely known the processes and outcomes of the dialogue have been, including whether they were publicised. Stakeholders were asked to reflect on the channels used to publicise the activities of

the groups on RTD programmes and to determine the extent to which the decisions influenced other processes of public decision-making and activity as well as those of the private sector.

The issue of process in the policy dialogue was investigated by consideration of the presence of iterative procedures. Transparency is required in such procedures to ensure that those who contribute to it have adequate information about the expected outcomes. It is important in the analysis of such procedures to isolate the different contributions made and at what stage in the process such contributions were made.

Information was largely obtained from secondary material issued by the Ministry of Environment, Science and Technology on the Draft National Science and Technology Policy, from the Science and Technology Policy Research Institute (STEPRI) of the Council for Scientific and Industrial Research on "The Development and Management of Science and Technology Policy in Ghana" and from the National Development Planning Commission on the preparation of a policy framework for the second medium term plan under Ghana Vision 2020.

The draft national science and technology policy document which was finalised in August 1998 is a 22-page document that sets out the goals and objectives of a science and technology policy, discusses the constraints to the development and application of science and technology, provides aspirations underlying Ghana's science and technology policy. It also provides some guidelines for the effective implementation of the science and technology policy through the development of an enabling environment, the utilisation of science and technology capabilities, capacity building, improvements in the quality of R&D activities, strengthening national engineering design capacity, protection of intellectual and innovative property rights, environmental sustainability, participation of women in science and technology, generation, use and application of S&T, international and local co-operation and linkages, promoting of an S&T culture, establishment of mechanisms for the finance, management of performance monitoring science, engineering and technology. The document also discusses sector-specific issues relating to agriculture, health, education, energy, industry, commerce, environment, human settlements, natural resources, communications, building and construction, military science and technology and basic research.

The phase 1 report on 'the development and management of science and technology policy in Ghana' was completed in February 1998. It was supposed to be a review document and the precursor to a second study which was planned to "set up a dialogue on S&T policy between the major stakeholders for consensus building and subsequent action". This report provided a historical account of the development of S&T activity in Ghana, including public sector policies that impacted on the RTD environment. The 49 studies that were reviewed in this report were placed in 5 main areas, namely (a) national S&T in the regional context, (b) S&T and national development strategy, (c) S&T and economic performance, (d) technological capability and enterprise development, and (e) S&T and the legislative framework. One of the major findings of this report is the fact that until 1998, there was no coherent body of public policies that related specifically to RTD or S&T development. It is suggested here that "elements of actions

intended to develop and utilise S&T are found in many documents which have some other principal purpose" (p.2). This finding remains true today, except for the fact that a draft national S&T policy has been prepared.

The draft Medium-Term Development Policy framework (2001-2005) for Ghana Vision 2020 has just been completed at the National Development Planning Commission and highlights the latest national sentiments on RTD. The Medium Term Development Policy framework was prepared through March-September 2000 in a somewhat participatory manner. It was the culmination of work done by eight cross-sectoral planning groups made up of a large number of representatives of public agencies, the private sector, civil society including political parties, and a number of individual professionals. The document provides a situation analysis of development in Ghana, including the application of science and technology. It also discusses the constraints to a more effective development process and then considers future development requirements and what policies will lead to their achievement. The document notes, among other things, that the absence of legislation on RTD was a major problem. It therefore seeks to place RTD at the centre of national actions to enhance production, technology and competitiveness. It devotes considerable attention to technology development and how this should facilitate the future competitiveness of Ghanaian production. It also discusses the use of technology in the areas of health and agriculture, and in construction.

The processes through which these three recent documents relating to the future of RTD in Ghana were developed are highly significant for a discussion of the policy dialogue, hence the attention paid to them. The consultant discussed with various officials the process of developing the first two, and participated in the process of developing the last, i.e., as a participant observer. What is important in this report is their link to the S&T policy document and how this achieved.

In the diagnostic study of RTD in Ghana, (Aryeetey 2000), the field work took the form of questionnaires administered among the management of research institutions, policy makers and some private sector enterprises. The questionnaires sought information from research managers on their research development goals and objectives; channels for articulating those objectives; the types of research they were engaged in; perceptions about the outcome of research endeavours and the current policy environment; explanations for the current state of RTD; their own institutional constraints, including human and financial resources; the processes for instituting those particular projects; their ties to donor agencies and other northern institutions as well as suggestions for improving RTD in Ghana, including the mainstreaming of RTD into donor development assistance programmes. The questions asked of other stakeholders were more in respect of their assessments of the policy environment as well as assessments of the capacity of research institutions to carry out their mandate. They were also encouraged to provide suggestions on how to improve the RTD situation in Ghana. The stakeholders interviewed for the diagnostic study were made up of 9 policy makers, 18 heads of public and university research institutions, 1 head of a private research institution, 2 private sector enterprises and 2 donor representatives.

For the present study, discussions were held with 10 individuals who had participated in processes for developing the draft national S&T policy, as well as persons that had been part of the Carnegie Project to initiate a policy dialogue in Ghana. The study also sought the views of selected researchers on the policy dialogue. The views and opinions expressed in this report are largely a reflection of those expressed by various stakeholders in the various interactions described above.

In the remainder of this report, we provide a summary discussion of the current RTD situation in Ghana based on the earlier-mentioned diagnostic study (Aryeetey 2000) in section 3, and then follow it with a characterisation of the policy dialogue on RTD in section 4. In section 5, we assess the influence of Ghana's RTD policy dialogue as an effective mechanism for directing RTD policy and then finally make recommendations for improving the situation on the policy dialogue in section 6.

3. The state of RTD in Ghana

It is generally acknowledged that different Ghanaian governments have invested significantly in the development of infrastructure for science and technology development. While this is so, there is also the widespread perception that research and technology development outcomes have been far less than expected. Many stakeholders recognise the relatively large number of publicly-sponsored research institutions that have been put in place for specific sectors of the economy but suggest that their outputs are not in proportion with the size of the infrastructure. We discuss here recent policy objectives with respect to RTD, consider briefly some institutional developments and then discuss perceptions of current RTD outcomes.

3.1 Some recent RTD policy objectives

The basic aim of Ghana's science and technology policy is to support national socio-economic development objectives with a view to accelerating economic growth and improving the quality of life through the creation of a science and technology culture at all levels of society. The S&T objectives are expected to lead to the achievement of broader social and economic development objectives. These objectives include the development of scientific and technological capabilities and infrastructure which will narrow the gap between Ghana and the rest of the world, reduce the country's dependence on foreign technologies, technical skills and know-how, and promote self reliant and self- sustaining national economic development in the long, medium and short term.

In the long-term, the main objectives are to develop indigenous science and technology capacities appropriate to national needs, priorities and resources and to create a science and technology culture in the country. In the medium-term, it is intended to accelerate the development and utilisation of scientific and technological capabilities in order to widen and strengthen the national science and technology processes including new and emerging technologies, especially those of

particular relevance to the development of the national economy and its major natural resources. For the short-term, objectives are to restructure the entire science and technology machinery, infrastructure and programmes in order to make them more responsive to national science and technology needs and priorities. Emphasis has been placed on revamping the basic and applied research infrastructure; restructuring the teaching of science at the basic, secondary and tertiary levels of the education system; acquisition of known technologies and their application in industry; training of a critical mass of middle-level technical personnel to address the provision of basic needs of food, shelter, health, clothing, energy etc., and to enable the citizenry and the nation to participate in a competitive global economy.

While many RTD stakeholders appreciate the recognition of science and technology in Ghana's long-term development framework document (Ghana Vision 2020) and the statement of objectives for the purpose, they also argue that such a set of objectives must be backed by concrete actions in order to achieve them. They do not see much commitment in this regard, a point which they support with the long time it took to get the cabinet to approve a science and technology policy for Ghana. The policy provides at the national level a comprehensive co-ordinated strategy for building and strengthening indigenous S&T capacity. It also specifies strategies for both human and institutional capacity building and utilisation, private sector development and sustainable economic growth.

A national programme of action for S&T prepared with support from UNDP to develop capacity in the sector pays attention to capacity building for development management support in S&T for the private sector and poverty alleviation. The action programme devised an S&T system comprising the school system, tertiary education system, research and development (R&D) institutions, service and regulatory institutions, and science and technology associations. The report observes that for efficient functioning of the S&T system, access to education in the sciences must be increased and that research of relevance to development be given priority. The report further observed that there were serious weaknesses in the S&T educational system - especially in the areas of human resource, infrastructure, and financial support. It observed, however, that these shortcomings within the system could be eliminated through capacity building programmes for S&T education and training and popularisation of science.

3.2 Institutional structure for RTD

The Ministry of Environment, Science and Technology (MEST), created in 1996, is the public body responsible for S&T policy formulation, planning, programming, co-ordination and monitoring of S&T programmes. These functions were previously performed by several different institutions. MEST proposes to

1 To guarantee optimal use of national resources for development, develop scientific and technological capabilities and infrastructure and set and promote standards for environmental protection;
2 To reinforce collaboration with educational institutions, community-based organisations and institutions in looking for answers to problems associated with the environment, science and technology.

3 To create and sustain S&T culture in the citizenry, commercialise the development and application of technologies, both existing and new, and mobilise funds from the private sector;

The Council for Scientific and Industrial Research (CSIR) has been recently reconstituted and made the principal public research institute by an Act of Parliament (Act 521). Its main function is the implementation of government policies on scientific research and development. It is also expected to advise the Minister at MEST on scientific and technological advances likely to be of importance to national development. The council is also expected to co-ordinate all aspects of scientific research in the country and to ensure that the research institutes under it and other organisations engaged in research in Ghana, co-ordinate and co-operate in their research efforts. It has the authority to review, monitor and periodically evaluate the work of its research institutes. This is to be done to ensure that studies carried out by the institutes directly benefit identified sectors of the economy and are within the national priorities. With these institutional arrangements, CSIR relies on the main public research institutions that operate under its umbrella. These are

- Crops Research Institute (CRI),
- Animal Research Institute (ARI),
- Soil Research Institute (SRI),
- Soil Research Centre (SRC),
- Building and Road Research Institute (BRRI),
- Food Research Institute (FRI),
- Institute of Aquatic Biology (IAB),
- Industrial Research Institute (IRI),
- Water Resources Research Institute (WRRI),
- National Atlas Development Centre (NADC),
- Oil Palm Research Institute (OPRI),
- Scientific Instrumentation Centre (SIC),
- Savannah Agricultural Research Institute (SARI),
- Ghana Grains Development Project (GGDP),
- Science and Technology Policy Research Institute (STEPRI),
- National Science and Technology Library and Information Centre (NSTLIC),
- Forest Research Institute of Ghana (FORIG) and
- Plant Genetic Resources Unit (PGRU).

The efforts of these institutions are complemented by research in the universities and other professional institutions.

Based on the objectives developed for Vision 2020, there have been a number of modifications to the institutional arrangements in the RTD sector. The changes can be described as follows:

1 Commercialisation of the research programmes of the institutions under the Council for Scientific and Industrial Research (CSIR);

2 Strong emphasis on information dissemination, hence the creation of a Science and Technology Policy Research Institute (STEPRI);
3 Development and utilisation of research capacity, focusing on the collection, storage and dissemination of information to small and micro-enterprises;
4 Mobilisation of funds for RTD from the private sector, e.g. the Gold Fund and the Energy Fund and possibly an S&T Fund.

The privatisation and the introduction of market principles into CSIR's operations is perhaps the most distinctive feature of its new mandate. The council and its member institutes are expected to generate at least a third of their income through the sale of products and services, and to institute a system of contract research. This is being pursued with the creation of a Central Business Development and Information Unit (CBDIU) which co-ordinates commercialisation activities of the various research institutes and serves as a focal point for client contact with CSIR. There are also smaller Business Development and Information Units (BDIUs) to undertake periodic client needs assessment surveys and liaise with the CBDIU on such matters as partnerships and commercialisation.

What is significant for the evolution of a policy dialogue in science and technology is the growing interest in the adoption of a multi-disciplinary approach to problem solving, hence the creation of the social science arm of CSIR, whose principal objective is to link science and technology to the production sector. The social science arm is responsible for the monitoring and evaluation of research. Its main institutions are STEPRI and INSTI. The broad mandate of INSTI is to develop a national capacity for the provision of scientific and technological information to researchers, policy makers and production agencies. A Science and Technology Information Clearing House (STICH) has also been established for the collection, storage and dissemination of S&T information to producers and users of S&T. To address the problem of human resource inadequacy for RTD, particularly with regard to the shortage of manpower, programmes have been instituted to train, develop and utilise local scientific and technological skills and know-how at all levels of the S&T community. Human resource development has been given principal consideration under the National Agricultural Research Project (NARP).

3.3 Outcomes of RTD efforts

The diagnostic study (Aryeetey 2000) provided some very interesting insights into what various research institutions considered to be changes that they were going through as a result of the reorientation of the RTD environment following public sector reforms. They discussed this in terms of the relevance of the research they were doing, ownership and the quantum of activities undertaken. In general, there is a strong perception among research institutions that they were pursuing quite relevant research, even if the quantum was questionable. Where this was so, they blamed the poor quantum on the lack of public resources. Indeed, the study showed major differences in the perceptions among different stakeholders about the quantity and quality of research outcomes. While most research institutions could easily point to a number of satisfactorily completed projects, the view about significant research achievement was not shared by the wider public, particularly the policy makers and private sector stakeholders. One of the more

objective interesting findings from the survey is that considerable useful research outcomes were achieved by a number of research institutions a long time ago but these achievements have not been built upon in more recent times.

Some prominent research outcomes that have been successfully transferred to industry/end-users in the last two decades are as follows:

Food and Agriculture Sector

1 To aid in the effective planning of cattle production, ARI has prepared a tsetse map of Ghana to serve as a source of reference. The institute has also developed a method of control and possible eradication of tsetse by the use of atomic radiation to sterilise male tsetse;

2 ARI has developed formulations of wheat bran for the preparation of animal feed, up to 20% of wheat bran in broiler starter mash and growers' diets and 50% in pigs' diet.

3 ARI has a pasture management procedure for large-scale farmers and has developed a wooden-type battery cage for the poultry industry.

4 CRI has developed three high yielding Quality Protein Maize (QPM) hybrids named *Dada-ba, Mama-ba* and *CIDA-ba* with yields of 5.0-7.3 tonnes per hectare have been developed and been widely cultivated by farmers.

5 CRI has also developed *Sikamo*, a high-yielding, disease-resistant variety of rice with a potential grain yield of 5.5 tonnes per hectare. This has been released to farmers for cultivation.

6 The institute has developed three varieties of cassava that are highly resistant to pest and disease attack and with yields three times that of local cultivars.

7 FRI has developed fufu flours from plantain, cassava, cocoyam and yam. Also developed are cowpea flour, dehydrated fermented maize meal (an intermediate maize meal for preparing porridge, kenkey and banku) and composite flour from a mixture of corn and wheat flour for baking.

Industrial Sector

8. IIR has designed and fabricated various food processing and industrial machines.

Nuclear Technology and Health

9. BNARI has been involved in research into plant breeding using in-vitro culture and mutation breeding techniques.

Health and Medicine Sector

10. Studies of the effect of the use of agro-chemicals (fertilisers and pesticides) by vegetable farmers indicate an abuse of agro-chemicals with adverse effect on farmers' and consumers' health.

11. Research activities of MOH have principally been in the area of Primary Health Care (PHC). The Danfa Project researched into the most efficient means of utilising available resources in the operation of comprehensive rural health services.

Universities

12. KNUST researchers developed the Kumasi Ventilated Infrastructure Project (KVIP) latrine.
13. The Technology Consultancy Centre (TCC) of KNUST, established the first Intermediate Technology Transfer Unit (ITTU) at Suame Magazine, Kumasi and also set up a foundry at the site for fabrication and casting of machine, especially vehicle components and parts.
14. TCC also developed oil palm extraction technology with a pounder that is five times faster than the traditional method. The technology, which employs a manual screw press, eliminates drudgery and improves the efficiency and yield of oil extraction.
15. The Nutrition and Food Science Department of the University of Ghana worked with the FRI to develop the Chorkor Smoker in an effort to improve the productivity of small-scale fish smokers. Also the Department of Physics has carried out extensive research into application of solar energy for household use.

Small-Scale Research

16. Most small-scale research is of an industrial nature and largely private. Experimentation at Suame Magazine has been the most notable. GRATIS and TREND are also co-operating with small entrepreneurs in the further development of this area.

3.4 Constraints to RTD in Ghana

There are two broad views about why the quantum of research outcomes is less than required to achieve the policy objectives and why the relevance of some research may be questionable.

1 In general, policy makers believe that researchers are not committed to pursuing relevant research and are more focused on career development.
2 Researchers tend to believe that the main problem is inadequate funding.

Other problems often mentioned by stakeholders include the following:

3 Inadequate policy support – lack of clearly defined national RTD aims and objectives and the absence of integration of RTD into the overall development plan of the country. The S&T policy objectives are perceived to be not implementable under the current institutional conditions.
4 Ineffective/lack of linkages between the S&T community and the production/end-users of the research outcomes.
5 Lack of effective information and documentation facilities coupled with lack of effective mechanisms for translating RTD findings into industrial ventures.
6 Inability to attract and retain professional and skilled S&T personnel.
7 Lack of mechanisms to determine public interest in terms RTD.
8 Poor mechanisms for assessing the S&T needs of the society.
9 No clear and credible procedures at the Ministry of Finance for budgetary resource allocation.

3.5 Some initiatives to address constraints

Following the re-orientation of CSIR, there have been a number of new initiatives to address some of the problems facing the RTD sector in Ghana. These have taken the form largely of projects and new institutional arrangements, as well as changing attitudes among research institutions. Thus, one now finds

1 Increasing interaction between the RTD community and end-users. CSIR has stepped up its publicity efforts.
2 A major boost to the operations of many research institutions as a result of the National Agricultural Research Project (NARP). Institutional rehabilitation, improved documentation and the development of an agricultural sector plan have been made possible.
3 The development of link arrangements with foreign research institutions.
4 The development of regional linkages, e.g. IITA, ILCA and OCP.
5 There are a number of donor-sponsored initiatives including the Cape Saint Paul Wilt Disease project sponsored by AFD, GRATIS with EU Support, etc.
6 Increasing revenue generation by research institutions.
   - Consultancy services;
   - Training of personnel from other establishments;
   - Offer of technical services like calibration, repair and maintenance of S&T precision instruments as well as industrial equipment;
   - Sale of research by-products;
   - Development of cocoa plantations;
   - Sale of research publications.

4. THE POLICY DIALOGUE ON RTD

The evolution of RTD is based on the understanding among stakeholders that the combined strength of science and technology makes possible a dynamic problem-solving framework that has great benefits for development. Development here refers to the changing structure of the economy and society, i.e. modernisation of the economy in such a manner as to improve welfare for a growing majority of the population. This belief is strengthened by the recent experience of East Asia. The preparation of the science and technology policy for the Ministry of Environment, Science and Technology as well as the preparation of the second step of Vision 2020 have been based on this understanding of the role of science and technology.

Whereas in the past, only the research institutions basically determined what research could lead to the modernisation of the economy, there is increasing pressure from other stakeholders, particularly policy makers to have the process of research and technology development opened up for greater scrutiny and participation. It is now recognised that for effective and successful RTD, it is important that there are continuous consultations among researchers, end-users, industrialists, policy makers and all other stakeholders. Thus, while parties to the RTD agenda have traditionally been the state and the research institutions (with the government largely playing the role of the financier), there has been a new interest in identifying the position of the private sec-

tor. There are a number of reasons behind this opening up of the process. First, it is now recognised that achieving science and technology goals is not cheap in terms of the human and material resource requirements. At the same time, the returns to social and economic development cannot be guaranteed, unless it is regulated to ensure that it fulfils public expectations. Thus, to avoid high costs to the public through possible poor and costly decisions by the private sector acting on its own, public agencies have been encouraged to become key actors in the initiation and implementation of S&T policy. The state certainly needs the private sector to provide entrepreneurial insight and discourage it from pursuing unrealistic and grandiose S&T policies which cannot be supported by the economy. The two also need to ensure that researchers do not get carried away by a desire to undertake only self-serving enquiries, hence the growing pressure to initiate a dialogue. Another reason for the new interest from policy makers to open up the research agenda is tied to the economic policy reforms that Ghana has pursued since 1983. The reforms oblige policy makers and the wider society to question critically the rationale behind providing resources to what are perceived to be non-performing institutions.

4.1 The nature of the policy dialogue

In order to produce the current national science and technology policy document, a series of activities took place at the Science and Technology Policy Research Institute, starting from 1986 and finalised in 1998. The policy dialogue proceeded through the following stages:

1 At the first stage, a compendium of S&T initiatives going back to the 1970s was compiled by a group of experts;
2 At the second stage a consultative group was assembled, representing major RTD stakeholders for broad consultations on the future of S&T;
3 At the third stage sector consultations took place on what should go into the policy document, involving discussions with all the key ministries, departments and agencies that will be responsible for the implementation of a national S&T policy;
4 In stage 4, the experts got together to "set out the issues" for the policy document;
5 Stage 5 took the form of a one-day national stakeholders forum held in August 1998 with 170 participants drawn from all the major RTD institutions including the universities, key ministries, departments and agencies, industry and the press;
6 Following the national forum, a final document was prepared in stage 6, which led to cabinet memorandum being issued;
7 In stage 7, an implementation plan is currently being drawn;
8 In the final stage, this will involve the setting up of a consultative group for monitoring the implementation of the policy that should lead to modifications if necessary and re-orientation.

It is understood from the stakeholders that in the various consultations that took place, the issues of concern that engaged their attention could be summarised as follows:

1 There are problems of human capacity as the numbers of persons with technical know-how in basic science and technology are considered inadequate.
2 The formal and informal educational systems hardly expose and equip beneficiaries to

appreciate basic science and technology. Pedagogical methods of basic and applied science have largely been inadequate. Too much emphasis has been placed on theory and far less on its application.

3 Unavailability of satisfactory working conditions and remuneration needed to attract, motivate and retain research and other science and technology personnel has resulted in the exodus of skilled persons to other management type jobs.

4 Lack of modern science and technology information and documentation facilities hinders the growth of a scientific culture.

5 Major projects and programmes under-utilise local science and technology expertise. The result has been a lack of transfer of technology knowledge.

6 There are inadequate policy directions as a well as limited incentives for studying, upgrading and adapting local and foreign technologies in order to reduce over-dependence on imported finished products, thus stifling endogenous scientific and technological creativity as well as entrepreneurship.

7 Discontinuation of national development plans whenever there is change in political administration. This in the past tended to frustrate the proper execution, monitoring and evaluation of planned science and technology programmes.

8 No clear policy framework exists on technology transfer though some elements have been captured in the industrial policy statement. (Gogo, 1997; Appiah, 1991; Boeh-Ocansey, 1991 and Republic of Ghana, 1997):

Despite the obvious indications of the evolution of a policy dialogue, it may be pointed out that in the earlier diagnostic study (Aryeetey 2000), information from stakeholders regarding the degree of interaction among them suggested considerable dissatisfaction with the current level of interaction. Users of research complained generally about not being consulted by researchers, while researchers complained about the absence of effective structures for linking up with end-users. While we found an increasing number of RTD institutions holding workshops/seminars to let the probable users know about their research outcomes, users of research complained that little interaction took place before research was designed and carried out. It is likely that the absence of interaction with potential clients could explain why only few research outcomes lead to technological developments. Stakeholders generally share the view that the interface between researchers and users of research outcomes is quite weak.

What is interesting is the observed minimal participation of the private sector in the policy dialogue and in RTD activity in general. Stakeholders suggest that the private sector should contribute to RTD in three possible ways: first, support financially the activities of research institutions in a broad sense; second, commission specific research projects from research institutions; and finally directly undertake RTD activities with own set-up. While elements of all three are acknowledged to be present in Ghana, there is a general consensus that this is minimal.

Most research activities in the private sector are directed at achieving commercial success for selected products or services. For this reason, RTD in most commercial and industrial establishments is sales- and market-oriented. But there is very limited documentation of private sec-

tor direct involvement in research, as most of such establishments prefer keeping their RTD activities and other commercial strategies as 'trade secret', away from potential competitors. Stakeholders also suggest that the universities and research institutions do not amply appreciate the RTD needs of industry and society, thus making commissioned research less likely. There is also the perception among stakeholders that private sector establishments find research institutions too academic and unreliable as partners in any commercial undertaking. In general, however, many stakeholders suggest that the private sector is basically unaware of the capabilities of the universities and research institutions, and also does not appreciate significantly the value of investment in RTD because of inadequate information about the value of research.

4.2 How open has the policy dialogue been?

In discussing the issue of openness, we provide in this sub-section details of what transpired under each of the steps outlined earlier. Indeed in determining the extent to which greater openness has been achieved it is essential to compare the processes that led to the preparation of a science and technology 'plan' for Ghana in 1981 as shown in the compendium of S&T activities and the one that led to the science and technology policy document in 1998.

Under the Limann Government in 1981, the scientific community was requested to make a contribution towards the preparation of a National 5-Year Development Plan. Nineteen (19) members of the scientific community met for about a month at the premises of the Ghana Atomic Energy Commission (GAEC) at Kwabenya to produce a "science and technology" paper in order to satisfy the constitutional requirement for the development plan. Only an abridged version of this S&T plan was taken by the government for the purpose of the abortive National Development Plan. A number of stakeholders eventually criticised the resulting science and technology position paper on the following grounds:

1 It was hurriedly prepared;
2 There was no prior consultation with institutions and organisations that were going to execute the plan;
3 There was little knowledge of the proposals made in the other sectors that the S&T plan was to assist in execution;
4 The report was mainly on S&T for Agriculture and Industry and did not address adequately the health, medical, natural and the social sciences.

In view of the above criticisms made against the earlier attempt at developing an S&T plan, attempts in 1986 to re-visit the issue were much more elaborate and more participatory in their preparation. The 1986 attempt as outlined above, in the wake of economic reforms and structural adjustment had the following features:

1 Many representatives of the S&T community were mobilised to work on developing the various options in order to ensure that the resulting plan would be implemented successfully. Opening up participation was generally greeted as a means of ensuring ownership of the plan.
2 There were several open discussions and consultations among all the different stakeholders, namely the organisations and individuals who would actually execute the

plan.

3 There was a thorough review of past initiatives in the area of science and technology development.

With this at the back of the new initiatives, the government formally launched in September 1986 five national sector programmes in which S&T application was to be promoted. Technology committees were constituted in the following areas:

- Agriculture, Forestry, Fisheries;
- Industry and Technology;
- Health and Medicine;
- The Natural Sciences;
- The Social Sciences.

In 1987, government made funds available for the Technology Committees to start the work of elaborating on S&T policy options. The membership of the Technology Committees was drawn from the scientific community, development agencies and policy makers. Together with sub-committees and working parties, a total of some 250 persons (including some organisations) participated in the preparation of the draft S&T policy options. The draft S&T policy options were sent out for comments in 1989. These drafts were discussed at a Consultative Group Seminar held in May 1990. About 170 participants attended the seminar. Their suggestions were incorporated into the plan to produce a draft which was submitted to government for executive action. This draft document was inspired by the Vision-2020 document.

The process of preparing the S&T policy was slowed considerably after 1990 in the absence of funds. This continued until the UNDP later assisted the Ghana Government to develop a framework for capacity development and utilisation in 1993. Among the areas studied were science and technology, culminating in a report for the development of the sector that was used to restart the process of preparing the S&T policy document. The report on Science and Technology included the earlier-mentioned proposal for a national programme of action for the sector. Based on this, the government began to formulate the goals and objectives of an S&T policy as well as policy measures and strategies designed to attain the objectives. In addition, guidelines were established for priority in industry and technology development, acquisition and transfer (National Capacity Building Assessment Group, 1996).

The S&T report from the UNDP initiative on capacity development and utilisation observed that the problem of financing RTD may be reduced through extension of the market for research and development output. This required the demand side of the market for R&D output to be stimulated. The report subsequently suggested the creation of a Technology Clearing House (TECH) for the commercialisation of all research and development output of the research institutes in Ghana. It further recommended that funding for the setting up of TECH be arranged through a co-operative joint venture between the Government of Ghana and all recognised industrial, commercial and professional associations. The Trades Union congress was also noted to require representation. TECH was to contract and fund the production and testing of

prototype machinery and products it deemed fit for the promotion of industry.

Having considered the various documents that came out of the several deliberations listed above, a committee housed at STEPRI put together the science and technology policy document for the new Ministry of Environment, Science and Technology in 1998, after consulting with the private sector and other stakeholders to solicit their views on earlier documents. It is important to observe that the policy dialogue at this stage was dominated by researchers and technocrats from CSIR, who consulted with other stakeholders on behalf of Ministry of Environment, Science and Technology. While it is evident that significant openness was achieved, compared to the earlier attempt, it is important to emphasise the point that the process was limited to what are described as stakeholders. The process paid little attention to the participation of non-scientists and did little to attract their views. In the same way relatively little attention was paid to getting the general public to participate. Thus, for example, while the press was part of the consultative process, this did little to stimulate broader national discussions about S&T. The press simply reported some of the proposals that came from the meetings put together, with hardly any effort to stimulate debate in their papers. Indeed, underlying the mode of consultation, as is the situation with many similar cases, has been the presumption that non-stakeholders would not be interested in the issues.

It is also important to emphasise the fact that due to the rather narrow definition employed for "stakeholders", it is not surprising that the areas of RTD covered in the draft S&T policy document were rather narrow. To illustrate, the document that went to government did not address the vital issue of Information and Communications Technology (ICT). Its discussion of communications was restricted to how best to publicise the contents of the policy document. Its mention of biotechnology was in passing as the discussion of agriculture and other sectors was limited to traditional approaches to developing S&T in those areas. No mention was made of marine technologies and biomedical technologies even though the document mentioned the need to conduct biomedical research. The draft S&T policy document was almost entirely about the need to support research activities that promoted agriculture, health, education, energy, industry, commerce, environment, human settlements, natural resources (lands, minerals, water, etc.), communications (information and mass media), building and construction, military science and technology and basic research. Its focus on the traditional areas of scientific enquiry was striking.

4.3 Does the policy dialogue facilitate learning?

The process of learning is expected to ensue from a feedback system that allows for new information to be internalised by the process. One test of whether this has been achieved is derived from the length of time it took to get the draft S&T policy document completed, and the fact that the process included learning from previous experience by compiling a compendium of S&T initiatives from the 1970s. The compilation took into account reports on over 100 different initiatives to develop an S&T framework for specific institutions and national programmes to solve a number of technological problems.

In addition to the study of earlier documents, the proposals for the S&T policy might have gained from the feedback when officials from STEPRI introduced elements of it to the Cross-Sectoral Planning Groups used to put together the Medium Term Development Policy framework.[3] Copies of the S&T policy document were made available to the planning groups whose membership came from diverse backgrounds with little professional interest in S&T. They studied the documents and offered significant suggestions on how to make the proposals supportive of a broader development agenda. This was necessary as the medium term development plan is intended to develop a scientific approach to problem solving at the production level in all sectors. Feedback to the initiators of the S&T document provided them with information about the expectations of a larger well-informed set of Ghanaians. It also gave the initiators an opportunity to negotiate with the development planners and ensure that crucial aspects of the S&T document were reflected in the medium-term policy framework document.

Thus learning from each other has reflected in the Medium-Term Development Policy framework acknowledging the need to provide adequate resources for RTD and making concrete proposals for that. This involves policy management in the area of science and technology development, strengthening of science and technology institutions, and provision of incentives to entrepreneurs to use the results of scientific and technological research.

It must be pointed out, however, that despite the possibilities for discussion and learning that have characterised the process of developing the S&T policy for Ghana, there has been little publicity given to the activities and hardly any assessments of the situation, outside of those directly responsible for preparing the document. This is so largely as a consequence of the poor development of the news media in Ghana. There are hardly any journalists that are equipped to lead public discussions of S&T developments. Thus, the average Ghanaian does not know of the existence of an S&T policy document, and those who know of the existence of one seldom know its contents (Aryeetey 2000). There is hardly any public discussion of S&T and RTD. The best illustration of how little information there is available to the public about RTD is the lack of knowledge, even among the most knowledgeable groups of Ghanaians about expenditures on RTD. Most policy makers have no idea how much is spent on RTD in Ghana. This is because the information is simply not available.

As earlier indicated, an activity that has recently led to more critical assessments of the S&T policy is the adoption of the theme of "science and technology" by the Institute of Statistical, Social and Economic Research at the University of Ghana for the Human Development Report 2000. This has obliged researchers to discuss the extent to which the development of S&T affects human development in Ghana. It looks at the process of S&T development in terms of impact (both expected and actual) on livelihoods. It also considers the interaction with the edu-

[3] It is not obvious, however, that this feedback to the experts influenced the documents 'evolution' as it had already been placed before cabinet, from where it was finalised without recourse to the group that had prepared the draft.

cational system as well as the health system. In this regard the policy framework is critiqued in respect of its scope and management. It considers such areas as intellectual property rights and ICT and how they fit into the current RTD framework of Ghana. The treatment of health goes beyond the consideration of the formal health system to look at other less formal arrangements, such as traditional medicine.

The most interesting aspect of the adoption of S&T for the Human Development Report 2000 is the fact that it allows researchers from different disciplines to examine critically the effects of S&T development on ordinary people. The process leads to questions about whether the poor can benefit from the application of modern science and what should be the processes that facilitate that. In particular, in the area of traditional medicine, there are discussions about the efficacy of various medications that are available on the market and how the application of modern knowledge has or has not influenced current conditions. The issue of intellectual and industrial property rights and how they relate to traditional healers opening up their procedures for scrutiny and learning are considered in the Human Development Report 2000. Thus the issue of users of traditional medicine not knowing, and probably not caring, about the chemical composition of medication that they take is examined within the context of how demand for such facilities is affected. It obviously leads to the dual system, since more knowledgeable people are judged to be less likely to use it in most instances. The fact that the S&T policy does not examine such issues critically is noted.

Indeed, the main constraint to greater learning from the development of S&T has been the rather limited discussion of the policy among 'the experts' without much access and participation from a wider segment of Ghanaian society. It is certainly not too late to achieve this as greater publicity will facilitate more objective considerations of aspects of the policy by outsiders, as the Human Development Report has shown is possible.

4.4 Is the policy dialogue a continuing process?

The various stages indicated earlier for the development of the S&T policy document suggest that each stage was built on the outcomes of consultations with specific groups. While this was certainly positive for the policy dialogue, there is no indication of the committee of experts going back to the groups they consulted for discussions on how earlier positions had worked out in practice. Thus, for example, while a forum was convened to discuss the draft of the policy document, there was no structure to ensure that the stakeholders who constituted that forum could influence the implementation later. Indeed they have not been brought together in any form. What is being worked out now is an implementation plan within the public sector that does not necessarily have to see participation from the earlier groups of stakeholders.

But one can point to the presentation of the policy document to the Cross-Sectoral Planning Groups as an attempt to broaden the participation in the process and bring broader feedback into it. The problem here, however, remains that the influence of these groups on the process for developing the S&T policy document is not well-articulated. While the National Development Planning Commission, in putting together a Medium-Term Development Policy Framework has

the authority to ensure that provisions of the policy document are adopted by various agencies for implementation, the discussions among all parties have not covered these grounds so far. Indeed the delay in putting together an implementation plan has led to a lack of clarity in how different institutions are required to relate with one another in pursuit of the S&T goals.

While the lack of clarity is definitely not suggestive of a lack of transparency in the processes by which the policy dialogue has evolved, it does not augur well for the future implementation of the S&T policy. It is certainly essential that now that a draft Medium-Term Development Policy framework is in place, an arrangement for allowing all the different stakeholders to contribute to implementation will ensue.

But the issue of transparency raises questions about the different levels of participation by different stakeholders. Indeed, who were the stakeholders? And was their selection transparent and broad enough to accommodate as many different views as possible? Did the stakeholders have the capacity to articulate specific views that could then be fed into the process through refinement of earlier positions? Did the stakeholders have the mandate and capacity to continue monitoring the process?

Our discussions with the stakeholders indicated that the "stakeholders" were defined to embrace persons/institutions, who, by the nature of their work had a direct interest in RTD. These were therefore persons working in research institutions mainly. They also came from public and private institutions that contributed directly to RTD in Ghana. The stakeholders were represented by persons that were in positions of authority in their institutions. As in most such structures of consultation in Ghana, individuals are expected to represent the positions of their institutions, but ironically the institutions seldom have positions on the matters under discussion. The lack of discussion in the institutions that they represent ensures that their representatives are usually not able to express any specific opinions on matters of substance in such deliberations. And when they do, these are usually their personal opinions. Viewed against the fact that representation by the most senior person in an institution does not necessarily provide an opportunity for the most knowledgeable persons to represent that institution, issues of transparency can be raised. In other words, the usual methods of selecting representation are not transparent enough to identify the best representation, based on merit and relevant knowledge.

It is evident that considerable work went into the preparation of the S&T policy document. But the fact that a number of new areas in S&T were not dealt with to any appreciable extent, as was pointed out earlier, only goes to emphasise the narrow scope of RTD activity in Ghana. The process was not structured to unearth more. This was largely because the process was created to deal with existing public institutions through their representatives, and they were unlikely to raise issues concerning areas of research that they had little or no knowledge about. Since ICT was relatively new and no public research institution dealt with issues of ICT, it did not get into the spotlight as is happening elsewhere.

On the question of whether the stakeholders have the capacity and mandate to continue moni-

toring the process of a policy dialogue, there are indications of continuing interest in doing so. Indeed, the draft S&T policy document made provision for "a separate body of experts … to perform the role of reviewers of the implementation strategies of all science and technology activities". A number of stakeholders we spoke to were positive about the capacity to monitor the policy dialogue from the proposed arrangements working with current institutions. This is reflected in the on-going initiatives at STEPRI to develop studies of the policy dialogue. While the experts involved in the preparation of the policy document certainly have the capacity to undertake specific monitoring actions, it is not clear that the current structure will be adequate for ensuring that monitoring has a broad base. There is an obvious need to consider in the implementation arrangements the development of a suitable structure of a well co-ordinated network of institutions to monitor the process and have the mandate to take corrective measures to allow the achievement of set objectives.

If properly set up, another source of monitoring for the S&T policy is the National Development Planning Commission which has the mandate to monitor the implementation of all such plans. It is essential to structure properly the links between the Commission and CSIR in order to facilitate such monitoring. While the NDPC is interested in ensuring that the implementation of S&T policy leads to significant advances in that area, in order to enhance production and productivity, it is also interested in ensuring that people derive significant benefits from such developments and that they are protected from the negative effects of RTD. A number of stakeholders suggest, however, that the current structural and capacity weaknesses of NDPC will make it extremely difficult for it to play such a monitoring role properly. It is not perceived to have either the human or financial and other resources to undertake the necessary reviews (NCBAG 1996).

5. Influence of the policy dialogue on policy

Considering the fact that the policy dialogue led to the completion of a draft policy two years ago, and which has only recently been accepted in a modified form by government, it is legitimate to establish the extent to which the policy dialogue influenced the final form that the policy took. We also need to establish the extent to which the policy dialogue has been effective in motivating developments in the RTD environment.

In this section, we discuss briefly the specific outcomes of the policy dialogue. We introduce here also the successes and failures of Ghanaian S&T policy based on assessments by stakeholders in terms of the achievement of set objectives.

5.1 Outcomes of the policy dialogue

Following the policy dialogue, the general thrust of the S&T policy presented to government is the development and strengthening of indigenous capacity to support the attainment of long-term national socio-economic development objectives. Attainment of the S&T policy targets have been pivoted around efficient action planning in the following areas:

-*Funding*

Provision of adequate funds to ensure that S&T activities are successfully carried out. Government has already facilitated the setting up of a Gold Fund and Energy Fund. An S&T Fund into which industrialists, bankers and others are expected to contribute is also being developed. Such collaboration with other stakeholders is expected to widen the source of funds and make more independent as well as user-driven research available. The target is to increase RTD spending to the minimum 1% of GDP as recommended under the Lagos Plan of Action.

-*Human Resource Capacity Development and Utilisation*

Human resource development planning is to be increased and deliberate efforts made to fully utilise the capacity thus developed. This is to be achieved through the creation of attractive training programmes in addition to improving the conditions of service for science teachers, technicians, scientists and technologists at all levels. Also, policy is geared towards ensuring that the requisite facilities and equipment are provided to enable them function effectively. For example, under the National Agricultural Research Project (NARP), human resource development was given paramount consideration. The aim has been to improve the research and academic skills of staff on the project. In this connection, sponsorship for post-graduate training at local and foreign universities has been encouraged. In addition, short career development courses both local and external have been sponsored for the benefit of staff. By the end of the first quarter of 1997, about 53 and 37 research staff had been sponsored for MSc/MPhil and Ph.D. degrees.

-*Information*

It is proposed to establish a national network of information and documentation centres. Such a network is expected to facilitate the storage and timely retrieval of scientific and technological information.

-*Public Education and Promotion of RTD*

It is proposed to promote scientific and technological literacy in the country. This is to ensure that the public can understand and appreciate the importance of RTD and enhance the application of science in everyday activities.

-*Local Expertise*

It is proposed to utilise available local scientific and technological expertise in all project agreements and contents that need S&T inputs. This will lead to proper communication and application of the interdependence that should exist between the different sectors of the economy.

-*Traditional Technologies*

A programme of study into traditional technologies and practices is planned. This is to create a firm base and confidence from which to launch further self-reliant scientific and technological

adoption, adaptation, innovation and inventions.

-*Environmental Concerns*

The policy seeks to ensure that negative side-effects on the environment resulting from the application of S&T are controlled or minimised.

-*New Technologies*

Globalisation makes new technologies much more easily available. Ghana will prepare for the acquisition and adaptation of such technologies. This is particularly crucial in the development and application of new beneficial technologies including microelectronics (especially computer technology and automation), remote sensing, biotechnology and development of alternative sources of energy.

-*Exclusive Economic Zones*

It is proposed to ensure that in the area of the development of natural resources, Ghana will apply S&T to manage and exploit the marine resources of the newly acquired 200-mile Exclusive Economic Zone (EEZ). To this end, Ghana is to establish an institution for oceanography to address relevant issues.

Under the long-term development plan (Ghana: Vision 2020), the policy objectives of science and technology (S&T) comprise the following:

1 Creation of general awareness of the value of science and technology in everyday social, cultural and economic activities. It is intended to encourage the application of science and technology in both the formal and informal sectors of the economy.

2 Mobilisation of funds from the private sector and other sources to support the national effort to achieve sound socio-economic development through the development and application of appropriate technologies. Government intends to promote and strengthen co-operation with educational institutions, traditional authorities, local government authorities, community-based organisations, non-governmental organisations (NGOs) and banks in seeking scientific and technological solutions to social and economic problems.

3 Increasing the interest of women and their involvement in the application of S&T through workshops, ensure both a growth in numbers and improved quality of their participation in science and technology application, particularly in agriculture, manufacturing, agro-based enterprises and service enterprises.

4 Adoption of technologies, both foreign and local, which continuously improve efficiency in all types of production and make local production internationally competitive.

5.2 Failures of the policy dialogue

It may be observed that while there now exists a fairly comprehensive policy framework for RTD in Ghana, the framework fails to address such issues as harmonisation of inter-ministerial

and cross-sectoral 'conflicts'. These 'conflicts' usually arise from unclear reporting relationships, improper placement of responsibilities and lack of linkages. It is unclear how simply placing co-ordination at the highest level of government in the absence of strengthened institutions solves the problems confronting the RTD sector.

The above observation arises because the policy document separates the policy objectives from implementation strategies. While it provides a comprehensive list of all the things that must be done in order to achieve the broad objectives, it is not at all illuminating in terms of specifics. It is indeed silent on exactly what has to be done and who will do it. Since it does not discuss with any exactitude what specific actions will be pursued, the policy document sheds very little light on how different stakeholders can contribute to the process. The draft document was indeed written as if all the necessary activities will be initiated by government.

The tendency to view RTD activity arising from the S&T policy as a catalogue of public actions is a direct consequence of the policy dialogue not having drawn from a base that was broad enough in terms of representation and scope. As representation focused on specific public RTD organisations, and interaction with the private and other interests were not well synchronised, the debate was largely restricted to how the same institutions could obtain more from the public budget. In that kind of situation, such broader issues as the demand for RTD outcomes and their sustainability are not usually priority. Even less interesting is the implementation arrangement that seeks to achieve harmony. The issue of territory (as opposed to function) reigns supreme in an environment where the positions of participants in the dialogue are informed largely by the need to draw more public resources for their institutions and strengthening them against competing interests. Indeed, the lack of specifics in the policy document remains the greatest weakness of the S&T policy document that was presented to the government.

The most important question, however, remains the extent to which the deliberations of stakeholders in the policy dialogue were reflected by the actual policy document. In a meeting with representatives of the stakeholders (Aryeetey 2000), many of them expressed concern about how long it was taking for government to consider the draft policy document presented to it in 1998. As earlier indicated, government finally took a decision to accept a draft a few weeks ago, but not until significant re-working of parts had been carried out by the policy makers themselves. Discussions with stakeholders for the present study saw a couple of them stating that while the policy had undoubtedly been influenced by the policy dialogue, this influence had been significantly watered down in the final content of the document that cabinet passed. No doubt, this raises questions about the relevance of the policy dialogue in such a development. It is obvious that government policy makers have come to consider the role of the stakeholders as only being advisory and therefore their proposals were not binding on them. They however maintain that the spirit of the policy dialogue has been maintained even if the letter of the draft policy document was altered.

5.3 Successes of the policy dialogue

While the new policy on S&T may have had some initial problems in getting various stake-

holders to act in concert, there is agreement among the stakeholders that the policy dialogue has been successful in getting various institutions to refocus their activities. The dialogue has had the positive impact of pre-empting some discussions within institutions at a level that had not been seen for a number of years. While they often lacked the capacity to embrace issues beyond the immediate sphere of their mandated activities and were often unprepared to engage in issues of a more generic nature, they discussed those of immediate importance to their own sub-sectors and institutions, largely in terms of what they needed to do in order to attract additional resources. The dialogue made them recognise their short-comings and hence a need to correct them. For example, many institutions have accepted the need for cost-effectiveness in their operations and the need to improve considerably the quality of their human resources. There is currently an attempt in most institutions to develop some form of a plan for their future operations.

The proponents of the new S&T policy were also successful in getting the discussions for the Medium-Term Development Policy framework to dwell on RTD. Issues of RTD run extensively through the document, thus linking S&T to longer-term national development. Hopefully, the articulation of the policy framework into actionable development plans for various ministries, departments and district assemblies will see the transformation of the S&T policies into clear programmes of action that satisfy broader national development goals.

6. Towards improving the policy dialogue

It is important that the policy dialogue for RTD is seen as an on-going process of ideas being developed with as wide a participation as possible and no limitation on the list of issues to be covered. The dialogue needs to have a goal that goes beyond the production of a policy document. Similarly the focus of stakeholders should rise above the parochial interests of attracting additional resources from the public sector.

6.1 How open should the policy dialogue be?

There is a tendency for various stakeholders to conceive of the policy dialogue as a medium of interaction between the government and RTD institutions. This is amply reflected in their proposals for prioritising the national research agenda as indicated at a meeting of RTD stakeholders, largely representatives of the research institutions (Aryeetey 2000). While they conceded that the institutional setting of RTD has received considerable attention in the last decade, there is still unease among them about the policy environment. In questioning the commitment of government to an enhanced RTD environment, they expressed the desire for government to demonstrate its new commitment by providing a direct channel between the research institutions and the highest decision-making authority of the land. The assumption here is that such a relationship will facilitate the inclusion of issues of RTD in national development programmes, which would then possibly facilitate the funding of research projects.

The stakeholders saw the preparation of a Medium-Term Development Policy framework for

Vision 2020 as an ideal opportunity for making RTD a focal point in national development priorities. This was acceptable since it would ensure that proposals from the scientific community became an integral part of the policy guidelines that would be used by MDAs to prepare their sectoral programmes. The suggestions they made underscore the fact that they see an improving policy dialogue as one in which the public sector was the other significant actor aside from the research institutions. They proposed that

1 Government should broaden its support for RTD through well co-ordinated actions for them to have the desired impact on society.
2 Government should intensify effort to integrate S&T in the national development plan; thus MDAs should be obliged to abide by the plan guidelines they receive from the National Development Planning Commission.
3 Government should create the necessary policy environment for the private sector to contribute more to public research institutes and also to undertake RTD activities.
4 CSIR should be given autonomy under the Office of The President.
5 Increased Government support should facilitate effective monitoring and evaluation of RTD outcomes on the population.

But it is essential that stakeholders understand that the policy dialogue should embrace other interested parties. In discussions with selected stakeholders for this assignment, they accepted this suggestion for wider participation in the policy dialogue. It was proposed to them that the dialogue needs to establish several forms of interaction that would essentially see the generation of many different ideas. Thus, the use of workshops, seminars and meetings that are orchestrated from one central point is not necessarily the best way to go.

It is indeed possible for several disciplines at universities to organise their own discussions and debates on what should be included in the S&T research agenda and how best to actualise what gets listed. One of the best lessons gathered from the preparation of the Human Development Report 2000 is that a multidisciplinary approach to discussing RTD is highly beneficial to expanding the scope of issues and making them meaningful and relevant. It is equally possible for other stakeholders such as industry to organise discussions from within their ranks which will then be fed into a large policy dialogue with other RTD stakeholders. Getting the policy dialogue to be more open also calls for greater participation by various professional bodies, including those of engineers, medicine, planning, architecture, pharmacy, survey, law, etc. The advantage of using professional bodies to undertake policy discussions is that they provide a platform for policy makers, private business and academics to interact along professional lines as opposed to doing so on the lines of employer type. Ghanaian professional bodies have not been mainstream participants in the current policy dialogue.

Aside from getting several directly interested stakeholders to organise many different platforms for discussions and debate, it is essential that the dialogue focuses on issues that go beyond what government must do. While it is true that government involvement at this stage of Ghana's development is crucial, there are also other fundamental issues that need to be considered. For example, there is no open discussion of genetically modified foods in Ghana. How does one

bring up the issue of GM foods into both the academic and popular debates? Similarly, while some government officials are desirous of regulating the growth of ICT, there is little intellectual discourse on the future of ICT in Ghana and therefore what purpose regulation would serve. The nation's goals for ICT development are not known. In the absence of a well-organised discussion, there is every likelihood that public regulation of ICT will be highly rigid, while no regulation would only result in the industry determining its own future with little regard for the broader development needs of a poor nation.

Opening up participation in the policy dialogue and broadening its scope of issues requires that the news media be well-informed and interested in carrying the debate to the people. Considering the policy objective of instilling a culture of science and technology among Ghanaians, this can best be achieved if the people were assisted to have access to information on science and technology, beyond what they may have acquired from school. To illustrate, there are currently no regular feature articles on RTD in any Ghanaian news outlet. But such a regular feature will be essential to getting ordinary Ghanaians to participate in the dialogue. Such an open discussion provides opportunities for assessing market conditions. It also provides feedback on the effectiveness of the RTD environment, including the efficacy of particular technologies. Getting the Ghanaian press to discuss RTD on a continuous basis will require training for journalists, and this needs to be discussed with the Ghana Institute of Journalism. In addition to that, RTD stakeholders need to be encouraged to make their positions on various issues more public by writing about them for public consumption.

6.2 Achieving greater learning capacity from the policy dialogue

A greater learning capacity from the policy dialogue requires the availability of information to all persons interested in the RTD processes. People need to be well-informed about the decisions arrived at through the dialogue and how such decisions are implemented. But most importantly, the decisions taken should be internalised by all such stakeholders. And this does not in any way contradict the goal of the current S&T policy that seeks to make that culture a part of the Ghanaian culture.

Indeed, at the RTD stakeholders' workshop (Aryeetey 2000), the need to develop a much more "science and technology development oriented" society was agreed upon. It was regarded important that the society understands and appreciates scientific ways of solving problems, as this enhances the ease with which researchers and their 'clients' can interact. This would obviously require a broader integration of S&T into the culture of Ghanaians and also in the everyday activities of institutions. The stakeholders made a number of suggestions for the achievement of this ideal, including the following:

1 The institutionalisation of science and technology projects, such as the regular organisation of "Science Fairs and Science Projects" in all educational institutions.
2 Public awareness campaigns, education and promotion of S&T.
3 The development of indigenous technology using local materials to produce simple household equipment/appliances and processes. Society should be encouraged to employ such technologies in their occupational and everyday activities.

4 Intensified promotion of S&T research findings. Such findings should be translated and applied to the general understanding of society.
5 Local science and technology inventors should be identified, adequately motivated and given recognition through the award of prizes
6 The CSIR Awards Scheme should be broadened to cover all categories of innovators: from the rural artisan to academic researchers.
7 Organisation of public workshops/symposia and industrial and technology fairs.

It is important not only to disseminate information about the progress of activities in RTD but also to keep all stakeholders informed about progress on the dialogue. One crucial area that has to be considered is the publication of expenditures on RTD. They are a reflection of what current priorities are and lead to further debate on their appropriateness and adequacy. To do this would require attempts in the budgeting procedures to record all appropriations for RTD purposes irrespective of institution. In addition to the public appropriations, record needs to be maintained about outlays from the private sector and donors.

Ensuring greater learning from the policy dialogue also requires that a monitoring and evaluation mechanism exists. An improved capacity of different types of institutions to keep an eye on what takes place within the context of the dialogue is crucial to the success of the dialogue. While STEPRI is, undoubtedly, well placed to lead the process of developing solid research on the policy dialogue, this should not discourage other interested organisations to undertake complementary research. CSIR currently has a number of units that can inform the public about developments in the RTD sector and how these relate to the policy dialogue. But it is also important that independent monitoring and evaluation take place in order to enhance the credibility of such assessments.

6.3 Developing the process of the policy dialogue

Ensuring feedback and a growth of the policy process requires dynamism. Aside from opening up the process for broader participation the need to create room for inclusivity is crucial. While the procedures discussed in section 4 showed that there was some consultation with identified stakeholders, it is important that the process of consultation does not end with one interaction. Thus, for example, following the government's expression of concern about aspects of the draft policy document it received, the need to resolve differences on the matter should have seen it referred back to the consultative group for discussion. By having modifications done solely by a small group of experts at the behest of the responsible ministry, this step effectively reduced the significance of the earlier consultations.

We propose that the consultative group on RTD be expanded and restructured and made a standing committee of the Ministry of Environment, Science and Technology. The purpose of the expansion will be to bring in as many relevant disciplines, including the social sciences, into the S&T policy dialogue. In re-structuring it, the objective is to make it a semi-permanent advisory group to the ministry that will be able to preserve its institutional memory. Thus, in addition to a limited number of persons representing key stakeholder agencies, there will be a number of

individuals sitting on the committee for limited terms on account of personal knowledge and experience, and who will be expected to lead the process of expanding the scope of the research agenda and enriching the policy dialogue with sound debates and discussions.

The semi-permanent nature of the body may be given a well-defined and structured relationship with STEPRI, which may provide secretarial and logistical support to the committee. Among the committee's functions, it will collate on a regular basis all discussions taking place in Ghana and elsewhere on RTD. In synthesising the debates and discussions, it will be able to draw out relevant issues that may be considered by the Ministry of Environment, Science and Technology for future modifications of the S&T policy. The active functioning of this committee, in the presence of a more open policy dialogue will effectively ensure that the dialogue becomes a continuous learning process.

The proposal for a semi-permanent consultative group to serve as an anchor for keeping active the policy dialogue should not be prejudicial to on-going efforts to restructure CSIR and its constituent research institutions under the National Institutional Renewal Programme.

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