Chapter 2 Organising Chemistry to Benefit the Third World

2.1 Aims and Organisation of the Conference

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The longer-term aim of the whole conference on "Chemistry and Developing Countries" was stated to be "to enhance the ability of scientists to contribute to the well-being of their peoples by helping (through new ideas, contacts, information and expertise) to increase their interest and ability to play a more pro-active role in the wider applications of their professional knowledge, eg. in wealth generation and job creation, in institution building and the formulation of relevant national policies, as well as in teaching and research".

The conference focused on the two themes of (1) 'Chemistry for the Environment' and (2) 'Organising Science to Benefit the Third World', with particular emphasis on chemistry - balancing the generation of wealth (via chemical research and chemical engineering) with protection of the environment (via analytical chemistry). Emphasis was placed on the more applied aspects of organising chemistry because of the desperate need of most developing countries to generate wealth in order to fund further development and economic growth and to reduce poverty. It also complements the more academic and physics-related activities of the Third World Academy of Sciences in Trieste, whose President (Professor Abdus Salam) was invited as a speaker, but was eventually unable to come; his greetings were read out at the opening session. In this overview of theme 2 we use the more accurate and less presumptuous title of 'Organising **Chemistry'.**

Theme 2 included talks, 'tabled' papers which were handed to participants on arrival, and posters. Speakers included representatives, past and present, of major agencies (UNIDO, UNESCO, World Bank) and commercial firms (British Technology Group, Unilever, Taiwan's Grand Pacific Petrochemical Corporation) as well as academia. The published papers based on the talks, 'tabled' papers and one poster are listed in the contents; authors were encouraged to include relevant information and ideas arising out of subsequent discussion or reflection, while observing a limit of 1500 words of text (waived in the case of 2.17, which deserved to be published in full as a 'management tool' for possible future action). The wealth of first-hand experience in Third World countries represented by the contributors and the geographical diversity of their origins are emphasised by the curriculum vitae at the end of the papers as well as by the contents of the papers.

In addition, six chemists were invited to London (but one was unable to come at the last moment) to represent various regions of the world (Latin America, Caribbean, West Africa, East Africa, Middle East, Asia) to discuss their problems at a workshop and to make recommendations; their names are included together with the recommendations on pages 5-7.

This was, by all accounts, a pioneering theme for a conference. Two points should be stressed:

1. The enthusiasm and support of the speakers, regional representatives and other participants, which indicates that the conference met a strongly felt need. The resolutions and recommendations (see pages 5-6) strongly urge The Royal Society of Chemistry to "take a more direct interest in the problems of the developing world ... and interact more strongly with UN and other donor agencies ....".

2. The apparent and very recent changes in attitude and likely shift in emphasis on the part of the major donors towards 'institution-building' and strengthening S and T (science and technology) in developing countries (see below). This suggests that the conference has, by a lucky chance, taken place at the right point in time.

The papers and recommendations, together with the ensuing discussions, have provided a dovetailing collection of reports, surveys, analyses and proposals which highlight problems and dangers, identify key factors, and offer models and suggestions for action within the selected area relating to chemistry in the developing world. They identify the willingness to licence in the best available imported technology, coupled with the ability to 'debug' and improve such technology, as key factors in enabling countries like Japan and Taiwan to achieve their industrial 'take-off' (2.3, 2.5, 2.10); they also point to areas such as technology transfer and intellectual property rights, where further information (perhaps even a further meeting or background research) is desirable. They indicate a remarkable degree of consensus about the way forward, in particular the need (to select just a few of the many points): to link basic chemistry more closely with wealth-generation, in particular to build up chemical and process engineering; to develop regional collaboration and regional centres of excellence, otherwise funds and expertise will be spread too thinly, as well as more extensive international collaboration; to strengthen support services in both the technical (equipment, workshops, technician training) and information fields (from publishing to data-bases); also the importance of a supportive government and appropriate economic policies and the need for chemists to play a more active role vis-à-vis the media and government bodies. They probably form a unique compilation of information and ideas concerning 'institution-building' in any area.

We restrict comments here to (1) some of the lessons learnt (including points arising from unpublished further discussions) about the potential role of chemistry in wealth-generation in developing countries and the mechanisms required to achieve this, and (2) a summary of the evidence (some of it not available before the conference) for the shift in emphasis on the part of the donor agencies.

Lessons from the Conference; Chemistry and Wealth-Generation

One can now identify several broad areas in which chemistry could make a major contribution. Tcheknavorian and Oxley from UNIDO (2.4) emphasise the need for a local or regional chemical industry to supply the basic chemicals (acids, alkalis, chlorine, solvents, fertilisers, oils, insulating materials, etc.) which are essential to virtually all other industries as well as to agricultural efficiency; the cost of transporting such relatively cheap but bulky chemicals from distant sources would place an insurmountable hurdle in the way of development of quite simple industries and would cause an unbearable drain on foreign exchange. At the other end of the spectrum, Wu (2.10) points out that 'the economic miracle of Taiwan would have been impossible without the establishment of a world-class chemical industry over the last 25 years'. Since, however, Taiwan has a high population density but little in the way of natural resources, and has based its industrial development on the labour-intensive garment and shoe industries before integrating backward into chemicals, it may not provide an appropriate model for most countries in Africa and Latin America which have relatively low population densities but relatively abundant natural resources (whether animal, vegetable or mineral). In these countries it is the more intermediate level of chemical and process engineering, backed by chemical research, which is required for upgrading raw materials (foodstuffs, timber/pulp, plant-derived products, biomass and other agricultural by-products, as well as the better known minerals and oil) to higher value-added products and which could contribute substantially to industrial development and to foreign exchange earnings; but this potential has hardly yet been exploited. There is perhaps some justification in focussing on chemistry and the associated chemical and process engineering when trying to organise science to benefit the Third World!

It has also become clear that there are significant differences in the mechanisms required to link chemistry with wealth-generation in the First and Third Worlds. As a broad generalisation one could say that personnel in pure chemistry (as represented in, say, a university chemistry department) should be linked to personnel in (a) chemical and process engineering, (b) patenting and, to a lesser extent, technology transfer and licensing, and (c) the world of entrepreneurs and venture capital. In the First World one can, to varying degrees, assume the existence of experts in these other fields and of organisations and networks to bring the different parties together (see, for example, Kathoke (2.5)); the system works, even though First World governments may feel their university scientists are not sufficiently interested in possible applications of their work! The assumption cannot be made in the Third World, as shown dramatically by the state of development of chemical engineering. Wu (2.10) points out that the remarkable development of Taiwan's world-class chemical industry depended on "the existence of skilled Taiwanese engineers and technicians able to de-bug and even improve the technology, all of which was originally imported ...". Taiwan now has 36 Departments of Chemical Engineering, which produce about a thousand graduates each year; the first graduated in 1945, ie. long before the dramatic "take-off" of the Taiwanese chemical industry. By contrast, the whole of black Africa still has only two Departments of Chemical Engineering (2.19). There can hardly be a more telling indicator of the failure or inability to mobilise S and T for Africa's benefit and, conversely, of the urgent need to start the 'institution-building' needed to underpin the effective application of S and T.

Entrepreneurs of the required type simply do not exist in some developing countries; the aim must be to encourage the scientists themselves, by providing appropriate training, to develop and commercialise their findings. People with any knowledge of patents may also be absent; it is probably easier for the country to start building up interest and expertise in patents amongst its scientists than amongst its non-technical lawyers. The need for such links between chemists and other groups is obviously far greater in the Third than in the First World, while their existence is far less common. In many cases chemistry (and probably the other basic sciences) could provide the spring-board for developments in chemical engineering (cf. Førland and Førland (2.19), in patents and in entrepreneurial activities.

Even the technologies required may differ in the First and Third Worlds. Chemical firms in the First World and many in the Third World may want the latest, high-tech, continuous process on the market, and networks exist to help them locate such technologies. Other operators in the Third World may actually prefer a batch process because of the serious consequences of interruptions to the process caused by irregular supplies of power and spare parts; the solution he seeks may already be available in some other part of the Third World or in some obsolescent technology in the First World; or a process with accompanying hardware which has been abandoned by a First World firm at the pilot-plant stage could be exactly what is required for a full-scale plant in a Third World country. There appear to be no suitable networks to help the Third World operator locate such technologies.

The links between pure research (in all fields) and wealth-generation in the UK and the effects of the government's R and D policy have been well analysed in an article by Maddock in 1975 (1), which still provides instructive reading. There is a need for a similar thorough analysis for one or more developing countries; some of the conference papers obviously make a very useful contribution to this field.

Changing Attitudes and Emphasis within the Donor Agencies

Evidence of several distinct and very relevant changes in attitude and shifts in emphasis have emerged within the last year and a half from documents and publications of different organisations such as: the World Bank's report on 'Sub-Saharan Africa; From Crisis to Sustainable Growth' (2), published in November 1989 (just after the conference themes had been decided); the UNDP's 'Human Development Report 1991' (3), published in June 1991 (ie. after the conference, but while drafting this summary); and an internal document of the OECD's Development Assistance Committee called 'The Role of Science and Technology in Development Cooperation with the Less Advanced Developing Countries in the 1990s', a shortened version of which is included in 2.2. The three most important and relevant changes would appear to be:

1. An increasing willingness to be frank, to call a spade a spade, and to identify the real problems and issues involving both donors and recipients. The World Bank, for example, slates "weak public sector management" and "the deteriorating quality of government" (p.3) but adds that "Responsibility for Africa's economic crisis is shared. Donor agencies and foreign advisers have been heavily involved in past developments along with African governments themselves. Governments and donors alike must be prepared to change their thinking fundamentally to revive Africa's fortunes" (p.2).

The UNDP's report points out that "If resources are poorly distributed, the cause generally is political. Protected interests and power structures - military establishments, urban and rural elites, corrupt bureaucracies - all can cause maldistribution" (p.9) and that donors sometimes prefer "to forge an alliance with the government rather than with the people" (p.9); it concludes that "it is too often a lack of political commitment, not of resources, that is the ultimate cause of human neglect" (p.11) and suggests that "Requests for aid should include plans to cut back military budgets and to increase the human expenditure ratio" (p.10). As a reviewer noted (4), "A few years ago, the slightest hint of such political conditionality would have produced a reflex accusation of racism and neo-imperialism ... But since the end of the cold war, all this has changed. The UNDP can now argue in public that political priorities in many developing countries are determined not by patriotism but by the greed and vanity of ruling elites".

2. An increasing shift (more correctly, an increasing call for a shift, since it has apparently not yet materialised) from "mega-projects" to "institution-building" and "social expenditure", ie. from short-term to longer-term support, which is echoed in all three documents. The DAC (see 2.2) says "There is a strong tendency in the whole aid system to supply a wide range of capital equipment on a highly subsidised basis while at the same time failing to ensure that the recurrent expenditure on human resource capacities needed to sustain the effective use of this capital is available ... Aid agencies should increasingly shift from a project-by-project approach to a more strategic, capacity building thrust with longer-term commitments ..." while the UNDP Report says (p.8) that donors "prefer to give money for capital-intensive schemes that just happen to require machinery and technical assistance from the same donor countries" and that "too much is often being spent on foreign expertise and too little on building up local institutions and mobilising national expertise". At least one cause of this shift in emphasis is probably disillusionment with previous policies; the World Bank report quoted (p.27) a 1987 evaluation which showed that half the completed rural development projects which it had financed in Africa had failed.

3. An increasing realisation of the contribution which science and technology could and should make to development and hence of the need to strengthen science and technology in developing countries, ie. to shift from an almost accidental inclusion of "science and technology within a policy" to a more positive "policy for science and technology", to use Professor Oldham's phrase (2.3). This is the main thrust of the document prepared by the OECD's DAC (see 2.2), which argues that to achieve the main aim of strengthening the capacity to manage technological change requires, inter alia, building up "a strong national science and technology community" and "a much enhanced partnership between the economic and social policy-makers and science and technology professionals"; it urges "aid agencies (to) seek ways to enhance dialogue with the wider science and technology community in their countries, including NGOs and the private sector". The World Bank also stresses (p.4) that "If Africa is not to be further marginalised ... two initiatives are crucial. Africa must (1) improve its science and technology training and aim at the highest standards for at least a minimum core of specialists and (2) forge new partnerships with qualified firms and research institutes in the developed countries". This change in emphasis has probably been prompted by the success of countries such as South Korea and Taiwan, which obviously owes so much to the effective exploitation of science and technology.

A contributing factor may have been the thought that some of the emerging technologies such as biotechnology, advanced materials and information technology are less capital- and energy-intensive, and therefore more appropriate for developing countries, than the older "smokestack" and "metal-bashing" industries usually associated with development. Scientists must be excused their wry pleasure that the importance of science and technology has at long last been realised!

Summary

The Conference has produced a valuable compendium of information and ideas directly relevant to the problem of strengthening and utilising science (with particular reference to chemistry) in the developing world at the same time as the donor agencies are showing increased interest in institution-building in general and in strengthening science and technology in particular. The next steps involve further discussions between The Royal Society of Chemistry on the one hand and both the Commonwealth Science Council and the OECD donor agencies on the other. It is hoped that this Conference will also encourage other countries to contribute to the on-going process of expanding knowledge and expertise in this field through organising meetings on related topics.

References

1. I Maddock, Proc. Roy. Soc., 1975, **A345**, 295.

2. 'Sub-Saharan Africa: From Crisis to Sustainable Growth', The World Bank, Washington DC 1989.

3. 'Human Development Report 1991', Oxford University Press, New York 1991.

4. A Kaletsky, 'The Times', 3 June 1991, 23.

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