

Science and Economic Development Conference Science & Technology to Support Pakistan's Economic Development

The Conference Report

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Introduction

A conference on **Science and Economic Development** was held at Hotel Pearl Continental, Lahore on 1-2 December, 1997. The event was sponsored and organised by the Lahore School of Economics. The World Bank provided a grant to help meet the cost of participant travel and subsistence.

The conference brought together Pakistan's leading businessmen, scientists, engineers, and economists to discuss and develop ideas on how to improve Pakistan's state of science and technology (S&T) capabilities with a view to accelerating the country's pace of economic development, strengthening its competitive position in the global economy, and preparing it for the challenges of the 21st century.

The conference calendar and the list of participants can be found in the Annex.

Background

While the importance of S&T in the long-term development of Pakistan's economy has been widely recognised, there is a general consensus that the current state of the country's S&T capabilities is seriously deficient. Over the years, official reports and articles by Pakistan's leading scientists and other concerned academicians have bemoaned the sad plight of S&T in Pakistan.¹ But there has so far been no palpable improvement.²

¹ Perhaps, no one strove harder than the late Professor Abdus Salam to promote science in Pakistan. An excellent overview of the state of S&T in Pakistan is provided in his *Science and Education in Pakistan*. 1988. The Third World Academy of Sciences. Trieste, Italy. It is a reflection of the limited progress that despite the lapse of a decade since its publication, this work still remains highly relevant. The latest in official reports is the *Final Report* of the Prime Minister's High Level Review Committee on Science and Technology, 30 July, 1996, which provides a sobering and painstaking analysis of S&T in Pakistan. A good overview is also given in Ehsan Masood, "Imprisoning the beams of the Sun", *Nature*, the Supplement on Science in Pakistan, 24 August, 1995, Vol. 376.

Among the reasons for the lack of progress, the following three factors seem to have been decisive:

- The promotion of S&T in Pakistan, as in most other developing countries, has been held to be almost exclusively the government's responsibility, even though it has been evident that the government had neither the political will nor the administrative and financial resources to carry out the task on its own.
- The state of S&T has not been recognised as one of the central issues in the discussion and formulation of Pakistan's development plans and economic policies. Pakistan's *Five-Year Plans*, for example, have paid no more than lip service to S&T.
- Pakistan's business community has shown little appreciation of the importance of S&T for economic advancement and international competitiveness, and has not actively participated in the discussion and formulation of the country's S&T policy.³ This has meant virtual exclusion from policy-making of potentially the principal source of demand for science and technology.

Science through enhancing Man's understanding and command of his physical environment and through conceptualisation of engineering laws and principles, provides the underpinnings for technological progress. If Pakistan is to get on to a path of rapid growth and begin to catch up with the more advanced countries—which seems to be a national aspiration—then there is an urgent need for a fundamental rethinking on the role of S&T in our society and daily lives.

The basis of long term growth and the rise in living standards of a country is technological progress, involving the introduction of new and improved products and more efficient production processes over time. This is as true of agriculture as industry. Feeding a growing population requires continuously raising agricultural productivity. Competing in the world market of manufactures requires producing quality goods at competitive prices, involving continual innovation and improvement in industrial efficiency.

The 50th anniversary of Pakistan's independence from colonial rule provided an opportune time to seek to renew the nation's commitment to the promotion of S&T, and to work on a strategy that indeed could help in

² Defence research has been a significant exception.

³ A significant exception has been the above-mentioned *Final Report*. A number of Pakistan's business leaders contributed to the deliberations of the Committee charged with the preparation of the report.

turning Pakistan into a dynamic economy, drawing on the experience of the successful Asian economies, and embarking on a path of accelerated long-term sustainable economic growth. With the government's resources severely constrained and policy shifts in favour of the market and the private sector, the new strategy clearly would have to rely heavily on the drive and initiative of Pakistani business.

The conference on **Science and Economic Development**—by bringing together the nation's business leaders, scientists, engineers, and economists—was expected to play the role of a catalyst in forging a new approach to the promotion of S&T in Pakistan. It was seen by its organisers as a forum that would contribute to the definition and development of a business-centred strategy for the promotion of S&T capabilities and capacities in Pakistan. Specifically, the conference sought to engage and involve the business community in shaping a new S&T strategy, as it is ultimately businesses that must become the principal source of demand for scientists and engineers. By bringing in some of the key policy-makers, it was hoped that the issue of S&T development would become central to the definition of a policy-framework for the long-term economic growth of Pakistan. The goal was to arrive at a set of actions that the participants would be expected to pursue to carry out the conclusions reached at the conference.

The Conference Format

The conference had as its participants leading Pakistanis who have, through their work, contributed to the development of our country. The participants—business people, scientists, engineers, and economists—were invited to the conference for their known interest in the promotion of science and technology in Pakistan and for their ability to do something about it. It was understood that their attendance signified that they shared the belief that, despite Pakistan's many problems and handicaps, individuals could make the difference and bring about social and economic change. This spirit is captured quite nicely in the words of Margaret Mead, the renowned anthropologist:

“Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has.”

The conference format was designed to ensure active participation and to draw on the participants' wisdom, knowledge, and experience. With the exception of the opening statements and keynote address, no formal lectures or presentations were organised. Only a limited amount of background reading material was distributed. The participants were, however, encouraged to share their own writings on the promotion of S&T

in Pakistan. The heart of the conference, however, was discussions within four small groups, which were constituted on the basis of what were deemed to be the key issues in the development and promotion of S&T in Pakistan. The selected issues were:

- What steps could be taken to foster closer collaboration among businesses, scientists, engineers, and economists in the promotion of S&T
- What steps were required to help Pakistan leapfrog in the achievement of S&T capabilities
- What kinds of S&T capabilities Pakistan needed to promote as it enters the 21st century
- What could be done to improve the number and quality of scientists and engineers in our country

Each Group had a Chairman, a Rapporteur, and three Lead Speakers. The Lead Speakers' task was to initiate the discussion by laying out the principal issues. The goal was for the group to agree on a programme of action as a follow-up to the conference. The participants were urged to concentrate on what the participants themselves could do, rather than making recommendations for the government.

A Summary of Proceedings

Plenary Sessions

The first session of the conference, which was held on the evening of 1 December, 1997, was in the nature of a 'warm-up' exercise. After the formal opening, the participants introduced themselves and indicated their expectations from the conference. This session also commemorated the contribution of the late Professor Abdus Salam to the promotion of science and technology in Pakistan. Dr. Abdullah Sadiq, Director General, Centre for Nuclear Studies, Islamabad, paid a tribute to Professor Salam and reminisced about his contacts with the famous physicist. This was followed by similar reminiscences by other participants.

The keynote address was given by Mr. Safi Qureshey, CEO Emeritus, AST Research Inc. Mr. Qureshey underscored the need for spreading educational opportunities in Pakistan and making the population better informed and educated. In today's world knowledge has become a crucially important factor of production. He also exchanged with the participants

ideas on how Pakistan might tap the large reservoir of world class scientists and engineers living overseas. He was of the view that a large number of overseas Pakistanis were eager to serve their country, but mechanisms needed to be established to make it possible for them to do so. There was considerable interest in developing information on the availability of such resources. The experience of the successful countries of East Asia in this exercise could provide invaluable insights into what may and what may not work in the context of Pakistan.

Mr. Ahsan Iqbal, Minister of State, etc., spoke next morning on the requirements for science and technology as Pakistan prepares itself for the 21st century. He outlined the Vision 2010, and underscored the need for more widespread education. Mr. Iqbal also returned to preside over the concluding session where the group reports were presented.

Group Discussions⁴

Group 1. Making the Connection

If science and technology are to support Pakistan's economic development, there must be a much closer co-ordination of economic policy, with a focus on the objective of balancing the sources of supply (scientists and engineers) and demand for S&T capabilities (mainly the business sector). The institutional setting of how different agents—businesses, policymakers, researchers—interact to generate and manage technological change has come to be called the *national system of innovation*. This system needs to be defined and developed in Pakistan to support the national aspiration for accelerated economic growth.

The group "Making the Connection" had as its task to identify and develop the means for closer working relationships among Pakistani businesses, scientists, engineers, and economists in the promotion of S&T. The issues that the *Group* discussed included the following:

1. What may be done to promote collaboration between Pakistani businesses and the domestic scientific and engineering community to direct R&D in their spheres of interest?
2. What may be done to improve the consultative mechanisms so that Pakistan's policymakers, in designing economy policy, take account of the implications for the development of S&T capabilities? How

⁴ The following sections are based on the reports prepared by each of the four groups.

can the Pakistani business involvement in the country's national development be fostered?

3. What may be done to increase contact/interaction with the community of business persons, scientists, engineers, and economists living outside Pakistan?
4. What is the feasibility of creating a non-governmental network of concerned Pakistani business people, scientists, engineers, and economists who wish to collaborate in the promotion of S&T in Pakistan? Could such a network (let us call it Network to Promote S&T, or Net-POST for short) become influential in redirecting government policy and mobilising resources for the promotion of S&T capabilities?
5. If Net-POST is deemed to be feasible and desirable, what may be its principal tasks and how might it be created?
6. What steps may be taken to reach those businesses, scientists, engineers, and economists who were not present at the conference? How can the awareness of the need for S&T capabilities be fostered among Pakistani businesses?

The *Group* sought to identify the actions or approaches that would facilitate continuing interaction and cooperation between industry and the academic and R&D institutions. It was also deemed important to establish linkages with overseas Pakistani organisations to tap the engineering and scientific resources available abroad. The *Group* underscored the need to obtain a reliable estimate of this resource and to develop approaches for local existing industry to benefit from it.

The *Group* recognised the desirability of establishing **Net-POST**, and proposed the appointment of a small *working group* of experts—drawn from the community of Pakistani businesses, economists, and scientists and engineers—who would be given the task of formulating the Terms of Reference for the proposed network, defining its structure, scope, objectives and the framework of its operations.

The small *working group* was envisaged to undertake the development of an information base on overseas Pakistanis—their skills, education, and qualifications—who are willing and able to contribute to the development of Pakistan. This information could be built up with the help of overseas Pakistani societies or professional organisations. In order to carry out its task, the working group would be expected also to take

stock of the available local R&D capacities of the existing government, private, and university research centres. Ultimately, the Net-POST would be expected to facilitate the process of matching the industry's needs for S&T inputs and the resources available, domestically and abroad, to the country.

Without prejudicing the task of the proposed working group, the *Group* concluded that the Net-POST would be dedicated to promoting the interaction among Pakistani business, education, and industry to ensure demand driven technology development and absorption. It could do so by making known to industry, through seminars, reports, or other means of publicity, the work programme and output of local research institutes. It could also organise seminars and conferences at Pakistani universities, colleges, or even schools to expose them to the needs of business and industry. Equally important would be assistance and advice on how local R&D institutions could market their services to industry. To facilitate interaction and the exchange of information, establishment of a website on the Internet would be indispensable.

The Net-POST could also help in the induction and adoption of new technologies by Pakistani industry, through fostering a business culture that recognises the importance of science and technology. One member of the Group pointed out that the smuggling of appliances and consumer goods was a major reason why private sector investment in domestic R&D was discouraged. The creation of a new culture of S&T in Pakistan would not materialise without building trust between industry, academia and research institutions. There is a need for wider dissemination of the stories of success—such as GIK materials laboratory, HEJ institute, and UET high voltage laboratories—that highlight the benefits of demand driven services and interaction for mutual benefit.

The *Group* felt that the proposed Net-POST should in the end lead to the establishment of a formal, broadly-based association, Pakistan Technology Board, that would provide for linkages and interaction with the government, policy makers and serve as a forum that facilitates the participation of engineers, scientists, economists, academics, business and industry. There was a proposal for the establishment of PTB in 1995, but did not receive the official approval. The Group felt that the Net-POST could provide the foundation for the setting up of the PTB in the private sector.

Group 2. S&T Leapfrogging

Pakistan cannot emerge as a dynamic and internationally competitive economy without considerable investment in building local capabilities to generate and manage technological change, which are at present totally inadequate to meet the challenges of the global economy. The pace of technological change in Pakistan (as, for example, measured by the growth of labour productivity) compares very poorly with the performance of some of its competitors in Asia. This is the principal explanation for Pakistan's slow economic growth and faltering performance in the world market. The traditional approach to building technological and scientific capacity, which relies on spreading education and building R&D institutions, will yield results too slowly, and Pakistan in the meantime will have fallen further behind the more advanced developing countries, not to mention industrial countries. If the country is to catch up with the more advanced developing countries, shortcuts to develop local S&T capabilities and to lay the foundations for a robust national system of innovation will have to be taken to enable the country to leapfrog to the technological demands of the 21st century.

The *Group* was asked to deliberate on the following issues and arrive at recommendations on steps to be taken:

1. Pakistan has not only fewer scientists and engineers per capita than the rapidly growing economies, the available S&T capabilities are of indifferent quality and are being poorly used. What may be done to remedy this situation? What may be done to improve the quality and relevance of our R&D?
2. Since the financial resources for promoting S&T in Pakistan are unlikely to increase significantly in the near future, what criteria may be applied to use the available funds most effectively?
3. What is the scope of using defence research for civilian purposes?
4. How best can we take advantage of the few world class Pakistani scientists and engineers (living in Pakistan or abroad)? Should elitism in S&T be fostered, even as a short-term palliative?
5. One positive aspect of globalisation is that it has increased the opportunities for interaction among the world's scientific and engineering community. What can Pakistan do to derive maximum benefit from this interaction? What is the scope of exploiting such low-cost means of communication as the Internet?

All the members of the *Group* agreed that industrialisation is crucial to Pakistan's economic development. However, industrialisation requires a literate work force, qualified technicians and engineers, and a professional management backed by active research and development institutions. A major reason why the state of science and technology in Pakistan has remained unsatisfactory is that neither the government nor industrialists have been able to create a robust R&D infrastructure. It is difficult to speak of a national system of innovation in Pakistan. But there are a few bright spots in the R&D effort. One example is the laser group in Islamabad (headed by Dr. Shaukat Hameed Khan, one of the *Group's* members), which has successfully developed the expertise, personnel, prototypes and manufacturing facilities for laser devices needed by the defence establishment. Such experiences have lessons for other fields as well.

Various speakers, especially those from industry, pointed out that contrary to popular belief, the Pakistani low-wage does not offer much of a competitive edge to manufacturers over rivals in other developing countries, because of low labour productivity. The main cause of low productivity is the workers' low level of education. The Pakistani education system neither imparts relevant knowledge and appropriate skills nor does it inculcate a professional attitude towards work. It was, therefore, considered imperative that Pakistan's education system be thoroughly overhauled and reconstituted along modern lines. The education system must produce a literate work force, equipped with relevant knowledge, skills and a scientific approach to work.

The *Group* felt that the use of new information technology and multimedia may help to alleviate the shortages of well qualified teachers at college and university level. This will include LAN (Local Area Network), NWN (Nation Wide Network) and Internet; local area television and CD-ROMs. Although, the state will have a crucial role in the promotion of science and education in the short term, the initiatives of the private sector and NGOs could play a far more important role in the long term. The *Group* suggested the setting up of a committee of concerned citizens—comprising educationists, scientists, engineers, entrepreneurs, professionals and leaders of public opinion—that could help to create an awareness among the public of the importance of education in general and of technical and scientific education in particular in Pakistani society.

Group 3. Pakistan in the 21st century

This group was asked to develop ideas on the orientation of the S&T capabilities that Pakistan would require to meet the challenges of the 21st century. A forum, consisting of business leaders, scientists, engineers, and

economists, is ideal for examining trends in the global economy and the impact of scientific and technological developments, foreseen or those that have already occurred. This discussion could suggest priorities in the development of S&T capabilities.

Since Pakistan's financial and administrative resources for the promotion of S&T are unlikely to increase significantly in the foreseeable future, priorities in the development of S&T capabilities assume a central place. At the same time, the role of private business in the promotion of S&T is bound to increase over the coming years. This role would be better performed against a perspective of global economic, commercial, and technological trends. In particular, the *Group* was asked to consider the following issues.

1. In what ways does the economic structure need to change if the pace of economic growth in Pakistan is to accelerate? Pakistani economists and politicians have been arguing for the promotion of high value-added lines of production. What does this mean in terms of the industrial orientation of the Pakistani economy?
2. Can such restructuring take place by relying on market mechanisms alone? If government interventions are needed, what options does Pakistan have in the face of WTO regulations?
3. There is hardly a country in the world where economic restructuring has occurred without very close collaboration between the government and private business. What are the prospects of Pakistan Inc. emerging?
4. Economic restructuring would of course necessitate the development of suitable S&T capabilities. What steps may be taken for a better linkage between economic restructuring and the promotion of S&T.

The *Group's* discussions emphasised the differences between the methodologies of science and technology. While science can grow in quantum leaps, technology grows incrementally. Technology is about the application of science, specifically to solve identified problems. The promotion and application of technology entails the development of physical, managerial, and human resources. It needs to address areas of both existing and potential competitive advantage. The development and delivery of technology requires the rationalisation of existing technology institutions in Pakistan, strengthening their links with the universities, and forging close relationships with domestic businesses and industry.

Technology must also address the new challenges arising out of changes in the global market, taking into account the outcome of negotiations/discussions in such world fora as the World Trade Organisation (WTO) and World Intellectual Property Organisation (WIPO).

The *Group* agreed on a programme of action which its members hoped to undertake themselves. This programme was intended to take advantage of the *Group's* composition, that included leaders from Pakistan's leading R&D institutions, academia, and industry. The action programme would consist of:

- Popularising the interest in S&T among the youth of Pakistan.
- Reviewing the existing policies and incentive mechanisms that promote or retard S&T capability and application.
- Supporting the application of scientific management.

Helping to rehabilitate the existing Centres of Higher Learning (notably, the University of Engineering and Technology and the University of the Punjab), including depoliticising them.

Group 4. Science and Engineering Education in Pakistan

No country has developed without an adequate supply of high-level scientists and engineers. While Pakistan is lagging behind in terms of both quantitative and qualitative indicators, there is also the problem of unemployed scientists and engineers. To the extent that this is the result of poor quality or an unsuitable mix of available skills, simply increasing the quantity of science and engineering graduates will not improve the situation. There is, therefore, a need to develop ideas on how educational institutions may respond better to the emerging requirements for scientists and engineers.

This *Group* was assigned the task of developing ideas on what steps might be taken to increase the number and improve the quality of scientists and engineers being produced in Pakistan. In particular, the *Group* was asked to consider the following issues:

1. To what extent has the establishment of private educational institutions helped or worsened the quality of science and engineering education?

2. Low-cost, affordable university education has been the principal means for the children from low-income families to move up the economic ladder. How is private education fulfilling this social goal?
3. Are the best brains of Pakistan still choosing science and engineering fields? Does the growth of business administration schools suggest a shift in market demand conditions?
4. What measures may be taken to increase the number of students going into science or engineering fields? Is the constraint one from the supply-side of educational places or demand-side?

The *Group*, in its discussions, focused on natural sciences, technology, computer sciences, and engineering. Their central recommendation was the establishment of an association of private and public sector academic institutions that would co-ordinate and improve the functioning of the private academic and research institutions. Among its tasks, the association would develop a ranking system or criteria to evaluate the quality of academic institutions and devise a system for allocating endowments, grants, or financial gifts among different institutions and purposes. The *Group* proposed that each university campus should be treated as an individual institution for academic purposes. But a quality assurance system should be developed along the lines of the ISO-9000 system for both private and public sector academic institutions.

In order to make private sector education more widely accessible, the *Group* proposed that at least 10 per cent of the fees should be allocated to qualified, but needy students. No student should ever be refused admission on financial grounds alone. Private institutions should also develop programmes of student loans, on-campus jobs, job placement, and sponsorship of deserving students by the government or private sector. Consideration should also be given to the reorganisation of the Pakistan Banking Corporation's programme of loans--*Qarz-e-hasana*—under the guardianship of the State Bank of Pakistan.

The *Group* expressed concern that the best brains of Pakistan were not choosing science and engineering fields. However, they noted that a shift in market conditions seems to have taken place in favour of managers who are equipped with engineering or scientific expertise. There is evidence of increasing demand for the so-called "Technical Managers", i.e., managers who have a good grasp of S&T. There is also a very rapid increase in the service sector where technological qualifications are required (e.g., computer expertise). In any case, to encourage the young to choose science and technology fields, much greater effort at awareness on science and

mathematics needs to be given at an early stage in primary and secondary schools. At the same time, there is a need for redesigning science and engineering courses at the university level that give much greater attention to job market trends.

With respect to measures that may increase the number of students going into science and engineering fields, several ideas were discussed. These included: presenting to young students attractive role models of Pakistan's leading scientists and engineers; publicising the achievements of scientists and engineers; offering rewards to young scientists; creating scholarship programmes to undertake science and engineering education; introducing credit programmes for science and engineering-based investments; setting up technology parks and laboratory facilities to foster innovation; and providing tax exemption for job creation in technical fields.

The *Group* proposed an action programme that consisted of:

- establishing a professional body of private institutions operating in Pakistan offering programmes in the natural sciences, technology, computer sciences, engineering.
- Initiating a programme for the promotion of "Technical Managers", i.e., managers who have a relatively strong science or engineering background.
- Institutionalising the holding of future Conferences on Science and Economics Development along the lines of the current one.

Afterword

The Conference on Science and Economic Development took place at a time when the Government of Pakistan was in the midst of what was virtually a constitutional crisis. This had two consequences for the conference. First, two of the invited Federal Ministers as well as a few key government officials were unable to attend the conference at the last minute. The result was that the key player in the formulation of S&T policy—the Government—was under-represented at the conference. Two, the political uncertainty combined with the serious financial and economic difficulties the country faced made at least some participants wonder whether any progress on the S&T front can occur in the prevailing circumstances.

The country's economic and financial situation since the conference has continued to deteriorate and no turnaround at the time of writing of

this note is in sight. With the Government preoccupied with attempts at managing the evolving financial crisis and businesses uncertain about their investments, it is difficult to be optimistic about the resolution of the fundamental problems of education and S&T in the foreseeable future.

Does this mean that the effort put into the conference on Science and Economic Development was misdirected or wasted? The answer of the Conference Director is an emphatic “No”, for the simple reason that the participants—who represented the country’s business and academic leadership—still have the freedom, resources, and capability to act on some of the conclusions reached at the conference. These are summarised in the Group reports presented above.

Although the Groups, in view of the severe limitation of time, could not realistically address all the issues that were given to them for consideration, the discussions were serious and purposeful. Even though each Group worked on a different set of issues, their conclusions appear to have some common elements.

First, the need for closer contact and cooperation among the scientific, academic, and business leadership of Pakistan was recognised by everyone. Towards this end, there was a strong endorsement for the proposal to establish a business-led Network to Promote S&T, or Net-POST. This proposal now needs to be translated into action.

Secondly, there was a general recognition that a great deal can be achieved through the better utilisation of Pakistan’s existing S&T resources and capabilities. This requires, more than anything else, making scientific and engineering research more relevant to the needs of domestic industry and the greater involvement of Pakistani businesses in research. The proposed Net-POST could help achieve this, but actions at the individual industry or business level would also be necessary. One possibility is to organise, along the lines of this conference, seminars or mini-conferences where industry-specific issues are addressed by participants drawn from business, academic, scientific, and policy-making circles.

Finally, there is a pressing need for popularising S&T in Pakistan. This would involve improving general awareness in the country on S&T issues (through, for example, the mass media), but, more importantly, improving science and engineering education at the primary and secondary school level. The country’s ‘best and brightest’ must seek science and engineering as professions of choice. In this area, all the participants can contribute through lectures, media presentations, and articles in Urdu and English language newspapers and magazines.

To conclude, it is important to remember that the Conference could only be a step towards developing a programme for strengthening Pakistan's S&T capabilities and infrastructure. Much will have been achieved by the conference if the participants emerge as a lasting nucleus or a network that helps to bring about the required change in policies and institutions governing the development of science and technology and promote a national environment where scientific methods begin to be applied to the inquiry of social and economic issues.