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HIGH LEVEL ADVISORY ASSISTANCE TO THE GOVERNMENT OF PAKISTAN IN
IMPLEMENTING ELECTRONICS POLICY

PROJECT: UT/PAK/96/098

Final Report

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United Nations Industrial Development Organization
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1. Introduction

The project was initiated in order to give high level advisory assistance to the Government of Pakistan (Ministry of Science and Technology - MoST) in implementing the Electronics Policy. This policy was formulated by the Government of Pakistan with the aim of gaining self-reliance in materials, chemicals, components, equipment, systems and software related to electronics in the shortest possible time. The focus has been put on the development of professional equipment and systems, materials and components to satisfy national needs.

The project gives assistance in implementing the Electronics Policy Framework through:

- analyzing the short and long term arrangements effecting the development of the electronics industry and suggesting measures to encourage and promote local industry

- evaluating investment projects by carrying out technical audit of the local industrial companies with special emphasis on the SMEs, R&D institutions, etc.

- establishing at Ministry of Science and Technology an information database on electronics companies that includes both hardware and software

- promoting the quality control awareness and managerial commitment at the enterprise level including both public and private ownership

- identifying new technical areas relating to the development of the electronics industry

During the project execution

- questionnaires have to be developed and circulated for collection and analysis of necessary information on electronics industry in Pakistan (including research, development and college/university level education),

- besides technical aspects, the analysis of legislative issues on fiscal policies, taxation incentives, export/import policy, intellectual property rights also has to be completed with recommendations on necessary promotion measures and modification,

- training courses will be held in Pakistan on industry management, government strategies, related information technology issues, advanced standardization and quality strategies,

- recommendations have to be developed to the Pakistani Government including measures on implementing state policy for electronics industry, elaboration a National Development Program in the stipulating domestic strategies and policies, protecting local markets and encouraging foreign investment, giving assistance in product development and manufacture, streamlining public purchasing strategy, elaborating post implementation review guidelines,

- data base has to be developed and implemented at the Ministry of Science and Technology on a PC environment. This hardware and software environment will be supplied to MoST within the execution period of the project work,

- a study tour will be organized abroad for Pakistani experts to study the implementation and management of electronics policy and projects, information systems on electronics, standardization, quality and certification issues.

Due to the temporary suspension of the UN agencies' activities in 1998 summer, project execution was commenced Fall 1998, about 2 months behind the original schedule. The 1st mission of the international expert was completed in October/November 1998. The 1st Progress Report was submitted

in December 1998, covering the first 3 months phase of the project execution. This period includes the development of four sets of questionnaires (companies, software houses, R&D institutes, colleges/universities) and the 1st mission of the international consultant. During the 1st mission 31 companies, associations, organizations, laboratories, research institutes, software houses and universities were visited and interviewed by the consultant, who was accompanied by the national project coordinator and the national consultant.

The 2-week study tour of the Pakistani specialists was organized in June 1999, during this period visits and technical discussions were completed at companies, accredited laboratories, industrial parks, universities and governmental institutions.

The 2nd mission of the international consultant took place in October/November 1999, the 2nd Progress Report was submitted in January 2000. This Report covers the evaluation of the Questionnaires, the major issues of the study tour of two Pakistani specialists and the 2nd mission of the international consultant.

Due to governmental changes in October 1999 and the rethinking process of national priorities in economy, the 3rd mission of the international consultant had a short delay and finally it was completed in May 2000. The Final Report was drafted in July 2000.

2. Background of the project, description of the subsector

The economy of Pakistan was undergoing a major development in the 5th, 6th and 7th Five-Year Plan, realizing 5-6.6% growth rates of GDP. This tendency had been changing during the 8th Five-Year Plan (1993-1997) and finally steadily decreasing 4.6%-3.1% figures were experienced, about 2%-3% below the target values.

Many sources of difficulties have been identified, including two major ones: the annual 3-3.5 billion USD export deficit and the growth of external debt up to 38.8 billion USD, which results heavy debt servicing of the federal budget. One of the immediate steps taken was the elaboration of promotion measures to increase the economy's export with core emphasis on engineering-manufacturing sector. However the plans were delayed in implementation and no recovery was experienced in the Pakistani economy during the last period.

The importance of manufacturing industry is steadily increasing, its relative share has risen up to 18% of the GDP. The Report of the Working Group on Science and Technology of the 9th Five-Year Plan (1998-2002) emphasizes that manufacturing is a key activity and industrialization should be self-sustaining. Both technology development and information technology is among the high priority areas, electronics and communication are also considered as key fields of this group.

Electronics industry is a complex sector of the economy, which covers a wide range of products and manufacturing activities. The electronics industry is mainly confined to manufacturing of telecommunication equipment and consumer electronics products like radio receivers, cassette recorders, television sets etc. The industry can be divided into two sub-sectors i.e. organized and unorganized ones. The organized industry basically deals with the TV industry and consumer electronics, which is based on multinational investments (e.g. Philips), Pakistani and foreign joint venture investments (Hitachi, National, Daewoo, Sony etc.). The sector of telecommunication equipment and systems were established by the Federal Government on the basis of joint ventures with multinational companies (e.g. Alcatel, Siemens).

Small scale enterprises and cottage industries are big shareholders in this sector with many companies, focusing mainly on the assembly of foreign patents or reverse engineered consumer products. This sector in the electronics industry shows a remarkable dynamics, technological adaptation and capabilities in meeting market requirements. These companies employ the 81% of the total industrial labor force, their share in manufacturing export is 30 % and the contribution to the industrial value added is 27 %.

Five television transmitting stations and ten re-broadcasting stations have been operating in the country, connected by a microwave network. About 80% of the population are within effective range of television transmitters. Color television was introduced in 1976, adapting PAL-B system. Television transmission is presently of VHF only, but there are plans to extend transmissions to the UHF band as well. The total requirement of TV sets in the country is around 500,000-600,000 per annum, out of which the local industry's share is only 100,000 sets. The rest comes by large scale and almost uncontrollable smuggling.

There were around 20 television manufacturers in the country with products mostly of Japanese origin. These companies were mainly established in 1990 when the Government announced special incentives to electronics industry to import components, raw materials and modules totally exempted from custom duty and sales tax. However industry has remained under pressure due to fluctuating tariff, under-invoicing, and especially due to high rate of smuggling. About half of this industry closed down in the past years. Government has now taken measures to reduce the rate of smuggling, but the results are far from satisfying yet.

There is a flourishing cottage industry for the assembly of radio sets, printed circuit boards, cassette recorders, decks etc. These are around 2000 in numbers. (Cottage industry has now been defined as an industry set up with an investment of not more than Rs. 300,000/- and not more than 15 workers employed.) They manufacture what ever appeals to them and basically operating on copied foreign designs. There is totally nil or just minimal concept of quality assurances in these industries.

The total number of radio sets in the country is estimated to be in excess of 5 million with an annual increase of about 8%. The annual demand is about half a million sets, the major portion of this need is met by radio sets manufactured in the cottage industries.

Three industrial units produce telephone exchanges, teleprinters, multiplex telephone and telegraph equipment, UHF equipment, radio transceivers and associated components and parts. These cater mainly to the requirements of the Pakistan Telecommunication Corporation Ltd. and other government organizations and services. The companies are: Carrier Telephone Industries, Telephone Industries of Pakistan and National Radio Telecommunications Corporation.
The telephone density in Pakistan is one of the lowest in the world. The demand is increasing at a rate of 50,000 units every year. There is a direct dialing network of 49 stations. Digital multiplex systems and also electronic switching systems are also manufactured.

Electronics Industry in Pakistan is basically composed of TV assemblers only. Components production is limited to a few products (diodes, resistors) at the public sector and serves own purposes (Telephone Industries of Pakistan, Carrier Telephone Industries). Electrical and mechanical parts (head phones, plastic capacitors, PCBs, metallic and plastic precision components) are fabricated also in the private sector. Companies had short lifecycle and closed down because of inexpensive Chinese import (e.g. United Technologies Pvt. Ltd - cathode ray tubes) or smuggling (a Karachi company producing satellite dishes).
There had been attempts in the past to establish an IC fabrication facility, but they all failed. The National Institute of Silicon Technology has wafer cutting technology but the very limited capacity is the major barrier of commercialization. .
The raw material for these components is imported in semi-finished form. Schemes were under consideration for the indigenous production of electronic raw materials like electrical ceramics, electrical glass and silicones for the manufacture of copper clad sheets for the electronic industry, but plans were not realized.

There is very little indigenous production capability in the field of computers and control systems, although various degrees of system design, hardware assembly and software application is carried out in the process industries, aviation, power generation/distribution and other national utilities.
The main-frame computers in use in Pakistan are with banks, insurance companies, public utilities, educational institutions, aviation etc. Control systems are in use in communications, aviation, load flow control and in oil and gas prospecting. Mini-computers, micro-computers and micro-processor-based systems have not made any significant entry into the market, although there is a large potential for their application. User software covers wide application areas whereas system software development and applications have not progressed sufficiently.

Very little research and development is being carried out in the Private Sector because the units are too fragmented to afford such facilities. This task therefore devolves on the Public Sector, but these institutes face the controversy of growing tasks and permanent understaffing. There are a number of development centers in the larger user organizations, where considerable work has been done, although the manpower capacity and the commercial exploitation of the results are below the expectations.
Some of the areas in which development work has been carried out are: silicon solar cells, nuclear electronic instrumentation, industrial electronic instrumentation, medical electronics, electronic measuring and test instruments, control instrumentation, transmitters and receivers, alarm systems, micro-processor based systems, micro-computers.

Keeping in view the high importance of the electronics industry, the Government of Pakistan formulated an Electronics Policy in 1993. It was developed with the aim of gaining self-reliance in materials, chemicals, components, equipment, systems and software related to electronics in the shortest possible time. The Policy has been focusing on the development of professional equipment and systems, materials and components to satisfy national needs.

The Policy intends to take into account the strength and weaknesses of the electronics industry, including the need for periodically review in order to synchronize it with the changing realities and national demands. It is planned to be implemented through a series of short- and long-termed arrangements undertaken by the Ministry of Science and Technology and monitored by the National Commission for Electronics.

The Policy has the following major objectives:

i)   to increase self-reliance and self-sufficiency in materials, components, equipment, systems and software related to the field of electronics,

ii)   to increase fast growth in industries dependants on electronics and software based systems,

iii)   to provide reliable base for development and manufacture of consumer electronics industrial and defense goods,

iv)   to become a net exporter in terms of electronics systems and software,

v)   to produce technically qualified persons in the required numbers.

Seven areas have been mentioned which need very clear sighted attention and all of them should orient towards common vector:

i)   Industrial establishment and growth

ii)   Fiscal measures, incentives

iii)   Education

iv)   Software industry

v)   Continuing training

vi)   Public awareness on electronics

vii)   Coordination between various R&D bodies

The proposed policy for the electronics sector is structured in the following way: it envisages two principal themes, i.e. a policy on technology diffusion and a policy to promote international integration of the electronics industry. Around these themes builds an Electronics Plan with a number of functional interventions concerning the following topics: human resource development, SME support measures, technology development measures, environmental protection measures and workplace restructuring. The policy has not been implemented yet, the objective of this project is to give assistance for implementation.

In 1993 the Government of Pakistan also formulated a National Technology Policy. This Policy has connections to the topics of the Electronics Policy and its objectives and the implementation mechanisms/action plans serve as useful 'pilot plans' and source of information for the implementation of the Electronics Policy (see details in Chapter 4). The execution of several projects of this initiative started on schedule, but in the past years due to budget problems the actions practically came to a halt.

The 9th 5-year plan (1998-2002) has included chapters both on information technology (1,060 billion Rupees) and electronics/software development (500 million Rupees). Till date (May 2000) the 9th 5-Year Plan officially has not been implemented (Chapter 4).

The ambitious national development plan, 'Pakistan 2010' sets the goals doubling the per capita income to 1.000 USD, promoting science and technology and many other sectors. This framework basically envisages the desired way of operating the national economy, defining the supportive measures and incentives, and lists the 21 major areas of the necessary collaborative actions. Science and technology, Industry, Information technology, Telecommunications are among the prioritized areas. However the ongoing rethinking of medium and long term economy goals makes the future of the this plan uncertain.

In 1998-99 the Pakistani Government developed the national 'Information Policy', which has been reformulated in 2000, and is planned to be public Fall 2000. The last draft, ready for submission to the Cabinet, consists of four major parts: IT Policy, Implementation, Action Plan and Incentives package. IT Policy also involves topics which overlaps those of the Electronics Policy such as hardware manufacturing, developing software industry, upgrading university training, quality issues, copyright and intellectual property issues. This initiative also has impact on the implementation mechanisms of the Electronics Policy and will be discussed in Chapter 4.

Finally in December 1999 the Economic Agenda Package for the next years was announced by the new government. One of the four basic priorities is the development of information technology and software industry (including issuing charters to IT based universities, eligibility of software industry for export financing, extension of Internet utilization through tariff cuts). Till date detailed action plans and implementation plans are not available.

3. Strategy for the assignment, milestones

In order to start with the assessment of the electronics industry in Pakistan four types of questionnaires had to be developed due to the participating units' special needs (industrial companies, software houses, research institutes and academia, see Annex I). The circulation of the Questionnaires was managed by the national counterpart, the Ministry of Science and Technology in Islamabad, and Questionnaires were also distributed during the on site visits.

The national consultant was in charge of preparing a detailed Phase Report on the implementation of the Electronics Policy prior the first mission of the international consultant.

The primary objective of the international consultant's 1st mission (20 October 1998-26 November 1998) was to carry out in depth assessment of electronics industry with on-site visits and interviews, which were organized at companies, software houses, research institutes, institutes of higher education and professional societies. Two agencies of the project execution were also visited. (Finally 31 visits were completed in three major industrial regions of Pakistan - Islamabad, Lahore, Karachi -, see information sources in Annex II, detailed analysis of the visits in 1st Progress Report). The results of analysis and findings were discussed in detail with the MoST officials. During the 1st mission the international consultant was asked to give comments and recommendations on the first draft of IT policy.

Training courses were developed in various issues of:
- industry management (including case studies on different countries' government strategies, policy planning and implementation),
- trend in international development and standardization (both technical and environmental issues),
- quality assurance.

Three presentations were delivered for national policy makers, professionals from IT institutes, research institutes, universities and associations:
- *International standardization in information technology The activities of ISO/IEC JTC1* (General IT standards, programming languages, networking, microprocessor systems)
- *International standardization in software engineering. The activities of ISO/IEC JTC1/SC7* (Standards for SW development and system documentation , evaluation and metrics, life cycle management, support of life cycle process, software integrity, process assessment)
- *International standardization in quality management and assurance. The ISO 9000 series ... and the others* (Standards on terms, manuals/guide, plan/project, economics and training, the 9000 series, standards on the application of 9000 family standards)

A fourth lecture also was prepared titled:
National policies and government strategies on electronics industry and information technology. A comparative study on 8 Asian countries.

The major findings of this lecture had been discussed with the representatives of the national counterpart. The conclusion was drawn that this comprehensive study would be presented on a seminar during the international consultant's 2nd mission inviting the representatives of ministries and official bodies who would participate in the implementation of the Electronics Policy.

The next phase of project execution included:
- analysis of the Questionnaires,
- the specification of the hardware and software to be installed at Ministry of Science and Technology for operating the data base and to advise on the tender proposals
- elaboration the program and organizing the 2-week study tour of the Pakistani specialists
- developing a proposal for the structure of data bank on the Pakistani electronics industry
- 2nd mission of the international consultant

The circulation and collection process of the survey had difficulties both with deadline and with the number of contributing organizations, the participating companies had moderate response attitude. The submission of the survey data was scheduled the end of 1998, but they were submitted by the national counterpart during the 2nd mission of the international consultant, in October 1999. Analysis process

was finished in November 1999 (see contributing organizations in Annex II, results in 2nd Progress Report).

Based on the computer hardware and software specification (Annex III) a tender procedure was conducted by UNIDO and the equipment was delivered and installed at MoST in June 1999.

The Contractor's Home Office (SAGE Ltd. Budapest, Hungary) elaborated the program of the 2-week study tour with the cooperating counterparts. The candidates, excepted by UNIDO, were the National Consultant and the Deputy Electronics Advisor of the Electronics Wing of MoST.
The proposal of Home Office was discussed and was accepted, which covered the following major topics:
- System of governmental funding of R&D (especially for SMEs), international joint R&D funds
- Establishment of industrial parks, legislative measures and incentives
- Visit of an high-tech electronics industry company and industrial park
- Standardization issues
- Certification, testing and conformity marks
- International and national programs on Quality systems
- Role and organization of professional associations, societies
- College/university level education system in electronics, telecommunication and information technology)
- Visit at the UNIDO Hungarian National Committee and UNIDO Vienna, to discuss project issues
The study tour was completed in full details between 12 June 1999 - 24 June 1999 (see program in Annex IV, detailed discussion in 2nd Progress Report).

In order to develop a data base for MoST on the characteristic data of the Pakistani electronics industry, an MS Access data-base pilot structure was designed by the Contractor. The identification of the electronics enterprises' relevant data was the task of the national consultant.

The 2nd mission of the international consultant (8 October 1999 - 6 November 1999) had the tasks as follows:
- Testing the data base pilot structure with the implemented MS Access software
- Based on the 1st mission and the processed Questionnaires summarizing the company audits with national counterpart's officials
- Advise, consulting support and lectures on government strategies for electronics industry, information technology
- Advise, lecture on introducing software engineering and assessment methods
- Advise, consulting and lecture on integrated R&D projects, the requirements for testing laboratories and conformity marks
- Discussions on technical, fiscal and legislative measures to establish Technology Parks, based on the experiences gained on high-tech Technology Park during the study tour of the Pakistani specialists.
The training and lecture courses were discussed with the national counterparts representatives and a two-day seminar with six presentations were held by the international consultant (see program in Annex V, slides in Volume II of 2nd Progress Report).
Besides the project oriented direct tasks the international consultant elaborated abstracts of project proposals for the Secretary of Ministry of Science and Technology.

The final phase of the assignment was focused on:
- Designing the final structure of the data base on Pakistani electronics industry
- Analysis of ongoing projects, plans directly or indirectly related to electronics industry and software
- Analysis of regulations on legislative, fiscal, intellectual property rights issues, developing recommendations
- Analysis of regulations and plans on quality, standards and environmental issues related to electronics industry, developing recommendations

The 3rd mission of the international consultant (7 May 2000 - 27 May 2000) was aimed to fulfill the following tasks:
- Implementing the data-base software at the Electronics Wing of the Ministry of Science and Technology, demonstration of system capabilities, training MoST personnel on data uploading and system operation (see description in Annex VI).
- Discussion and advice on electronics industry's potential, components strategy, proposal on directions of development
- Final consultations on policy planning, implementation mechanisms

The post mission period included the development of proposals, and the drafting of the Final Report.

4. Analysis of the data

The detailed analysis of visits at industrial enterprises, research institutes, software houses and colleges/universities was summarized in the 1st Progress report, the analysis of the Questionnaires was discussed in the 2nd Progress Report. This chapter deals with the major tasks of the governmental institutions (federal ministries and other bodies) which are involved in policy planning and decision process. The decision mechanism of initiatives/policies related to electronics is also introduced. National initiatives/plans/policies having overlaps with electronics/software industry is discussed as well. The status quo of standardization and quality issues, fiscal and legislative background is also introduced.

4.1 Institutions and organizations in contact with (Electronics) Industry

4.1.1 Federal Ministries

Ministry of Commerce
- Imports and exports across custom facilities
- Inter-provincial trade
- *Organization and control of chambers and associations of commerce and industry*
- *Tariff (protection) policy and implementation*
    Major attached departments:
    - Cotton Board
    - Department of Insurance
    - *Export Promotion Bureau, Karachi:*
    - *Formulating the export policies, promote and support sustained growth in export*
    - Textile Quota Management Directorate

Ministry of Communications
- Posts
- National level planning and research in road transport
- Inland water transport
- Navigation and shipping
- plus all infra-structural facilities
    Major attached departments:
    - Pakistan Post Office Department
    - National Transport Research Centre (NTRC), Islamabad
    - *Pakistan Software Board (until 28 February 2000, then connected to Ministry of Science and Technology)*

Ministry of Industries and Production
- *National industrial planning*
- *Formulation of industrial policy*
- *Promotion of investment in industry incl. foreign investors*
- *Grants and patterns for investors and registering new industrial designs*
- *Establishments of standards for weights and measures*
- *Establishment of Export Processing Zones*
    Major attached departments:
    - Dept. of Explosives, Rawalpindi
    - Dept. of Supplies, Islamabad
    - *Patent Office, Karachi*
    - Textile Commissioners Organization (TCO), Karachi

- Board of Investment, Islamabad:
    - *generate investment opportunities in all sectors of the country*
    - *provide investment facilitation services*

- *develop National Industrial Zones (NIZs)*
- *act as a one-stop-shop and focal point of contact between potential investors and government agencies*

- Export Processing Zones Authority, Karachi:
  - *develop master plan for the export processing zones*
  - develop and maintain infrastructure facilities
  - *attract foreign capital, technology and modern management facilities*
  - *create a source of supply for such components and parts as are imported for domestic needs*
- Small and Medium Enterprise Development Authority (SMEDA), Lahore:
  - *apex policy making body for SMEs*
  - *provide and facilitate support services for SMEs*
  - prepare plan for action to revitalize the role of small business in the development of the economy
  - coordinate between SBFC and commercial banks in arranging finance for the self-employment scheme

    Organizations (Autonomous)
    - *Experts Advisory Cell, Islamabad*
    - *Pakistan Industrial Technical Assistance Centre (PITAC), Lahore*
    - Threadlines Gallery, Islamabad
    - Pakistan Institute of Management, Karachi

Planning and Development Division
- *Preparation of comprehensive National Plan for the Economic and social development of the country*
- *Formulation of the annual plan and annual development program from National Plan*
- Recommendations concerning orderly adjustments
- *Monitoring the implementation of all major development projects and programs*
- *Evaluation of ongoing and completed projects*
- *Identifications of regions, sectors and sub-sectors lacking adequate portfolio of projects*
- *Organization of research in various sectors of the economy to improve the data base and information as well as to provide analytical studies*
- *Development of appropriate cost and physical standards for effective technical and economic appraisal of projects*
- Coordination of Social Action Program with World Bank and other Donor Agencies
- Administrative control of National Logistics Cell

Revenue Division (Ministry of Finance)
- *Tax policy*
- *Tax administration*
- *Administration of Customs and Excise Group, and Income Tax Group*

    Major attached department:
    - Central Board of Revenue (CBR)

Ministry of Science and Technology
- *Establishment of institutes and laboratories for research and development in the scientific and technological fields*
- *Establishment of science universities, as specially assigned by the Federal Government*
- *Planning, coordination, promotion and development of science and technology. Monitoring and evaluation of research and development works*
- *Promotion of applied research and utilization of results of research carried out at home and abroad*

- *Guidance to the research institutes in the Federation as well as the provinces in the fields of applied science and research (developing infrastructure, marketing)*
- *Coordination and utilization of manpower for scientific and technological research*
- *Promotion and development of industrial technology*
- *Promotion of scientific and technological contacts and liaison nationally and internationally, incl. dealings and agreements*
- *Initiate promotion measures for establishment of venture capital companies*
- *Promotion of metrology standards, testing and quality assurance system*

Major divisions
- Scientific and Technological Research, Policy and Coordination (wings: Electronics, Technological, Planning &Development)
  - *National Institute of Electronics, Islamabad*
  - *National Institute of Silicon Technology, Islamabad*
  - *National University of Science and Technology, Rawalpindi*
  - Pakistan Council of Appropriate Technology, Islamabad
  - Pakistan Council of Research in Water Resources,
  - *Pakistan Council of Science and Technology (PCST), Islamabad*
  - *Pakistan Council of Scientific and Industrial Research (PCSIR), Islamabad*
  - Pakistan Science Foundation, Islamabad
  - Pakistan Scientific and Technological Information Centre (PASTIC)
  - *Pakistan Standards Institute (under reorganization, will be a wing of Pakistan Standards and Quality Authority - PSQCA)*
  - *National Physical and Standards Laboratory, Islamabad*

- IT and Telecommunication (effective from 1st March 2000)
  - *Pakistan Telecommunication Corporation Ltd.*
  - *Pakistan Software Export Board*
  - Pakistan Computer Bureau
  - *Telephone Industries of Pakistan*
- Statistics Division

4.1.2 Provincial Departments

The major function of these departments is to develop and manage small industrial estates, promote SMEs, to organize vocational training and to manage technology specific service centers. The departments are: Directorate of Industries (Quetta, Belochistan), NWFP Small Industries Development Board (Peshawar), Punjab Small Industries Corporation (Lahore), Sindh Small Industries Corporation (Karachi)

4.1.3 Chambers and associations of Commerce, Industries and Trade

Federation of Pakistan Chambers of Commerce and Industry (Karachi) has 34 local chambers all over Pakistan and The American Business Council of Pakistan (Karachi) is also the member of FPCI&T.

There are 84 professional associations in Pakistan, of which eight associations are actively in electronics/supporting/software industries. They are as follows:

- Pakistan Capacitors Manufacturers Assoc., Lahore
- Pakistan Computer Association, Karachi
- Pakistan Cottage Electronics Manufacturers Association (PACEMA), Lahore
- Pakistan Electrical Equipment Association, Lahore
- Pakistan Electronics Manufacturers Association, Karachi
- Pakistan Plastic Manufacturers Association, Karachi

- Pakistan Small Industries Association, Karachi
- Pakistan Software Houses Association (PASHA), Karachi

4.2 Policy planning and approving process

The formal process of approval of policies initiated by the Ministry of Science and Technology is illustrated on flowchart (Annex VII). The major milestones of the process are represented by the Ministry of Science and Technology, the National Commission on Electronics, the Division of Planning & Development, the Finance Division, the Cabinet and the National Assembly. The specific feature of the procedure adopted is that the approval and publicly announced status of the plan/policy is not followed by automatic implementation. Budget evaluation and approval (or rejection) is an independent process, which follows the Assembly decision. The approved (by National Assembly), but rejected (by Finance Division) plans are eligible for submittal the next year, but with the same uncertain budgetary approval results, and the danger that the plans will be gradually outdated might be a real problem.

4.3 Governmental policies and plans with effect on electronics

4.3.1 National Technology Policy

In 1993 the Government of Pakistan (the Technology Wing of Ministry of Science and Technology) formulated a National Technology Policy. This Policy has overlaps with topics of the Electronics Policy, its objectives and the implementation mechanisms/action plans serve as useful 'pilot plans' and source of information for the implementation of the Electronics Policy.
In the Technology Policy it was expected, that by the end of the century Pakistan would be a contributor to the international stock of technology. Technology Policy would effect all institutions engaged acquiring, diffusing and upgrading technology and in developing human capital. There are four main objectives of the policy:
i)   Bridge the gap between the best local and the best international practices in industrial technology
ii)   Bridge the gap between the best and the sub-standard local practices in industrial technology
iii)   Improve and develop technology to enhance international competitiveness in the long run
iv)   Technical manpower development
The realization of the objectives is guided by the following strategies:
i)   The private sector will have a leading role
ii)   The policy will promote the development of a viable Metrology, Standards, testing and Quality System
iii)   The policy will promote the development of an efficient R&D system
iv)   The policy will strengthen the channels for the dissemination of techno-commercial information
v)   Efficient technology transfer will be promoted through the liberalization of regulations and through the promotion of direct foreign investment
vi)   The policy will promote technical manpower development
vii)   The policy will target also small and medium industry
viii)   Environmentally sound and sustainable technologies will be promoted
ix)   The policy will encourage the use of informatics
x)   The policy will promote new and emerging technologies
xi)   National Technology Policy will harmonize its recommendations with the National Development plan and other related policies
To implement the strategies of the Technology Policy the following instruments have been devised:
i)   A liberal regime for technology transfer and means to attract foreign investment
ii)   Effective mechanism for assessment, selection and introduction of technologies
iii)   Rationalization of R&D system
iv)   Commercialization of R&D
v)   Strengthening industrial infrastructure

vi)   Framework for industrial extension
vii)   An effective metrology, standards, testing and quality system
viii)   Effective dissemination of techno-commercial information and information technology
ix)   Promotion of technical education and vocational training
x)   Financial support for technology development
xi)   Trade and tax policy as technology development instruments
xii)   Improvement of intellectual property rights
xiii)   Development of local capacities for new and emerging technologies
xiv)   Inter-organizational implementation mechanism

The Technology Development Action Plan provides a framework for implementation of the National Technology Policy. It comprises two parts:

1.   The Action Plan, which underlines specific policy actions and related projects and identifies for the 14 instruments objectives, specific actions, outline costs, provisional time scale and implementing agency. The Action Plan has 65 projects with a budget of 1284,5 million Rupees.

2.   The Technology Development Plan, which gives a list of projects selected to support the National Technology Policy and the Acton Plan (91 projects, 1486,55 million Rupees).

The Technology Development Projects included e.g

–   Informatics - the establishment of CAD facilities,

–   HDR - post diploma courses in computer hardware, establishment of Institute of Computer Studies, establishing regional Computer Centres to offer training and services

–   Budget was planned for project proposals in Metrology, Testing, Standards and Quality Systems

The Policy was implemented in 1993 but the process was slowing down, majority of the projects did not start, financial cutbacks were also experienced and the implementation practically came to a halt.

4.3.2 9ᵗʰ 5-year Plan

The 9ᵗʰ 5-year plan (1998-2002) development strategy is that manufacturing sector should focus on enhancing efficiency and international competitiveness of the local industry. The subsectoral priorities state that the development of Hi-tech and electronics industry is essential. The Plan has included chapters both on information technology (1,00 billion Rupees) and electronics/software development (500 million Rupees).

This plan has a chapter on Electronics/Software development. National projects have to be set to encourage electronics industry, with priorities as follows:

–   Silicon foundry in the private sector through joint venture agreements

–   Design and launch national communication satellite/ancillary ground equipment

–   Setting up a national optical industry

–   Setting up Electronics Parks for the promotion of the Electronics industry.

However no fresh investment is foreseen by the Plan in Electronics sector until smuggling is curbed with effective measures.

Software development industry was planned with an annual 40% growth rate, and evaluated as one of the fastest growing sectors. Training and retaining manpower was seen as the most important aspects to achieve the goals.

Several topics have been identified which should be undertaken in software field and related services, e.g.:

–   Feasibility study to be conducted for the establishment of training institutes in Pakistan where the existing teachers of the software development fields will be trained

–   Training instructors and other software professionals in foreign countries

–   Action learning program for graduates through extensive one year Post Graduate Diploma courses.

The major projects during the Plan's lifecycle will be the development of Software Technology Parks in all major cities of Pakistan.

Till date (May 2000) the 9ᵗʰ 5-Year Plan officially has not been implemented.

4.3.3 Information Technology Policy

In 1998-99 the Pakistani Government developed the national 'Information Technology Policy', which has been reformulated in 2000, and is planned to be public Fall 2000. The last draft, ready for submission to the Cabinet, consists of four major parts: IT Policy, Implementation, Action Plan and Incentives package.

IT Policy involves:
- Vision, Mission, Goals
- IT Policy Strategies (HRD, IT Education, IT Training, Infrastructure Development, Telecommunications, Databases and Platforms, Technology Parks)
- SW Development Policies (SW Industry Development, Development of Local SW, Urdu and Regional languages)
- SW Development (Promotion of SW Export, HW Industry Development, Manufacturing, Technology Transfer and R&D)
- Internet (Internet market Development, IP Delivery Mechanism)
- Incentives (Incentives, Fiscal Incentives, IT Promotion and Awareness)
- IT Usage (IT in Government, IT in the Economy and E-Commerce)
- Legislation an Regulations (Legislation, Regulation)

IT Policy also involves coincidences with Electronics Policy such as hardware manufacturing, developing software industry, upgrading university training, quality issues, legislative issues. These include:
- Hardware industry development: competition with developed countries and manufacturing products of high volume and rapidly changing variety (e.g PCs) is not recommended. Focus should be placed on niche markets with large value added content. However local assembly of HW parts /sub assemblies shall be encouraged, and supporting industry needs upgrading to produce primary components.
- Software export, software industry: promotion of IT service areas, which require minimum time and can be started with currently available skills. Major multinationals operating in Pakistan will be encouraged to settle SW facilities and to bring international business through these channels. SW industry is planned to be free of all duties and taxes
- HRD aims both developing quality education and to retain trained manpower due to emigration. The implementation of standard curriculum is planned; the existing curriculum, last revised in 1986, has to be updated. Teachers' training needs to be organized and arranged, the establishing of faculty chairs is planned which involves research as well. For high quality education the capacity of 15 institutions (both public and private) will be built in areas like Computer Science, Computer Engineering

Submission of the IT Policy to Cabinet is planned in 2000.

4.4 Standardization, quality management

National standards in electronics, published by the Pakistan Standards Institute are extremely low in numbers, the country has been inactive on the international standardization arena. The implementation of ISO standards in Pakistani industries was a slow process, characterized by the lack of awareness because of the low quality demands of the local market. Just recently the understanding of quality issues and ISO 9000 quality standards is being developed which process is fuelled by the growing demand for exportable products (certifications in Pakistan - 1997: 50 companies, 31 December 1999: 900 companies, 31 April 2000: 1300 companies). Developing the awareness for the ISO 14000 environmental standards still needs strong nationwide actions (certifications in May 2000: 8 companies).

Certification is executed exclusively by foreign certification agencies, the lack of a national certification body is a major obstacle to raise a quality culture in the country. To fulfill this role under the administrative control of the Ministry of Science and Technology, the Pakistan Standards and Quality Control Authority (PSQCA) has recently been established. PSQCA will provide the services formerly offered by both the Pakistan Standards Institute (PSI) and the Central Testing Laboratory (CTL). Certification for ISO 9000 standards and ISO 14000 standards also will be provided. The

establishment of the body is partly funded by the Asian Development Bank. Reorganization in May 2000 has not been finished, the post of Director General is vacant.

The lack of a national accreditation body has also added to the difficulty of fostering standards in industry in Pakistan. All certification agencies operating in Pakistan are currently accredited by foreign agencies. The National Accreditation Council (NAC), under the administrative control of Ministry of Science and Technology, will provide indigenous accreditation services for Pakistan.

The low level of commercial testing and calibration services for industries in Pakistan provides another barrier for the implementation of quality and environment standards. The National Physical and Standards Laboratory provides calibration services, but it is located in Islamabad, far from industrial centers where services are required. Industries have to contract for the testing services of foreign laboratories in order to ensure rapid and accurate service.

The two governmental bodies, responsible for administering programs relating to ISO standards, are the Ministry of Science and Technology and the Export Promotion Bureau of the Ministry of Commerce. Ministry of Science and Technology responsible for partial funding and administration of the ISO incentive program, which provides a grant (200,000 Rs.) to industries that have gained ISO certification or are in the process. They also organize lead auditor and auditor training courses. Export Promotion Bureau co-funds the ISO incentive program in conjunction with Ministry of Science and Technology and is also involved in information dissemination concerning ISO standards. The Environmental Protection Agency of the Ministry of Environment is the leading government counterpart involved in promoting environmental management standards for industry in Pakistan.

The Federation of Pakistan Chambers of Commerce and Industry and the local Chambers have begun to offer information, reference materials and other related services on standards through the establishment of Expert Cells within their offices. Industry Associations vary in their involvement in promoting standards for their members, in electronics just the first steps have been taken.

The National University of Science and Technology started instructing students on importance of quality assurance and environmental standards. Other institutes train existing management staff through specialized courses and seminars, and commercial consulting and training services on standards are also offered to industries.

International contributions also promote standardization for industries in Pakistan in order to facilitate trade. The World Bank, the Asian Development Bank, the Department for International Development, the Swedish Embassy and the European Union are interested in projects fostering quality standards for industry.

4.5 Investment policy incentives.

Investment is in the focus of national efforts to increase the output of national economy. In the mid 90s foreign direct investments doubled (442 million USD in 1994, 1091 million USD in 1996). Investment of the private sector is considered to be the primary fuel of the Five-Year Plans of the country (during the period of the 8th Five-Year Plan the private sector had about 94% share of the manufacturing sector's investments). The latest Investment Policy was made public by the Board of Investment in 1999. The major issues, connected to industry and manufacturing sector are as follows:
Incentives
Manufacturing /Industrial sector has been prioritized in four categories:
(A) Value Added or Export Industries (including Electronics Industry)
(B) Hi-Tech Industries (including Information technology)
(C) Priority Industries (including Medical diagnostics equipment/devices and R&D /Technical testing facilities
(D) Agro-based Industries
Tariff
- Zero rated customs duty on imported raw materials used in producing for exports (custom dusty for raw materials used for local TV industry - picture tubes, tuners, transformers, back and front covers - is 5%, for modules and subassemblies 10%)
- Zero rated customs duty on plant, machinery or equipment (which is not manufactured locally) for industries (A) and (B) categories
- 10 percent customs duty on items - see above - for industries (C) and (D) categories

Fiscal (tax relief)
- First Year Allowance can be utilized to set off the statutory income in the year of assessment, unutilized allowance can be carried forward to subsequent years. The rates are:
    - Category (A) and (B): 90% of the cost of plant, machinery and equipment
    - Category (C) and (D): 75% of the cost of plant, machinery and equipment
- Re-investment Allowance also exists for investors who wish to re-invest the earnings to expand existing manufacturing facilities, improving technology. 50% of cost of Plant, Machinery and Equipment is allowed as Re-investment Allowance.

Corporate tax rates
- for public companies 33%
- for private companies 43%

Industrial Zones
A scheme for National Industrial Zones (NIZs) engulfing industrial estates, Export Processing Zone (EPZ), Free Industrial Zone, Free Trade Zone has been launched.
- Export Processing Zone Authority Ordinance was issued in 1980 by the Government of Pakistan with the mandate to plan, develop, manage and operate Export Processing Zones in Pakistan.
    - The incentive package includes:
        - 100% ownership rights
        - 100% repatriation of capital
        - 100% repatriation of profit
        - No minimum or maximum limit for investment
        - Duty and tax free imports
        - Duty and tax free export of finished products
        - Income chargeable under the head 'Capital gains' is exempt from tax
        - Income accruing outside Pakistan is exempt from tax
    (Existing EPZs: Karachi, Sialkot, Risalpur, plans are developed for Lahore, Multan, Quetta, Hyderabad, Sukkur, Gaddani, Nooribad and Mirpur)
- Free Industrial Zone will be a multi-product zone where a variety of export products can be manufactured, traded, exported or re-exported. Incentive packages will be offered on the pattern of EPZ.
- Free Trade Zone will serve as an effective instrument to boost up Export Trading. The zone set up as an enclave separated from Domestic Tariff Area is intended to provide duty free environment for trading of exportable products at low costs. The Free Trade Zone will be allowed similar concessions and facilities as are admissible to Free Industrial Zones.

4.6 Legal background, copyright, intellectual property issues

The amended Copyright Ordinance (1962) with reference on software issues was approved in 1992. Recent random police actions initiated by the Business Software Alliance against software piracy is based on this Ordinance. New Copyright Act is under development by the Ministry of Education
Protection of Software Ordinance was approved by the Cabinet in 1997 and submitted to the Assembly in 1998, but the procedure was interrupted in 1999. Reconsideration of the proposal was carried out by the Pakistan Computer Bureau and the Ministry of Science and Technology and the latest draft is the Protection of Software Ordinance, 2000. This draft involves the major issues including SW registration procedures, IPR in registered software, transfer of IPR, grace period to obtain authorization, infringement of IPR, punishment rates, divulgence of information.
Amendments have been carried out on Patent and Design Act to meet the requirements of WTO (by Ministry of Industries and Production), Trade Marks Act (by Ministry of Commerce).

5. Findings

5.1 Governmental-organizational

The topics is characterized by three major obstacles: slow progress, lack of information, lack of human resources. In details:

- The frequent changes of priorities and the declining performance of economy led to gradual halt of initiatives (Technology Policy) or unacceptably slow realization process (12 years till date for Islamabad Tech Town)
- The independent decision mechanism for the technical and financial approval of projects could result delayed implementation of outdated plans.
- No action has been taken yet in implementing the Electronics Policy, however efforts are being made to initiate the upgrading/protection of the local industry by providing fiscal and legislative incentives.
- The Electronics Policy has items, which in the recent economical realities are beyond addressable targets (increasing self-reliance in materials/components, investing in IC manufacturing facilities). The status quo statements and analysis of the existing capabilities are also overestimated (e.g. the availability of manpower, research capacity in the required quantity and quality). Due to statement of the Electronics Policy on possible revision and updating, the corrections have to be done.
- The implementation of Electronics Policy needs budget, converging decisions focusing on actions instead of bureaucratic and organizational issues.
- Private sector is mentioned as key participant in the realization of the Electronics Policy, but government has not reliable information on its capability and quality. This problem was evident when software houses and private universities were visited, which represented good international standard, high above the national public sector's level.
- The discrimination between public and private sectors has to be eliminated in taxing and the donation of research and development funds.
- IT capabilities of ministries need upgrade, local network and data base does not exists (in many cases instead of using government or ministry domain names, official E-mailing with high ranking staff members is done through international free mail providers)
- There is a lack of good practice in handling multi-discipline topics where many governmental bodies are involved. Senior officers have not been informed in proper manner and time.
- In overlapping fields low information exchange rate and cooperation is experienced between ministries (the latest example in supporting industry issues - molds and dies - between Ministry of Industries and Production, and Ministry of Science and Technology)
- Ministry wings work in a quite isolated manner, reliable information from other units even on coincident topics is not available.
- Due to complex tasks of ministries the units are understaffed (e.g Electronic Wing which is in charge of the national electronics industry, has two permanent staff members with university degrees)

5.2 Electronics industry

- Practically domestic electronics material and components industry does not exist. Any initiatives had taken to establish such industry all failed in the past years. A few exceptions exist, the large telecom companies produce components for own needs.
- In Pakistan electronics industry means in fact consumer electronics and telecommunication.
- Large-scale smuggling, pocket import and the ineffective measures to curb this kind of business resulted the closing down of many industrial units.
- In the last 3 years the existing companies experienced a sharp decline of business, due to the growing problems of the national economy. All segments of electronics was involved in this process and sensitive losses of export market was experienced. However, new export markets are also considered by companies of the Export Processing Zones.

- The majority of the companies have been doing business in the Contract Manufacturer (CM) category using simple reverse engineering methods. A few companies considered themselves as Original Equipment Manufacturers (OEM), mostly in the telecommunication segment.
- Extensive use of quality standards is not experienced, mandatory testing is also out of scope of the daily practice
- The operation of many SMEs results serious environmental hazards. Companies work in populated areas and disposal of the wastes is a common practice. In other cases waste material is collected and sold to people, the future of the material is out of focus of the company.
- There is an evident lack in using or selling patents, know-how. The upgrading of CMs to Original Design Manufacturer (ODM) or to Original Equipment Manufacturer (OEM) needs innovative approach of the firms. The need for technology transfer has not been recognized yet by the companies. Governmental bodies, professional organizations have much to do to change the situation with systematic training and preferences.

5.3 Research institutes

- The institutional infrastructure of electronics needs upgrading. This upgrading is meant in technology, equipment and manpower (National Institute of Electronics has about 36 staff members with university degree, which is an extremely low figure concerning the institute's complex tasks in electronics)
- Investment projects, major international R&D cooperation or international funds are not available for the research institutes.
- Better information flow has to be built up between research institutes and government. Institutes submit R&D policy recommendations and contributions without response from governmental sources, and the actual actions are out of the institutes' sight.
- The institutes experience a central over-regulation attitude of the government, which is considered the major barrier in the commercialization process. However commercialization also needs more innovative approach. Till date patents or know-how have not been marketed by the institutes.

5.4 Software industry/houses

- The SW companies have experienced a gradual decreasing of the domestic software market in the last three years, many companies work exclusively for export market (basically for US). These companies have top qualified employees and good IT infrastructure.
- One of the chronic problems is the skilled manpower. The number of available professionals and the graduating students pro annum is below the needs of SW industry and does not fulfil the expected figures of SW export (export is an estimated 30 million USD, the number of software professionals is around 3500, and about 500 new degree holders can be added annually). This manpower capacity is about 10% of the country's estimated needs.
- Software vendors emphasize the need for the more frequent actions of the Business Software Alliance and the police because the legal software market is hampered by the pirated software business (its share is estimated to 86% of the market). Police actions are reported from cities (Lahore, Karachi, Multan), but e.g. in Islamabad illegal copies of software packages are everywhere on sale in leading bookstores (on a 60Rupees/CD price).
- Standard software quality assessment methods have not been used, the companies apply own methods which raise questions on the company's assessment procedure.
- About 38% of the software houses classified themselves into the 'Leader ' category, which value is acceptable especially when the exporting firms are concerned. The rest of companies belongs to the 'Fast follower ' category and none of them is considered as a 'Follower'.

5.5 HRD/Colleges/universities

- The leading public universities have to face growing difficulties both in funding and in efficiency issues. The departments, which are associated to electronics industry and information technology, are unable to invest into instruments, equipment, information and faculty member mobilization.

The stagnating economy prevents industrial contracts, the very rare cases of donation are depending on personal contacts.

- Highly qualified people leave for private institutions, and the universities face the problem of manpower shortage. This process is generated also by the suspension of donating PhD grants, the consequence is a very serious shortage in PhD professionals throughout the country.
- The majority of universities are 'teaching universities. The infrastructure, the low number of faculty members and the extensive classwork (around 20 hours pro week for one faculty member) exclude the possibility of any research or work on fund generating industrial contracts.
- The isolation of the university community is observed. The professional staff has no connection with policy and R&D formulating bodies, no major international projects or even active R&D ties are not available for the engineering departments.
- A strong dividing line exists between the public and private universities, the latter institutions have to tackle many preconceptions. However because of the availability of funds and qualified manpower, they are gradually reaching a leading role and reputation in professional communities. Private universities expressed needs for cooperation with public R&D organizations.
- The general impression is that upgrading of the prestigious public needs immediate actions. The HRD goals of Electronics Policy and IT Policy (Schools of Excellence, high level training of manpower, conducting research) are beyond the recent infrastructural capacity of these institutions.

5.6 Standardization, quality systems

- The actions taken in recent years, the establishment of the Pakistan Standards and Quality Control Authority (PSQCA) creates the necessary framework needed to meet the quality issues of Electronics Policy.
- To place electronics export on a sound basis, the knowledge, dissemination and the use of ISO/IEC technical standards is also of vital importance. Pakistani electronics industry has shown modest activity in this field.
- To fulfill the ambitious software development plan the software assessment methods and in general the ISO software engineering standards provides the internationally accepted sound basis. Till date only few applications of these methods have been observed.

5.7 Fiscal incentives

- The latest Investment Policy involves an incentive package of positive modifications (e.g. IT is considered Category (B) industry). However the emphasized importance of the private sector does not justify the differences of corporate tax between public company and other company (33% and 44% respectively)
- The changing (decreasing) custom duties met the sporadic opposition of the local manufacturers. In cases the rate of custom duty was not based on acceptable justification (different rates for PC central unit vs. keyboards, printers and other peripherals, - this problem have been solved with 0% custom duty rate)

5.8 Legislative issues.

- The Government has shown activity in updating the legal background of copyright, IPR, patent and trademark issues, coordinated with international obligations. In fact the necessary legislative frame has been created for electronics and software industry.
- Software market is waiting the date of coming to force of the Protection of Software Ordinance, and regular actions are requested to clear up the software market from pirated software.

6. Recommendations

6.1 Implementation of Electronics Policy

The implementation of Electronics Policy needs the following instruments:
- Mechanism for assessment, selection and introduction of technologies

  The establishment of an Electronics Industry complex in Pakistan is not foreseen in the near future. This investment intensive solution brings mass production of products and it is not justified by the size of local or export market. The only realistic way to establish Hi-Tech components industry is to attract multinationals to open plants in Pakistan.

  The planned priorities are recommended to change from self-reliance on components and materials to the direction of utilizing and developing the existing electronics profile:
  - electronics design,
  - manufacturing of custom tailored PCBs,
  - manufacturing and assembling of IT hardware units,
  - telecommunication equipment,
  - thermal and electro-photo defense equipment,
  - computer -telephone integration services,
  - network design,
  - consumer electronics
  - supporting industries (plastic, metal parts)
- Improvement of Research and Development network
  - The immediate priority is to use the existing resources of R&D more efficiently. This can be achieved by upsizing the staff to efficiency level, set priorities in research topics due to industrial needs, use incentives to utilize research capacity of universities in industrial R&D.
  - Increase awareness of budget decision makers to allocate 1-1.5 percent of GNP for research and development
- Commercialization of R&D system
  - R&D programs in the public sector have to be evaluated on commercial criteria. Financial incentives, linked to market success have to be provided to institutions and individuals involved in R&D. Steps have to be taken to foster private investment in product-oriented research and development
  - Public sector R&D institutions has to actively market their facilities and services and they have to rely increasingly on self generation of funding
- Developing industrial infrastructure

  Incubation centers have proved successful in providing directly needed assistance to new companies. The establishment of incubation centers is recommended in existing or planned estates. Technology parks (Tech Towns) are the primary places to concentrate high-tech industries and to promote their cooperation
- Effective metrology, standards, testing and quality system

  Awareness has to be created among local consumers to exert on domestic pressure on manufacturers to produce high quality products. Studies will be conducted and disseminated on modern industrial management methodologies with a view to promoting quality consciousness. In order to foster nationwide quality initiatives and to promote electronics/software industry and export the recommendations can be summarized as follows:
  - Strengthen the capacity and efficiency of Pakistan Standards and Quality Control
  - Upgrade the facilities of National Physical and Standards Laboratory, promote the establishment of new testing laboratories in major industrial regions
  - Initiate the accreditation of testing laboratories
  - Elaborate training program on international standards system
  - Take actions to participate in international standardization process in major electronics/software ISO/IEC Technical Committees
  - Implement software assessment an software engineering standards. Bearing in mind that software industry products and services key role in improving the nation's economy in

Pakistan, the establishment of a Software Quality and Testing Unit is recommended (see Annex VIII)
- Initiate and implement standards/quality campaign
- Take measures to improve consumers protection
- Promotion of technical education and vocational training
    The existing factors are:
    - Skilled manpower is not available in the required quality and quantity
    - The major human resource of quality professionals is high level education. This includes both degree programs and training.
    - Large number of highly trained professionals emigrate
    - A very large number of educational/training institutes exist
    - Limited resources can be mobilized for almost limitless demands

    A comprehensive HRD program has to be developed for implementing Electronics Policy in synergy with coincident fields HRD of IT Policy. This program address major issues as follows:
    - An implementation body has to be formed to work on issues like curriculum development, faculty chairs, visiting faculty chairs, teacher training, scholarships and infrastructure development.
    - A body for accreditation has to be established to ensure the quality of Electronics/Software education and training. This body will be responsible for collecting data on educational institutions, rating the institutions and disseminating information on the institutions
    - Establishment of a HRD fund is recommended to improve the quality of electronics/software education, upgrade infrastructure including laboratories, develop faculty, provide student scholarship.
    - A managing body for the HRD fund has to be formed, which is responsible also to mobilize international agencies for financing Electronics/Software training
    - Continuous monitoring of education and training is needed using metrics
    - Development of standardized curricula is recommended on Bachelor level
    - A scholarship scheme has to be established to enroll the best students in graduate education
    - Teachers training needs to be arranged
    - Establishing faculty chairs is recommended to attract and to retain qualified faculty
    - Universities have to be encouraged to collaborate with private sector for conducting training programs when the facilities are available (e.g. vacation period)
    - Facilitation and encouraging is recommended for training and hiring women in electronics/software sector to utilize this human resource and to reduce unemployment
    - Forced awareness has to be developed for politicians and top Government policy makers to convince them to promote electronics/software at all levels
    - The establishment of tele-education, virtual education and training institutions is recommended
- Financial support for electronics
    - Private sector has to be encouraged to finance innovative and technology intensive projects. Financial incentives are provided to stimulate private sector investments in research and development.
    - Electronics Policy oriented projects have to be budgeted on a 3-year financial basis
- Tax policy, legislative measures as development measures
    Governmental efforts to amend legislative issues including copyright, IPR, software protection, trade mark and patents create sound background for Electronics Policy implementation. Incentive packages also encourage investors to open up new industries.
    To boost up electronics/software industry and export, to attract foreign investors the following recommendations can be made:
    - Constant monitoring of market and enforcing of legislative Ordinances is needed
    - Immediate, effective and monitored measures have to be implemented to curb smuggling and pocket import

- Propose major discount of software products for international software companies, and support educational and training institutes to install discounted products. Take immediate measures to cut the open sale of illegal software products
- Raise awareness for patents, know-how and technology transfer through professional associations, training centers, technology exhibitions
- Create information repositories on technology know how and disseminate information
- Initiate innovation ideas forums and competitions in schools, R&D centers
- Attract foreign investors using all possible forum (embassies, international exhibitions) to open industries in Pakistan
- The elimination of differences between corporate tax rate of public sector and private sector is recommended
- For local products manufactured with high quality assurance protection might be considered under the taxation system, not influencing custom tariff policy
- Implementation mechanism
  - Due to the complex nature of electronics and software the success of the Electronics Policy is depending on an inter-organizational mechanism. An inter-ministerial committee has to be established to oversee implementation and to review the policy.
  - In addition Ministry of Science and Technology has to be the catalyst
    - to bring together public and private sector organizations to implement the Policy,
    - coordinate technical and fiscal assistance for bilateral and multilateral agencies,
    - to establish an international panel of advisors to advise on implementation and further development of Electronics Policy

6.2 IT Policy, Telecommunication Policy

IT Policy has been drafted during project execution period. In overlapping fields (hardware industry, software industry, HRD, legal and incentive issues, standardization and quality systems) coordination and joint actions are recommended for the National Commission on Electronics and IT Commission to utilize efficiently the synergy of Electronics Policy and IT Policy.
Telecommunication Policy is also under consideration but concerning the many coincidences with Electronics industry and IT no definite steps are recommended before the implementation phase of the other two policies.

6.3 Post implementation guidelines, monitoring

For monitoring Electronics Policy implementation and for determining if the expectations are achieved, Post Implementation Review (PIR) has to be conducted. This should highlight the good practices on which a successful project has been built and underline the weak practices which should be avoided. A PIR should be conducted approximately 18 months after implementation of the project. The development of performance indicators is recommended for electronics industry, HRD, software industry (e.g for industry: the number of operating companies compared to a baseline date, annual sales, export sales; for HRD: number of institutions, number of enrolled students, number of qualifying students etc.)

Specific objectives of a PIR are to:
- demonstrate achievements against the projected costs, benefits and
- identify opportunities to add additional value to the project
- identify strengths and weaknesses of the project for future reference and appropriate action
- make any other recommendations on the future of the project.

Recommended guidelines:

Identification of the methodology used to conduct the review, interviews, team members, the duration of the review.
The following areas should be investigated:

- Comparison has to be made between the expectations contained in the original Implementation Plan and those of the current Plan at review date, as maintained to reflect changing conditions.
- Compare the functionality of the original Plan with the current plan. What are the implementing bodies' perceptions of the worth of the current functionality?
- Exceptions has to be highlighted and the impact of the omitted/added functionality explained
- Compare the actual timetable for the project against that approved in the original Implementation plan. Reasons for any differences should be identified and explained
- Compare the actual project costs against the planned costs of the original Plan. Reasons for any differences should be identified and explained
- Compare the benefits to date with the benefits expected in the original Plan. Reasons for any differences should be identified and explained
- Discuss the used project management approach
- Implementation approach has to be described, noting strategies, difficulties and/or eventual success.
- Make recommendations resulting from the PIR and identify the action plans to implement the recommendations. Costs and benefits related to implementing the recommendations, should be included.

7. Conclusion

The project execution has achieved the planned goals. Delays were experienced mostly due to circumstances beyond the participating parties' control, including the reengineering process of the Pakistani economy starting in late 1999, with changes in priorities and institutional frames.

The findings and proposals create the basis for implementing the Electronics Policy and to make the necessary updating decisions. The next recommended step is the formulation of an action plan by the implementing body, in close synchronization with budget needs. Due to many overlapping fields with IT Policy, coordination is recommended with IT Commission. This synergy creates both better lobbying capability for electronics/IT and prevents spending time and budget for doube efforts.

After so many years of developing ideas, the immediate taking up of Electronics Policy and commencing implementation without delay is of vital importance for the Pakistani economy.

ANNEX I

(Questionnaires)

1	Company ID	Name: .... In business since: .... Annual Revenue: .... Address: ....
2	Ownership	☐ Public ☐ Public joint venture (with: ....) ☐ Pvt ☐ Pvt joint venture (with: ....)
3	Telecommunication capability of company (use multiple answers if appropriate)	☐ Telephone line ☐ ISDN line ☐ E-mail ☐ Own Web site (http://....................................)
4	Company capacity involved in Electronics Industry	.... (%)
5	Segment of Electronics Industry (use multiple answers if appropriate)	☐ Consumer Electronics ☐ Computer and Peripherals ☐ Telecommunication ☐ Parts and Components ☐ Supporting Industries (please specify: ....)
6	Major products and annual number of products	a) ....(pcs) b) ....(pcs) c) ....(pcs) d) ....(pcs) e) ....(pcs)
7	In case of export give % value of export for major products and target countries	a) .... (%) .... b) .... (%) .... c) .... (%) .... d) .... (%) .... e) .... (%) ....
8	Relation to major products: CM=Contract Manufacturer ODM=Original Design Manufacturer OEM=Original Equipment Manufacturer)	a) ☐ CM ☐ ODM ☐ OEM b) ☐ CM ☐ ODM ☐ OEM c) ☐ CM ☐ ODM ☐ OEM d) ☐ CM ☐ ODM ☐ OEM e) ☐ CM ☐ ODM ☐ OEM

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9	Method of design (if design is involved)	☐ Reverse engineering/Sample part ☐ Manual design ☐ CAE (please specify: ....)
10	Dominating technologies for major products	a) .... b) .... c) .... d) .... e) ....
11	Equipment for dominating technologies	a) .... b) .... c) .... d) .... e) ....
12	Labour intensity/Machine intensity ratio of dominating technologies (e.g. 30/70%)	a) ..../............ (%) b) ..../............ (%) c) ..../............ (%) d) ..../............ (%) e) ..../............ (%)
13	Average defectives of major products	a) ....(%) b) ....(%) c) ....(%) d) ....(%) e) ....(%)
14	Quality and/or quality management standards	☐ Not used ☐ Yes (please specify: ....)
15	Calibration and/or testing procedures	☐ Not used ☐ Yes, own (please specify: ....) ☐ Yes, professional services (please specify: ....)

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16	The use of standards in products and technology processes	☐ Not used ☐ Yes (please specify: ....
17	Major hazardous materials/pollutants/wastes of the technologies (please specify relevant handling/treatment procedures)	a) .... (............................) b) .... (............................) c) .... (............................) d) .... (............................) e) .... (............................)
18	Number of employees	.... employees (.......... men / ....women)
19	Training level	College degree: .... employee(s) Technician degree: .... employee(s) Skilled worker(s): .... employee(s) Unskilled: .... employee(s) Other: .... employee(s)
20	Technology level of company	☐ Leader ☐ Fast follower (less than 2 years behind leaders) ☐ Follower (more than 2 years behind leaders)
21	Know-how, patents	No. of company know-how, patents: .... (of which ....used at company and .... marketed) No. of used know-how, patents from other parties: .... (please specify major sources: ....)
22	Participation in investment projects (please name counterpart, scope and budget)	☐ No ☐ Yes: a) ..../ ....(...............Rs) b) ..../ ....(...............Rs) c) ..../ ....(...............Rs)
23	Set priorities for this 'needs for support' list (mark 1 for the most important item and 7 for the least important item)	(.......) Direct research and development funding (.......) Direct support for technology transfer (.......) Training support (.......) Loans (.......) Tax incentives (.......) Export promotion (.......) Import controls

ANNEX 1

1	Company ID	Name: .... In business since: .... Annual Revenue: .... Address: ....
2	Ownership	☐ Public ☐ Public joint venture (with: ....) ☐ Pvt ☐ Pvt joint venture (with: ....)
3	Telecommunication capability of company (use multiple answers if appropriate)	☐ Telephone line ☐ ISDN line ☐ E-mail ☐ Own Web site (http://.................................)
4	Major activities of company (use multiple answers if appropriate)	① ☐ Dealer of third party's SW product ② ☐ SW subcontractor/supplier of other SW Company ③ ☐ Developing custom tailored SW ④ ☐ Consulting and system implementation services in Information Technology ⑤ ☐ Training ⑥ ☐ Other (please specify: ....)
5	Annual turnover of major activities (please quote both domestic and export market values, specify destination country)	Domestic Export Country ① ....(Rs) ....(Rs) .... ② ....(Rs) ....(Rs) .... ③ ....(Rs) ....(Rs) .... ④............(Rs) ....(Rs) .... ⑤............(Rs) ....(Rs) .... ⑥............(Rs) ....(Rs) ....
6	Most important products/services (please identify function/topics, target sector, activity code, domestic and export market values and destination country - e.g. Programmable Logical Controller SW for Electronics Industry ③ etc.)	a) .... ○ ....(Rs) ....(Rs) .... b) .... ○ ....(Rs) ....(Rs) .... c) .... ○ ....(Rs) ....(Rs) .... d) .... ○ ....(Rs) ....(Rs) .... e) .... ○ ....(Rs) ....(Rs) ....

7	CASE tools used in SW development	☐ No ☐ Yes: a) .... b) .... c) .... d) ....
8	International IT standards used at company	a) .... b) .... c) .... d) .... e) .... f) ....
9	SW performance and/or quality assessment methods used in SW development	☐ No ☐ Yes: a) .... b) ....
10	Number of employees	.... employees (.......... men / ....women)

11	Training level	College/University degree: .... employee(s)
		Post-secondary degree : .... employee(s)
		High school level degree : .... employee(s)
		Other : .... employee(s)
		    (please specify: ....
		    ....)

12	Technology level of company	☐ Leader ☐ Fast follower (less than 2 years behind leaders) ☐ Follower (more than 2 years behind leaders)
13	Equipment and infrastructural level of company	Hardware: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low Software: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low CASE tools: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low Telecommunication: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low
14	Intellectual property issues	No. of company's registered products: .... (of which ....have been used/sold in the country and ....have been used/sold abroad) Major registered products: a) .... b) .... c) .... d) .... e) ....
15	Participation in investment projects (please name counterpart, scope and budget)	☐ No ☐ Yes: a) ....(..............Rs) b) ....(..............Rs) c) ....(..............Rs)
16	Set priorities for this 'needs for support' list (mark 1 for the most important item and 7 for the least important item)	(.......) Direct research and development funding (.......) Direct support for technology transfer (.......) Training support (.......) Loans (.......) Tax incentives (.......) Export promotion (.......) Import controls

ANNEX 1

1	Institute ID	Name: .... Year of Foundation: .... Annual Budget: .... Address: ....
2	Ownership	☐ Public ☐ Public joint venture (with:....................) ☐ Pvt ☐ Pvt joint venture (with: ....)
3	Telecommunication capability of the institute (use multiple answers if appropriate)	☐ Telephone line ☐ ISDN line ☐ E-mail ☐ Own Web site (http:// ....)
4	Institute's capacity involved in (or supporting) Electronics Industry	.... (%)
5	Major profile(s) of Institute in Electronics	☐ Consumer Electronics ☐ Computer and Peripherals ☐ Software Engineering ☐ Telecommunication ☐ Parts and Components ☐ Supporting Technologies (specify: ....)

6	Participation in higher education	☐ No
		☐ Yes (please specify topics and college/university:
		a) ....
		    (..)
		b) ....
		    (..)
		c) ....
		    (..)

7	Financial source of research and development (use multiple answers if appropriate)	☐ Own funding (annual budget: ....Rs) ☐ Industrial contracts (ann. budget: ....Rs) ☐ Governmental projects (ann. budget: ....Rs) ☐ Other (please specify and also annual budget: ....)

Please consider Electronics, Information Technology and Telecom(except questions 1-3   ` ANNEX 1

8	Topics of most important R/D activities (please quote the average industrial utilization/commercialization rate)	a) ....(.........%) b) ....(.........%) c) ....(.........%) d) ....(.........%) e) ....(.........%)

9	Topics of joint R/D with national/foreign research institutes and/or universities (specify institutes' names)	☐ No
		 ☐ Yes:
		 a) ....
		   (...)
		 b) ....
		   (...)
		 c) ....
		   (...)
		 d) ....
		   (...)
		 e) ....
		   (...)

10	Participation in the formulation or implementation of national science/technology projects/policies (please specify topics and counterpart)	☐ No
		 ☐ Yes:
		 a) ....
		   (...)
		 b) ....
		   (...)
		 c) ....
		   (...)
		 d) ....
		   (...)
		 e) ....
		   (...)

11	Employees	PhD: .... MSc: .... BSc: .... Technician : .... Skilled worker: .... Other : ....

12	Equipment and infrastructural level of the institute	Electronics: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low Computer Science: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low CAD/CASE tools: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low Instruments, testing ☐ Good ☐ Medium ☐ Satisfactory ☐ Low Telecommunication: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low
13	Institute's own patents, know-how	No. of patents/know how .... (of which .... have been implemented in industry)

14	Participation in investment projects, incoming international funds (please name counterpart, scope, and budget)	☐ No
		☐ Yes:
		a) ....
		     ....(.............Rs)
		b) ....
		     ... .(.............Rs)
		c) ....
		     ....(.............Rs)
		d) ....
		     ....(.............Rs)
		e) ....
		     ....(.............Rs)

15	Major factors of improving the efficiency and the commercialization rate of the national R/D system.	a) ....
		     ....
		b) ....
		     ....
		c) ....
		     ....
		d) ....
		     ....
		e) ....
		     ....

Please consider Electronics, Information Technology and Telecom(except questions 1-3   · ANNEX 1

1	University/Institute ID	Name: .... Year of Foundation: .... Total annual budget: ....Rs Number of Students: .... Address: ....
2	Ownership	☐ Public ☐ Private
3	Telecommunication capability of institution (use multiple answers if appropriate)	☐ Telephone ☐ ISDN line ☐ E-mail ☐ Own Web site (http://......................................)
4	Degrees granted in Electronics, Information Technology and Telecommunication (from which year)	☐ BSc (.........) ☐ MSc (.........) ☐ PhD (.........)
5	Directions/majors of undergraduate programs (number of degrees pro annum).	a) .... (.........) b) .... (.........) c) .... (.........) d) .... (.........) e) .... (.........)
6	Directions/majors of graduate programs (number of degrees pro annum).	a) .... (.........) b) .... (.........) c) .... (.........) d) .... (.........) e) .... (.........)
7	Other training activities: topics, number of graduates pro annum (use multiple answer if appropriate).	☐ Post secondary: .... ☐ Science/technology updating courses for professionals: .... ☐ Tele-education: .... ☐ Other: ....
8	Industrial contact of students (use multiple answer if appropriate)	☐ No ☐ Visits ☐ Student's project work comes from/goes for industry ☐ Participation in institute's industrial R/D ☐ Other (please specify: ....)

9	Research/Development work of the institution (use multiple answers if appropriate)	☐ On own initiatives ☐ Industrial contracts (annual budget: ....Rs.) ☐ Governmental projects (annual budget: ....Rs) ☐ Other (please specify with annual budget: ....Rs)
10	Topics of most important R/D activities (please quote the average industrial utilization rate)	a) ....(.........%) b) ....(.........%) c) ....(.........%) d) ....(.........%) e) ....(.........%)

11	Topics of joint R/D with national/foreign universities and/or research institutes (specify institutes' names)	☐ No
		☐ Yes:
		a) ....
		          (..)
		b) ....
		          (..)
		c) ....
		          (..)
		d) ....
		          (..)
		e) ....
		          (..)

12	Participation in the formulation or implementation of national science/technology projects/policies (please specify topics and counterpart).	☐ No
		☐ Yes:
		a) ....
		          (..)
		b) ....
		          (..)
		c) ....
		          (..)
		d) ....
		          (..)
		e) ....
		          (..)

13	Employees	PhD: ....(faculty) ....(research fellow) MSc: ....(faculty) ....(research fellow) BSc : ....(faculty) ....(research fellow) Technician :.......... Skilled workers :.......... Others :..........

Please consider Electronics, Information Technology and Telecom only (except questions 1-3)   ANNEX 1

14	Equipment and infrastructural level of the institution	Electronics: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low Computer Science: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low CAD/CASE tools: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low Instruments, testing ☐ Good ☐ Medium ☐ Satisfactory ☐ Low Telecommunication: ☐ Good ☐ Medium ☐ Satisfactory ☐ Low
15	Institution's own patents, know-how	No. of patents/know-how: .... (of which ....have been implemented in industry)
16	Participation in investment projects, incoming international funds (please name counterpart, scope and budget)	☐ No ☐ Yes: a) ..../ ....(..............Rs) b) ..../ ....(..............Rs) c) ..../ ....(..............Rs) d) ..../ ....(..............Rs) e) ..../ ....(..............Rs)
17	Major factors of improving the national higher education system.	a) .... b) .... c) .... d) ....
18	Major factors of improving the national R/D system.	a) .... b) .... c) .... d) ....

Please consider Electronics, Information Technology and Telecom only (except questions 1-3)   ANNEX 1

ANNEX II

(Sources of Information)

Legend: * visited and surveyed
** visited
*** research quest. was delivered
(not marked: surveyed)

No.	Company	owned	Company profile/Category
1	Advance Marketing Services, Karachi	pvt-joint vent.w/Motorola	Telecommmunication
*2	Amber Capacitors (Pvt) Ltd., Lahore	pvt	Sup.: capacitors
3	Central Testing Laboratories, Lahore	public	Sup:testing services
4	Descon Manufacturing (Pvt) Ltd., Lahore	pvt	Sup:power source
5	Empire Intl. (Pvt) Ltd, Peshawar	pvt	Consumer Electronics
6	Energy Saving Devices (Pvt) Ltd.,Jullian Village, NWFP	pvt	Parts&Components
7	HI-PO Electronics (Pvt) Ltd., Lahore	pvt	Sup:power supply
8	Ibrahim Electronics Co., Karachi EPZA	pvt	Consumer Electronics
**9	LEDTRONICS Inc., Karachi EPZA	pvt	Parts&Components
**10	L.T. Engineering $ Trade services (Pvt) Ltd., Hasanabdal	pvt	Parts&Components
*11	Microelectronics Int. (Pvt) Ltd., Lahore	pvt	Telecom,Parts&Components
*12	Micropak (Pvt) Ltd., Lahore	pvt	Parts&Components
**13	NCPC Applications, Karachi EPZA	pvt	Computer&Pheripherals
**14	ORION Electronics (Pvt) Ltd., Islamabad	pvt	Consumer Electronics
15	PEL Daewoo Electronics (Pvt) Ltd., Haripur	pvt-joint vent.w/Sony	Consumer Electronics
**16	Print Tech, Lahore	pvt	Parts&Components
17	Prism Electronics, Mirpur Azad, Kashmir	pvt	Consumer Electronics
**18	Progressive Watch Manufacturers, Karachi EPZA	pvt	Consumer Electronics
**19	Telephone Industries of Pakistan, Haripur	62%PTC, 38%Siemens	Telecommmunication
20	Victor Electronics Appliances, Sawat NWFP	pvt	Cons.El, Parts&Components
21	Western Computers (Pvt) Ltd., Lahore	pvt	Computer&Pheripherals.
1	ABACUS System, Karachi	pvt	SW house
**2	Autographics Pakistan (Pvt.) Ltd., Islamabad	pvt	SW house
**3	Cressoft Crescent Software Products (Pvt) Ltd, Lahore	pvt	SW house
4	Descon Infodesk (Pvt) Ltd, Lahore	pvt	SW house
**5	Elixir Technologies Corporation, Islamabad	pvt	SW house
6	Hameed Majeed Associates (Pvt) Ltd, Lahore	pvt	SW house
7	Innovative Computers (Pvt) Ltd, Lahore	pvt	SW house
8	Reysheen (Pvt) Ltd, Karachi	pvt	SW house
9	R.R. Soft (Pvt) Ltd, Karachi	pvt	SW house
10	Spectrum Software Intl.	pvt	SW house
**11	Systems (Pvt) Ltd, Lahore	pvt	SW house
12	Universal Computing Sys, Lahore	pvt	SW house
1	Institute of Industrial Electronics Enginnering	public	College/University***
*2	National Institute of Electronics, Islamabad	public	Research Inst.
*3	National Physical and Standards Laboratory, Islamabad	public	Services&research
**4	Pakistan Space and Upper Atmosphere Res. Comm., Karachi	public	Research Inst.
*1	FAST Institute of Computer Science, Islamabad-Lahore	private	College/University
2	NICON	private	College/University
**3	Quaid-i-Azam University, Islamabad	public	College/University
**4	Sir Syed University of Engineering and Technology, Karachi	private	College/University
**5	University of Engineering and Technology, Lahore	public	College/University
*6	University of Engineering and Technology, Taxila	public	College/University
**1	Computer Society of Pakistan	x	Org., association, society
**2	Karachi Export Processing Zone's Authority	x	Org., association, society
**3	Pakistan Software Export Board	x	Org., association, society
**4	Pakistan Software House Association	x	Org., association, society
1	Ministry of Science and Technology, Islamabad	x	implementing body.
2	Ministry of Environment, Islamabad	x	
3	Planning and Development Division, Islamabad	x	implementing body
4	UNIDO Pakistan Office, Islamabad	x	implementing body

Sources of information

ANNEX III

(HW/SW Specification)

HW/SW Specification

Processor:	Intel Pentium II Celeron 333 MHz
RAM:	64Mb DIMM
FDD:	1,44 Mb
HDD:	6,4 GB
CD:	40x
Fax/Modem/Voice Card 56 KBPS	
Sound Card	
VGA Card:	4 Mb
Monitor:	17"
Keyboard, Mouse	
Laser Jet Printer	
UPS 600VA	
Windows NT	
MS Office professional	

ANNEX IV

(Program of Study Tour)

Program

Date	Topics	Venue
12 June, Saturday	Arrival, transfer to hotel	
13 June, Sunday	Administrative matters, finalization of the program	
14 June, Monday	Discussion of standardization, studying the international standardization process	SAGE Ltd., Budapest
15 June, Tuesday	Quality assessment of IT products	SAGE Ltd., Budapest
16 June, Wednesday	Intellectual property issues, studying the WIPO activities esp. on software	SAGE Ltd., Budapest
17 June, Thursday	Testing, certification of electrical equipment	MEEI Ltd., Budapest
18 June, Friday	MSc and PhD education in information technology	University of Miskolc
19 June, Saturday	free program	
20 June, Sunday	free program	
21 June, Monday	Project discussion w/UNIDO Hungarian Natn'l Comm.	Ministry of Economy
	Industrial policy, industrial parks	Ministry of Economy
	The role and structure of professional organizations	H. Assoc. of IT comp.
	Visit of an SME in IT hardware distribution	HRP Hungary Ltd.
22 June, Tuesday	Project consultations	UNIDO, Vienna
23 June, Wednesday	RTD projects, funding, joint international RTD projects	OMFB, Budapest
	MSc and PhD education in electronics	Techn.Univ. of Bpest
24 June, Thursday	BSc education in telecommunication	Széchenyi Coll. Győr
	Hi-tech electronics industry, industrial park	Philips C. Ltd., Győr
25 June, Friday	Transfer to airport, departure	

ANNEX V

(Program of 2-day Seminar)

بِسْمِ اللهِ الرَّحْمٰنِ الرَّحِيمِ

No. 4(31)/99-BW
GOVERNMENT OF PAKISTAN
MINISTRY OF SCIENCE AND TECHNOLOGY

ISLAMABAD 27th Oct. 19 99.

Subject:- TWO DAYS SEMINAR ON ELECTRONICS INDUSTRY,
         IT INFRASTRUCTURE & STNADARDIZATION, R&D PROJECTS,
         POLICIES.

Dr. Tamas Markus, UNIDO's Consultant, Director SAGE Ltd,
Hungary is executing his Mission to Pakistan under UNIDO's assisted
project on "Advisory Assistance to the Government of Pakistan in
implementing the Electronics Policy".

2.   Dr. Tamas Markus will give overviews on the following
topics in the Auditorium of National Institute of Electronics,
located in Plot No.17, Sector H-9, Islamabad at 10.30 A.M:

(i)   , 3rd November, 1999

    10.30 A.M.

        -   Overview of Electronics Industry: Capabilities,
            Government Strategies in SE Asian Region.

        -   Information Infrastructure Policies:
            USA and Asian Countries.

        -   Discussions

    12.30 P.M.

        -   Lunch break

    1.45 P.M.

        -   The fifth framework R&D programme (1999-2003) of the EU.

        -   Discussions

(ii)   . 4th November, 1999.

10.30 A.M.

- Information Society Technologies of the fifth framework R&D Programme (1999-2003) of the EU.

- The recent status of international standardization in information technology and software engineering
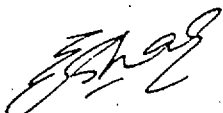
- Discussions.

12.30 P.M.

- Lunch break

1.45 P.M.

- Discussions.

- The EU standardization Direcitves and Harmorized Standdards'. Certification and testing.

3.   All the higher officials of relevant Ministries/Organizations have been invited to attend the event as per schedule mentioned in Para 2, above.

(Muhammad Ishaque)
Joint Electronics Adviser
Tele:9202684

9271589

- Mr. Abdul Rashid, JTA, MoST.
- Mr. Tariq-ur-Rehman, JSA(IL), MoST.
- Mr. Ayaz Hamid, JSA(P&C), MoST.
- Chairman, Pakistan Science Foundation, Islamabad.
- Chairman, Pakistan Council for S&T, Islamabad..
- Director General, NIST, Islamabad.
- Director General, PASTIC, Islamabad.
- Director R&D, NUST, Rawalpindi.
- Director, Board of Investment, Islamabad.
- Joint Secretary, Ministry of Communication, Islamabad.
- Mr. Anwar, Chief Research Officer, Ministry of Industries & Production, Islamabad.
- Joint Secretary, Ministry of Finance, Islamabad.
- Mr. Shahid, Director, National Tarriff Commission, Islamabad.
- Planning & Development Division, Islamabad.
- Director General, IIEE, PCSIR, Karachi.
- Chairman, Punjab Small Scale Industries Corporation, Lahore.

- President, Chamber of Commerce, Islamabad
- Member, Pakistan Telecommunication Authority, Islamabad.
- Chairman, University Grants Commission, Islamabad.
- Vice Chancellor, Quaid-e-Azam University, Islamabad.
- Mr. Bashir, Deputy Secretary, Ministry of Commerce, Islamabad.
- Mr. T.M. Qureshi, Asstt. Educational Adviser, Ministry of Education, Islamabad.
- Managing Director, Private Software Export Board, Islamabad.
- Ms Amy Robinsons, Consultant, UNIDO
- Director, Pakistan Standard Institution, Karachi.
- Director General, Pakistan Computer Bureau, Islamabad.
- President, Pakistan Software Houses Association, Lahore.
- Secretary, Computer Society of Pakistan, Karachi.

ANNEX VI

(Data Base Structure)

Structure of Data Base at Ministry of Science and Technology on the Electronics Industry of Pakistan

The project budget funded the purchase of a PC configuration with the necessary software packages in order to build up and to operate a data-base on the Pakistani electronics companies. The hardware and the MS software components were installed at the Ministry of Science and Technology in mid 1999. For the simplicity of implementation and operation process, an MS Access data-base software was selected.

The Contractor has developed a pilot design for the data base structure which was tested using MS Access software of the MoST PC environment, during the second mission of the international consultant. The identification of the electronics enterprises' major characteristic data was discussed with the National Counterpart and data selection was done in cooperation with the National Consultant. The final implementation, the uploading of the available company data, demonstration runs and the training of personnel to operate the system on the premises of Ministry of Science and Technology took place during the 3rd mission of the international consultant.

The data-base processes 19 company data as follows:

i)   Company name
ii)   City
iii)   Address
iv)   Phone
v)   Fax
vi)   E-mail
vii)   Contact person
viii)   Year of foundation
ix)   Revenue
x)   Owner (private, public)
xi)   Joint venture with (company's name)
xii)   Size (cottage, small, medium, large)
xiii)   Type (CM, ODM, OEM)
xiv)   Segment of electronics (parts and components, consumer, computer and peripherals, telecommunication, professional, supporting industries)
xv)   Products (list)
xvi)   Export market (list)
xvii)   TRIPS and TRIMS (list)
xviii) Certification (list)
xix)   No. of employees

The information needs of the National Counterpart justified 12 types of queries. Data search can be initiated by:

i)   Certification
ii)   Export market
iii)   Founded between (years)
iv)   Joint venture with
v)   Location (city)
vi)   Location (city) and certification
vii)   Location (city) and segment of electronics
viii)   Owner
ix)   Revenues between (revenues)
x)   Segment of electronics
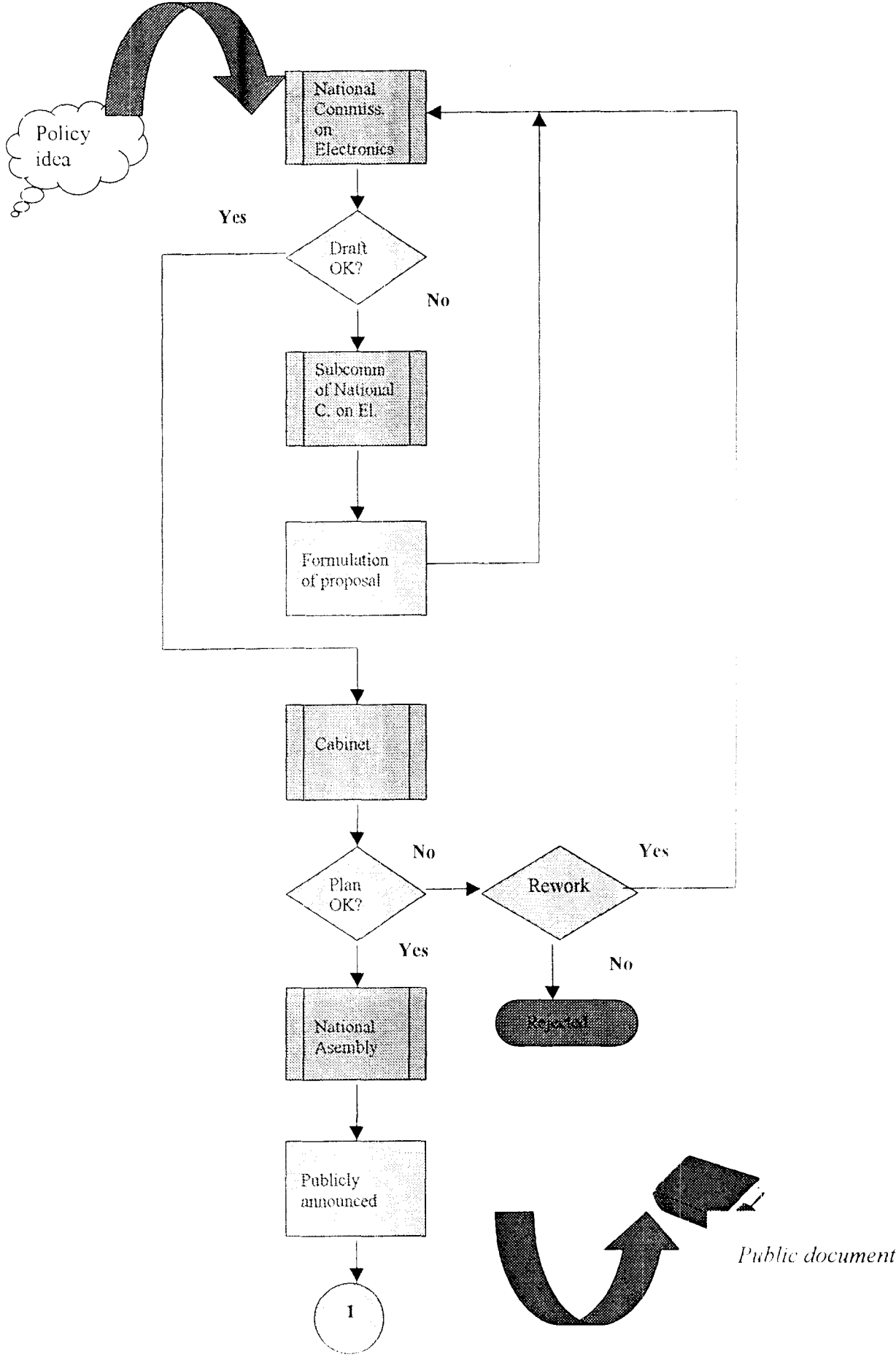xi)   Size
xii)   TRIPS and TRIMS

The data-base system includes queries and forms on screen (including an automated data input form), reports both on screen and in printed form. Demonstration runs with the available company data have proved the importance and benefits of the data base system.

However the reliable and immediate information retrieval and the efficient decision making of governmental bodies is depending on the up-to-date status of the available data. To fulfill this requirement, the National Counterpart is advised to work both on uploading new companies' data and on updating existing data on a permanent basis. The mechanism of this process could be an annual reporting request, that is sending the relevant data report form to companies and asking for modified data of any change. To realize the full benefits of the data-base this updating mechanism is of vital importance.

ANNEX VII

(Decision Mechanism Flowchart)

Decision Mechanism

Policy idea

National Commiss. on Electronics

Yes

Draft OK?

No

Subcomm of National C. on El.

Formulation of proposal

Cabinet

No   **Yes**

Plan OK?   Rework

Yes   **No**

National Asembly   Rejected

Publicly announced

1

Public document

```
                    ( 1 )
                      |
                      v
               +-------------+
               |    MoST     |
               +-------------+
                      |
                      v
               +-------------+
               | Ask for budget |
               |   provision   |
               +-------------+
                      |
                      v
               +-------------+
               | Division of |
               | Planning &  |
               | Developm.   |
               +-------------+
                      |
                      v          No
                    /  \    +------------+
                   / Budget \ ----> ( Try next year )
                   \  OK?  /             ^
                    \  /                 |
                     |  Yes              |
                     v                   |
               +-------------+           |
               |  Finance    |           |
               |  Division   |           |
               +-------------+           |
                      |                  |
                      v          No      |
                    /  \ ----------------+
                   / Money \
                   \ avail.?/
                    \  /
                     |  Yes
                     v
                 ( OK! )
```
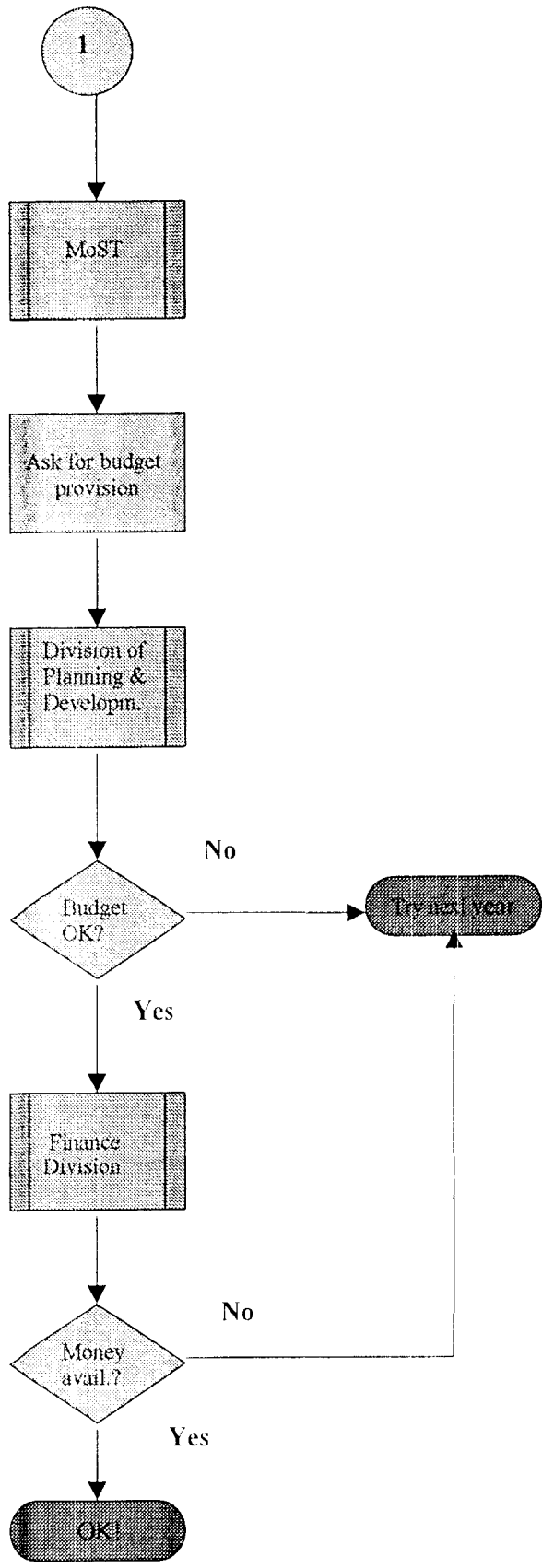
ANNEX VIII

(Proposal for the Establishment of a Software Quality and testing Unit)

Background information for justification

Over the past years Pakistan has met growing difficulties in its economical sector in achieving competitive positions and advantage in export markets. The basic reason behind this experience is the changing world market with emphasize on customers' requirements including the compliance with international standards especially with those of quality assessment and environmental management (ISO 9000 series and ISO 14000 series). The country has just started the first steps in introducing the major international standards, but the main barrier of this process is the lack of expertise and effective infrastructural background (coherent strategy for standardization, indigenous accreditation and certification bodies). An important step was completed by UNIDO in 1998/1999, preparing an assessment report on ISO 9000, ISO 14000 (and other international) standards in Pakistan. Instances of heavy losses of the Pakistani export were mentioned (textile industry, surgical instruments, fishery etc.), which directly originated from the neglect of international standards and directives.

In December 1999 the plan for the competitive reengineering of the Pakistani economy was made public. The planning was preceded by an analysis of the overall national resources and available manpower. One of the four priority fields, identified in the document, is information technology and software. Software industry in Pakistan has been considered for long the primary export product of the upcoming years. However the annual software export of the country is estimated between 20-25 million USD in 1998, lagging far behind the reference country, India which boasts with a software export figure of 1200 million USD. Estimates of Pakistani software professionals considered 200-250 million USD software export as a realistic target value for the early 2000 years with reserves to improve this annual output. Actions were initiated by the Pakistani government promoting software development, including the elaboration of an ambitious IT Policy, which is supposed to be public soon in 2000. In fact Pakistan has to face all the difficulties of the late comers on this market segment (Philippines' SW export is over 55 million USD and IT market in the developing countries of the region is high above this figure), and needs odds both in price and in quality.

In Pakistan about 230 companies have been active in software business, these software houses are located mainly in three main areas: Karachi (41%), Lahore and the region (30%) and Islamabad with Rawalpindi (26%). Due to information material on the services offered by the companies about 10% of these unit refers to some extent on software quality and software assessment methods, but these companies also suffer from the lack of exact technical information. The competitive appearance on the international market needs the ISO 9000 certificate as a minimum requirement, this tendency has begun to expand also on the software suppliers' market.

Bearing in mind that software services and products play key role in improving the nation's economy in Pakistan, the establishment of a Software Quality and Testing Unit is recommended.

Functions

The planned unit has multiple functions:

- Consultancy in the special preparatory work needed for companies developing software products (or giving software services) to obtain ISO 9000 certification
- National focal point for 'processing' international software standards giving technical guidance for the official national standardization member body (Pakistan Standards Institution or Pakistan Standards and Quality Control Authority)
- National focal point for developing software evaluation procedures based on the international standards
- Training programs for software house personnel and university faculty members in the technical context of international standardization on software quality, assessment, performance
- Feeding public awareness for governmental and private organizations, companies on the importance of the international software process and evaluation standards in market competitiveness and national export

The main activities of the unit involve the testing of conformance and compliance with existing international software standards. The issuance of specific software certification, in line with international procedures existing on this field, could be a future goal. The unit itself does not issue ISO 9000 certificates <u>but serves as an extension to the national ISO 9000 certification infrastructure when software development process and services are involved.</u>

The unit could be located in Islamabad and when it is fully operational opening local branches in the other main software industry areas (Karachi and Lahore) is recommended.

Draft budget calculation

The unit is planned to operate with 16 IT professional (MSc and BSc degrees). The operational cost of Year 1 and 2 is planned to be covered by the Pakistani government. From Year 3 the unit is self-sustaining on market contracts.

Pak Rs 12,268,000.- (USD 236,000 equivalent) Government input
USD 392,000.-   input from international donors

Details:

Hardware and software	130,000.- USD
International Consultants (14 m/m, 12,000.-USD/m)	168,000.-USD
National Consultants (11m/m, 2,000.- USD/m)	22,000.- USD
Fellowship training (12 m/m, 6,000.- USD/m)	72,000.- USD
	392,000.- USD

16 professional people, average 20,000.-Rs/m, 24 months	7,680,000.-Rs
4 administrative staff people, 8,000.- Rs/m, 24 months	768,000.-Rs
Furniture, supplies, overhead etc.	3,820,000.-Rs
	12,268,000.-Rs