III. 5 Needs From Industrial Structural Shifts

III.5.1 Three Structural Shifts

(1) Definition of High Tech

In the discussion of industrial policy in High-Tech industrial park, it is imperative to define "High Tech".

In general the products that require a large proportion of R & D activities and as a consequence are renewed constantly are called "High-Tech" products. It is not realistic for Malaysian industries to jump to integrated manufacturing activities of these High-Tech products. What is important as an industrial policy is what is more High-Tech than conventional manufacturing activities in Malaysia. There are two aspects in High Tech as follows;

1) High Tech as product,
2) High Tech as process.

High-tech products are the products themselves that undergo model changes and product obsolescence as a consequence of continuous technological development. The newer the product is, usually the higher is the profit margin. The need to improve production processes determine the level of profitability at the infant stage of product cycle since the process itself is immature and shows a high defect rate. In other words, it requires both product development and process development capabilities to bring into life High-Tech products.

Often the production is based on the premise of the existence of high-quality infrastructures and availability of supporting industries.

High-Tech process refers to the upstream manufacturing activities in manufacturing processes which include product development, product design, and process development.

In the analysis below we differentiate the move toward High-Tech product as **High-Tech Product Shift** and the one toward High-Tech process as **R & D Shift.**

The mandate of the KHTP is to play a leading role in transforming the Malaysian economy to a higher value-added production economy. The shift toward High-Tech products and shift toward High-Tech process both serve this end. The KHTP should accept factories that fulfill either criteria for investment and the Techno Centre should serve the manufacturers of both categories.

Product development and process engineering

Product development and process design are closely related issues. Product design often affects the ease of production, thereby affecting overall production costs. In turn process engineering defines the productivity of the product, thereby the profitability of the operation. This relationship between product and process engineering implies that the knowledge of process technologies is essential for product development. An entrepreneur may be able to start a manufacturing business without any original product development know-how, but not without process engineering. It is a natural progression in industrial development to acquire process engineering first, then move on to product development.

In many cases process engineering is the source of profit generation. At the infant stage of a product cycle, common characteristics in production are low recovery and high defect rates. The refinement and improvement in processes will bring a large profit to the production. In mass production, cost reducing technologies can bring profits of a large scale. It is a well-known fact that Japanese manufacturing sector penetrated into the world market with innovations in process engineering, such as zero-defect, just-in-time, and kanban system. Much of value was accrued in this process designing know-how. Currently, the selection of investment projects in KHTP is based on the level of R & D. It is necessary to expand the notion of R & D so as to encourage this type of manufacturing activities. The first step in **R & D Shift** is to move from simple assembly work to the inclusion of process engineering.

Emerging Trends

The manufacturing sector in the Northern Region have shown a tremendous growth in the last 5 years. A new surge of foreign investment into the area has tripled the installed investment base. Local entrepreneurs in High-Tech products are emerging. On the other hand, the rising costs in production, especially in wages, has caused existing companies to reexamine their production set-ups. Our survey revealed that the manufacturing sector in the northern region is undergoing transformation in three directions. High Tech Shift, R & D Shift, and Social & Environmental Shift. High Tech Shift represents a move by established firms to a higher value-added product in assembly work. R & D Shift is observed in local manufacturing sector to move up in manufacturing processes to include more product development and design work in Malaysia. These two moves are taking place separately and require different public support in promotion. EU's new industrial standards and stricter pollution control in Malaysia are posing new technical requirements for Malaysian manufacturers. The Techno Centre should respond with technical support along these three dimensions.

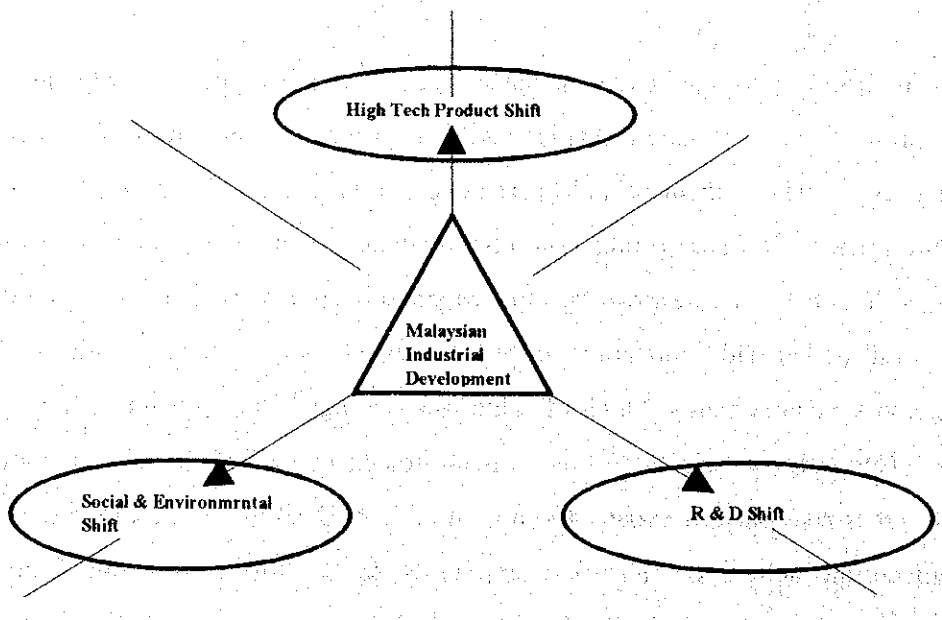

Figure III.5.1 Three Shifts for Industrial Development

(2) High-Tech Product Shift

One direction is a shift to higher value-added products. Rising costs in production are pushing out low value-added products to other labor abundant developing countries and converting the current set-ups in Malaysia into higher value-added product manufacturing. Sony's floppy disk drive factory, the center for world wide production is gradually shifting its production to CD-ROM drive manufacturing. Many other companies are considering a similar shift to higher value-added products. These items include optical products to electronic devices. However, shifts to higher value-added products do not directly mean a change in production processes that Malaysian factories conduct. The factories conduct assembly work even though the products may be changed. The higher up the technology ladder the product is, the need for conducting product innovations and development in the region where the technologies are emerging. A local company which ventured into personal computer motherboard manufacturing in 1992 and have risen to prominence with an annual turn-over of RM 300 million in two years holds an R & D centre in the US. No other media has replaced personal networks in access to rapidly developing technologies, even in the information age.

Nothing is more important for high-tech enterprises than access to areas where advanced technology is concentrated. Access becomes available through human networks. The basis of manufacturing in Malaysia was established by foreign investment; the country's industrialization began with assembly, relying on overseas technologies and production facilities that made use of such technologies. Although manufacturing led to component production, and Malaysia's manufacturing system was enhanced in the production cycle, upstream processes, software such as product development and development/innovation of the production process itself, was never transferred from the advanced industrial countries. The High-Tech shift taking place in Malaysia is that of the shift to high value-added products. Assembly of high value-added products requires more highly advanced product management systems, quality control, machinery maintenance, and distribution management, as well as stable and high quality infrastructure. However, a shift to high value-added products does not necessarily mean an advancement of true R & D activities. Production process descends vertically, dividing itself into operations in the north and

those in the south. Accordingly, a High-Tech shift in this country does not include product development or development/innovation of the production process.

(3) R & D Shift-Industrial Deepening

Move toward more integrated manufacturing system in Malaysia, i.e., expansion into more local R & D oriented activities, is taking place in standardized products especially in the products which have local customers. This is a phenomenon called industrial deepening.

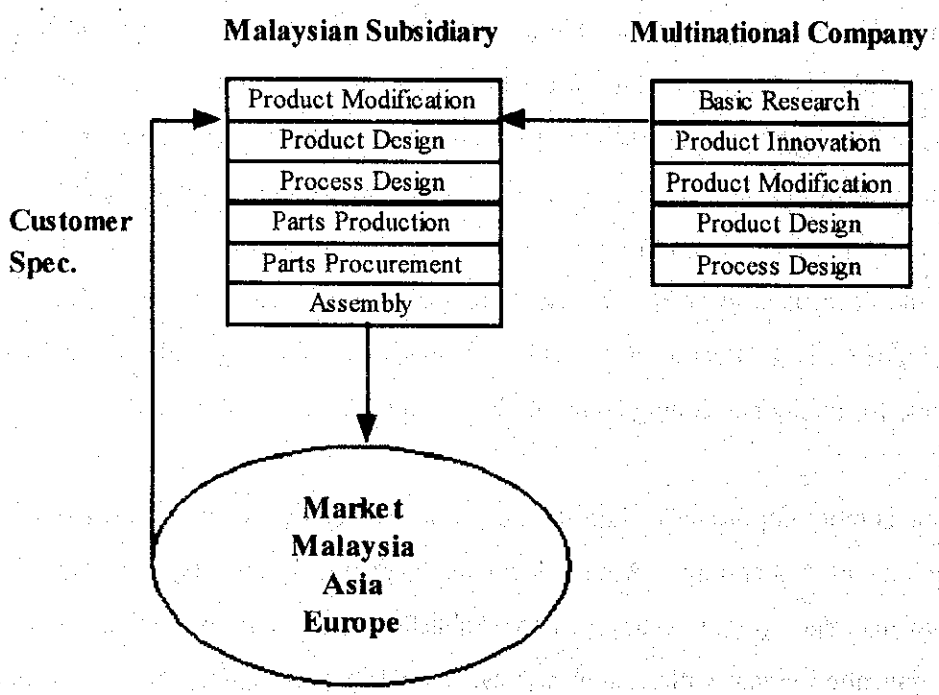

Figure III.5.2 Shift Toward R & D

In modern world market, matured products also need technical innovations. The need comes from fierce cost cutting competition and adaptations to customer preferences. Continuous efforts are made to reduce the number of components, shift to cheaper materials and streamlining of production lines and automation. As we see in most electrical products, these cost reduction brings prices down eventually. A price drop prompts firms to undertake further cost reductions. At present the majority of foreign joint ventures still conduct R & D in their home countries. Changes in products imply changes in production lines. The operation of product development and actual

processes impairs communication in layout change, installation of new equipment and re-training of workers. Cost-cutting pressure is now causing firms to consider the relocation of their process engineering and R & D functions to Malaysian factories.

The move is already taking place with standard products, which requires heavy interactions with local customers. Material handling equipment manufacturers such as conveyors and pneumatic control conduct most of their product development and parts production in Malaysia. An ultrasonic industrial washing machine maker that we surveyed develops electronic, mechanical designs control mechanism, and software though they contend that there is no major product innovations, but only product modifications to meet varying degrees of customer's requirements. Electronic components manufactures, especially the makers of transformers and converters, are expanding their product development capacity to improve communication with their clients and shorten delivery time. The Malaysian Government has pushed such localization with her industrial policies. At the same time it is true that the firms find it economically rational and technically feasible in Malaysia to conduct product design.

Fig.III.5.3 shows a general production cycle and industrial linkages. In Malaysia while manufacturing has expanded from assembly work to parts production, capital equipment manufacturing such as conveyor systems and jig production have developed. The development of capital equipment industry now is assisting the development of R & D activities and process design activities in Malaysia. As these upstream activities expand, the needs for die and mold and prototype production are expected to increase. The development of these supporting industries will constitute a base for further industrial deepening of promoting capital machinery industry as a move toward integrated manufacturing economy.

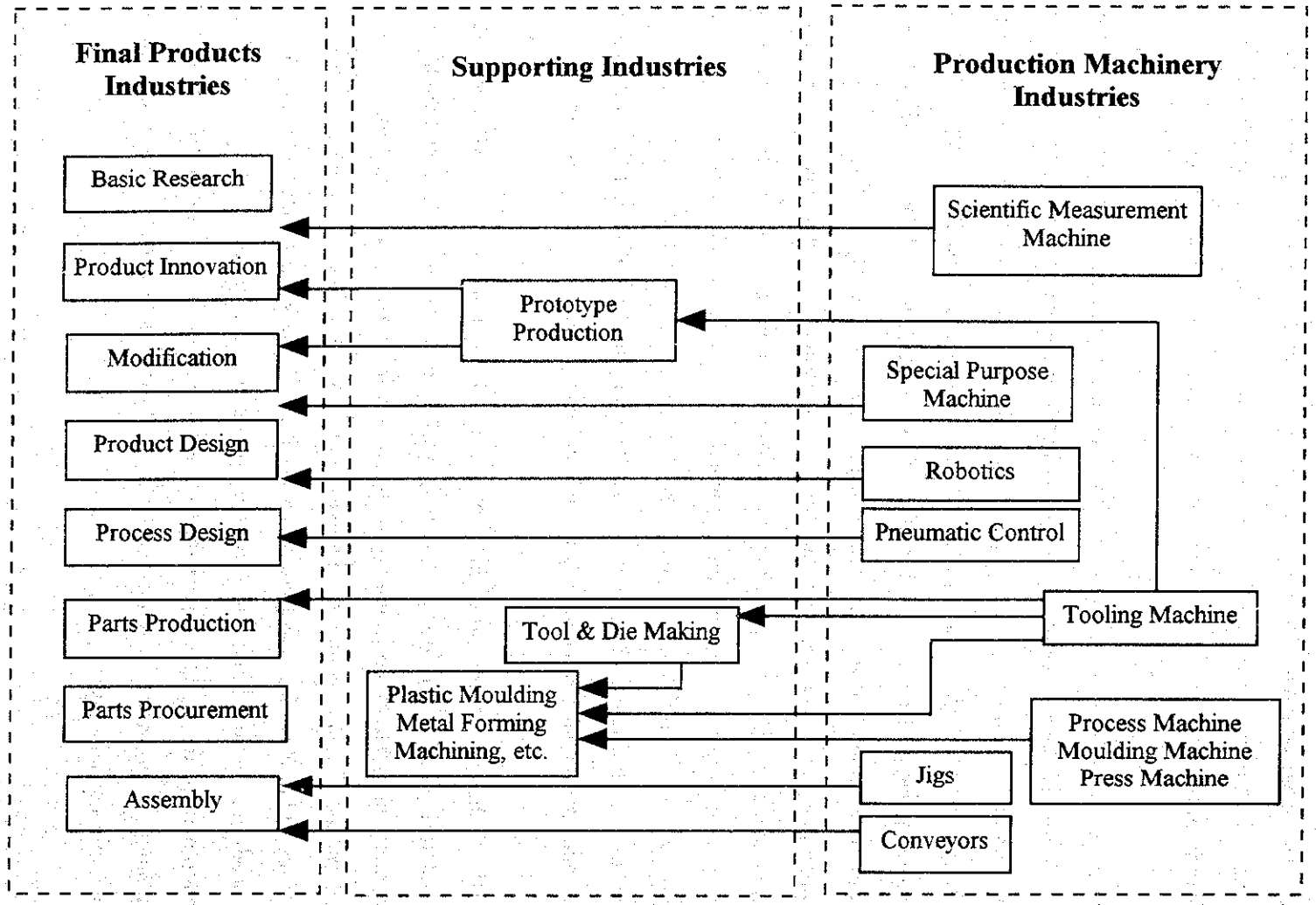

Figure III.5.3 Production Cycle and Malaysian Industrial Development

(4) High Tech vs. R & D

The factor that is precipitating the trends above is the appreciation of the yen in Japan. A sudden rise in yen-dollar exchange rate in 1985 has caused a fundamental change in international production system in Asia-Pacific region. Recent yen appreciation beyond 100 yen to the dollar is compelling Japanese managers to undergo another fundamental change in production location policies. Many firms voiced a total shift of production capacity to Asia is necessary.

Although Malaysia needs to pursue a shift to more R & D activities in High-Tech products, the current trends indicate that a shift toward more high tech and a shift toward more R & D are taking place separately. A shift toward more High Tech is a trajectory that is pursued by large multinational corporations in Malaysia while a shift toward more R & D involves more locally grown enterprises. This has some bearing on KHTP in its selection of High-Tech firms. It is easily foreseen that the fulfillment of high tech products and a large R & D expenditure as a requirement may be too stringent condition to fulfill since the supporting industries and capital equipment industries are not mature enough to support R & D activities for High-Tech products. It is recommended that two different standards should be applied to High-Tech products and R & D centred processes.

(5) Environmental and Social Shift

EU Industrial Standards

One social change that is impacting the manufactures, especially in the electronics industry, is new standards are being implemented in the European Union. As agreed upon in 1993 in EU, all products will be required to bear CE marks when distributed within EU. CE marking requirements correspond to stricter accountability demanded on producers under the notion of product liability.

One of the statutory requirements that has widest impact on manufacturers is Directive 93/336 which defines the certification of electromagnetic neutrality of products. The products have to be tested to verify that they do not interfere with the performance of

other equipment. The products that are subject to the requirement cover a wide range of electrical and electronic products, such as telecommunication equipment, home electronic appliances, light and lamps, TV and radio equipment, industrial production equipment, information processing equipment, aeronautical and naval equipment, and educational electronic equipment.

The testing of electromagnetic interference requires an electromagnetic shield room which is most likely beyond the capacity of private firms. If testing services are provided locally, the region is likely to enhance its competitive advantage as a manufacturing base in electronics.

Environmental Control

The Malaysia Department of Environment enforces strict environmental control, often stricter than that carried out in either the U.S. or Japan. On the other hand, local capabilities in monitoring, hazardous waste treatment, and neutralization are lacking. KHTP provides a waste depot which offers collective means to treat wastes. As the demand for environmental protection is expected to heighten, technical support in the area of monitoring and treatment of industrial effluent and waste are bound to become significant both technologically and economically.

III.5.2 High-Tech Industries in Northern Region of Malaysia

The most difficult task in our study is to determine the target industries of the Techno-Centre. There are no firms operating in the KHTP, therefore it is difficult to decide what future industries may locate in the region. However, it is necessary to focus on selected industries to determine the specific services and facilities of the Techno Centre.

On the other hand, the Techno Centre serves not only the firms in the KHTP but also High-Tech firms in Malaysia and Southeast Asia to maintain high levels of technical capabilities. Therefore, our study focused on emerging High-Tech industries in the surrounding areas to determine the needs for R & D support services.

In the Northern Region, a wide range of electric and electronic industries always constituted a large proportion of the manufacturing sector. The semiconductor industry has been representative of so called high-tech industry within the electronics industry. The firms located in this region represent world top class firms in the semiconductor business. Those are Intel, Hitachi, AMD, National Semiconductor, and Motorola to name five. Since 1990 the hard disk drive industry has emerged in this region, making the region a centre of electronic high-tech manufacturing.

(1) Semiconductor and Hard Disk Industry

Semiconductor Industry

The manufacturing processes of semiconductors are classified into two parts in general. The first part is called wafer production where the wafer is sliced from a single critical, etched with layouts, and implanted with impurities. The finishing process is to separate each circuit from the wafer, bond it with gold wires, and seal it in a package. All of the factories located in Malaysia undertake the finishing processes of semiconductor manufacturing. After the circuit is completed on wafers, the finished wafers are brought to Malaysia for bonding and packaging.

All semiconductor firms are expanding their operations in Malaysia, among which the leading investor is Intel. Intel invested over RM 1 billion between 1990 and 1993. There are indications for upward integration in the manufacturing processes of semiconductors. Wafer production requires stringent precision process control under super-clean environment with a very stable power supply and an abundant water supply. The KHTP can meet these demanding qualifications as a site for wafer production. Several investors have approached KTPC, and negotiations are underway. One of the existing firms surveyed mentioned the possibility of integrating wafer fabrication processes as well.

Hard Disk Industry

Along with the semiconductor industries, another high-tech product industry has emerged in Malaysia. That is the hard disk drive industry in Penang. Together with the final assemblers such as Conner, Quantam, and Hewllet Packard, there are hordes of

hard disk components producers such as a thin film head makers of Read/Rite, Applied Magnetics, Seagate, a disk producer of Komag, and an aluminum substrate producer of Kobe Steel. There also are local entrepreneurs that have grown in this industry. Engineering Technologies and Cam Precision produces hard disk casings and head assembly mountings. Penang shares 12% of worldwide production of hard disk drives of estimated 80 million production in 1995. Conner was the largest investor in Penang in the first half of the 1990s, spending over RM 1 billion in its expansion. Regional production system of hard disk drives goes beyond national boundaries. Still, Singapore is the centre of the Asian manufacturing base. It accounts for more than 30% of total world production. Hard disk drive components manufacturers such as Seagate and Read/Rite do not necessarily supply to local hard disk drive makers. They export to Singapore or Thailand for final assembly. On the other hand, local producers of hard disk drives procure their components from overseas, Singapore, U.S. and China.

(2) Technical Requirements

Technical Requirements in Semiconductor Industry

Wafer fabrication is far more demanding than the finishing processes in light of technical requirements. Wafer fabrication requires class 10 level* clean room for the operation to keep the wafer free from contamination and a large amount of purified water for washing products in progress. To maintain the extreme level of clarity, the equipment, operations, monitoring, testing, and infrastructure have to meet stringent quality requirements. Interruption in electricity means a loss of all the work in progress which amounts to one-month stock. It takes a few days to achieve the required level of cleanliness in the clean room. Water has to be purified and de-ionized before use. Monitoring requires PPB to PPT level of accuracy in comparison to ordinary PPM level analysis**.

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* Class indicates a number of particles larger than 0.5 micron that exist within one cubic inch per cubic foot.

** PPB represents Parts Per Billion, and PPT, Parts Per Trillion while PPM is Parts Per Million, all of which indicate density of dissolved elements.

Since operations in Malaysia concentrate on the finishing processes at the moment, the technical requirements remains not as severe as demanded by wafer fabrication. When Malaysian operations move into a fully integrated manufacturing of semiconductors, more stringent technical requirements will have to be met. The technological trends in the computer industry are to achieve faster speed in processes and larger capacities in information storage. Such trends can be made feasible only through further micronized processes. The processes are advancing from micron to nano-technologies. In such minute processes the purity in both materials and environment has become the prerequisite in production. The air requirement increases from class 5000 to class 10, the water requirement increases from PPM to PPT.

Since manufacturing processes are limited in Malaysia, analysis and testing needs in semiconductor industry is limited compared to the hard disk drive industry at the moment.

Technical requirements in hard disk industry

Hard disk is one of high-tech device that is characterized by constant innovations. Recently it is said that every 9 months a new generation of higher performance products is introduced into the market. The product relies on high precision technologies in every process of machining, plating, and assembly. The main products are processed in a Class 100 level clean room since even slight contamination could lead to product failure. The components must be cleaned to remove contamination, so the industry at every level uses a large quantity of water. The washing water has to be purified and the chemicals have to maintain a high grade of consistency. The analysis and testing for incoming materials and for product assurance are common requirements in this industry.

(3) Specific Testing Requirements

Fig.III.5.4 shows the schematic quality control requirements in semiconductor industry and hard disk drive industry. In general, any input has to be checked before the process, and any output has to be checked after the process. Since production comprises different process, at each process these testing and analysis needs exist. Therefore the testing and analysis volume is dependent not only on the final output but also on the

number of vertical links. The current testing and analysis needs come largely from hard disk drive industry. Our analysis will focus on the needs from hard disk drive industry with some reference to the future wafer fabrication needs.

Surface Analysis

Surface Analysis is needed to detect contamination and failures on the surface of the components. Direct analysis of the components are conducted for this purpose. Scanning Electron Microscope (SEM) and Energy Dispersive X-ray (EDX) are commonly used to detect contamination on element base. EDX can qualify as well as quantify contamination. As density becomes higher, the analysis requirements have increased to a submicron level. Wave Dispersive X-ray analyzer (WDX) and Electron Spectroscopy (ESCA) are new generation measurement machines. For organic contamination detection, Fourier Transform Infrared Spectrophotometer (FTIR) equipped with a good microscope is used. ATR-Cell is needed to prepare the samples for FTIR.

Because hard disk head flies over the disk at a small interval, the disk has to achieve flatness and the head has to have a aerodynamic feature to avoid collisions. As a part of innovation to increase memory density, the flying height of hard disk head becomes lower and lower. The next generation MR head is to maintain the gap of 0.3 micro inch. Scanning Probe Microscope or Scanning Tunneling Microscope is used to analyze the three dimensional character of these hard disk components. In Malaysia there are few institutes that are equipped with other than Scanning Electron Microscope.

Ionic Contamination

The heads of hard disks are very sensitive to corrosion. Wafer has to be clear of any ion to avoid short-circuit. Therefore, the water used in the manufacturing processes has to be free from ionic contamination. Compounds such as nitrite, chlorite, sulfite, and bromide have to be less than 0.5 ppb in the purified water. Ion chromatography is the equipment to measure ion contamination. Dionex is the only known maker that can supply the equipment that can measure above ppb level contamination.

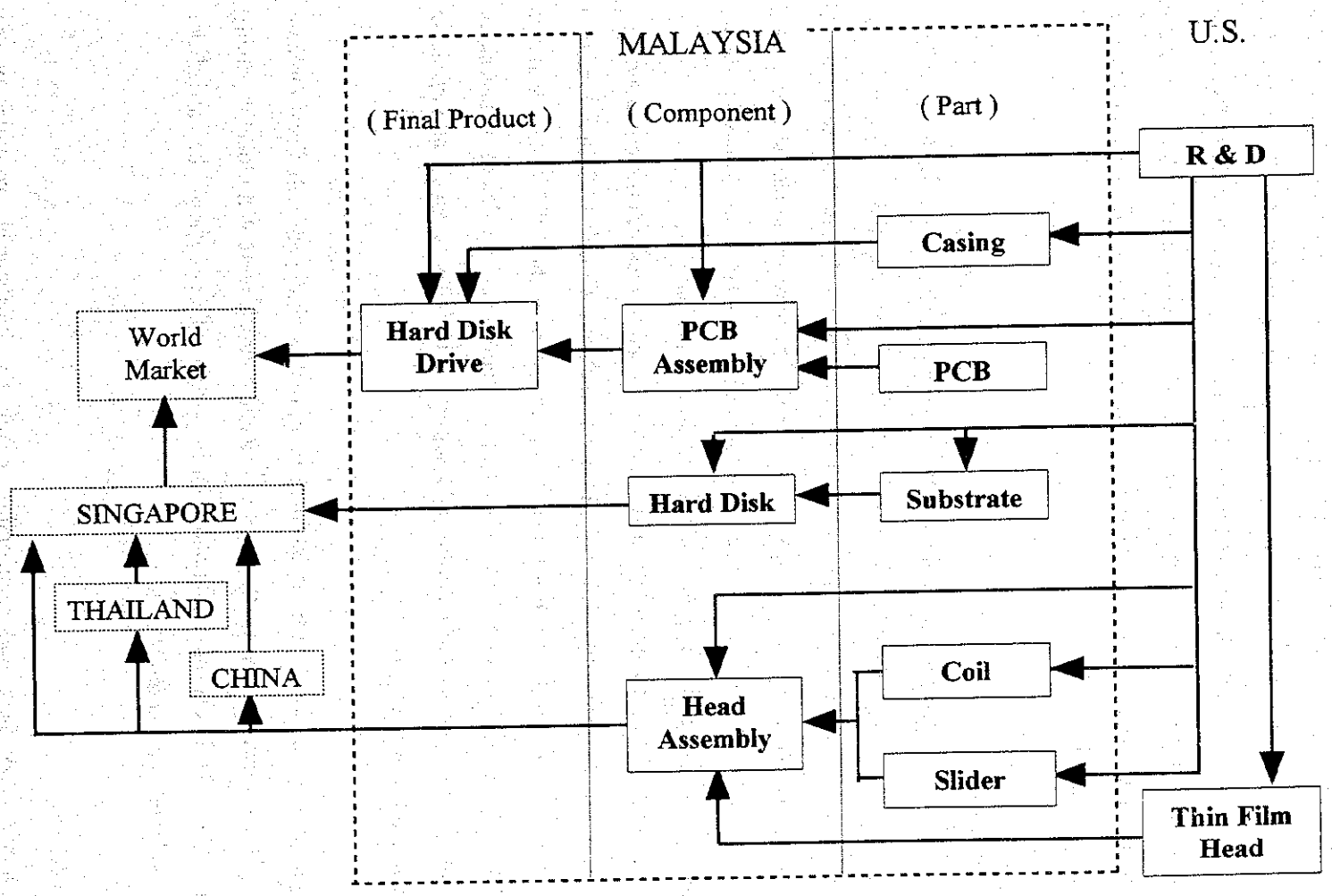

Figure III.5.4 Hard Disk Industry in Penang

Material and Chemical Analysis

When it is necessary to conduct identification of elements, local labs that have gas chromatography can provide such services . However, local labs are not equipped with Gas Chromatography Mass Spectrometer, or Atomic Absorption Spectrometer. Printed Circuit Boards (PCB) are the bases for circuit designs for most electronic devices. For sensitive devices the PCBs have to be tested in many aspects. For wafer fabrication, aluminum vapor deposition is used for the circuits. X-ray Fluorescence Spectrometer is used to test the thickness of the plantings. Currently most of these tests must be conducted in Singapore.

Water Analysis

In the hard disk industry every components including casings have to be free from contamination. A large quantity of purified water is used for cleaning. Komag, a disk producer, alone consumes 250 tons of purified water per day. The purified water has to be de-ionized before its use in washing process. Komag recovers metals, alumna, nickel and zinc from waste water to meet environmental standards in Malaysia before discharging. They claim to recover 2 drums of alumina per day.

Atomic Absorption Spectro-photometer is commonly used to measure the contaminating elements in water. Recently, new equipment, Inductively Coupled Plasma Emission Spectrometer, is often used to measure elements in water at the PPT level. Water is inspected at an interval of one month on 10 to 12 items such as calcium, magnesium, aluminum, ferrous, potassium, chloride, and sulfuric acid. The analysis at PPB level costs RM 200 for each element.

Although there is one local certified lab in Penang that is equipped with Total Organic Carbon (TOC) Meter to measure the level of organic content, there is no local capability to measure of volatile organic materials. An inspection of TOC should be carried out once a week and costs about RM 200.

Mechanical Test

For both hard disk drive and semiconductor industry, mechanical properties of the materials such as flatness and hardness are important factors in quality control.

Mechanical testing for the components needs to cope with the small size components. Dynamic micro hardness tester is one example of equipment typically needed for the hard disk industry.

Electrical Testing

So called performance tests and failure analysis are conducted mostly in-house in large establishments; external services are rarely used. There is a large demand for calibration of measurement and monitoring equipment. The engineers interviewed contend that the large backlog in calibration and insufficient quality in service are incurring unnecessary expenses in their operations. Sometimes firms own extra equipment to cover the absence of equipment during calibration.

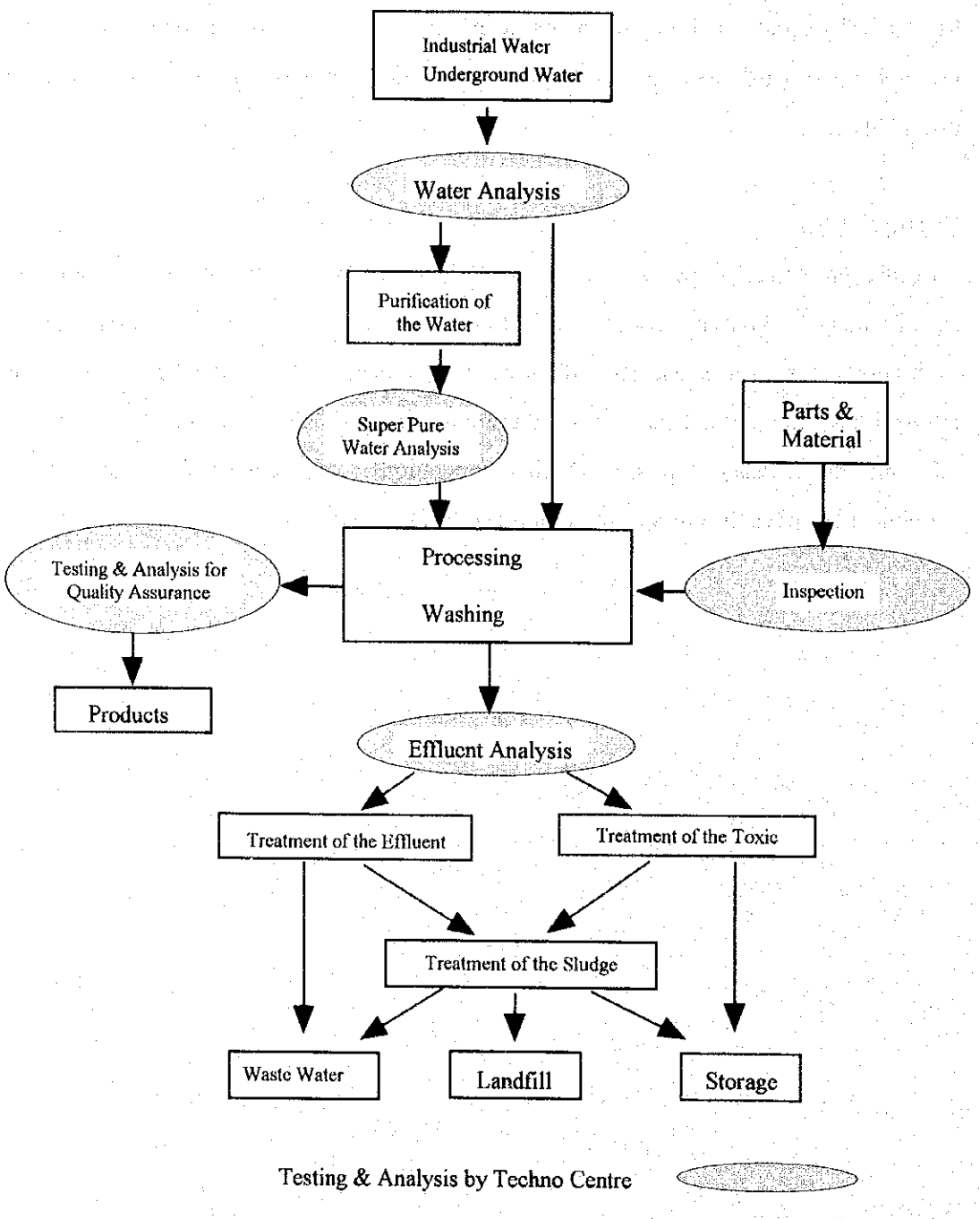

Figure III.5.5 Manufacturing and Testing/Analysis

III.5.3 High-Tech Industries and Environmental Management

(1) Necessity of High Tech in Environment Conservation and Management Fields as well as in Industrial Fields

High Tech for production of High-Tech products often uses various substances, for example rare metals, rare earth and, organic solvents, many of which are hazardous. For example, many organic solvents are used in the field of semiconductor manufacturing, and in the past, CFCs which are said to deplete the ozone layer were used in large quantities. Substances such as trichloroethylene were used in large quantities to remove grease from metal machinery and tool parts because they were effective. Time after time, the management and treatment of substances (intermediate and final substances) being produced as a result of the pursuit of efficient producing and value-adding by industry caused ground water pollution as a result of slipshod treatment and management structures. The example of Silicon Valley in the U.S. is famous. High Tech on the one hand invigorates production activities and supplies convenient new products, but on the other hand brings the possibility of destroying the natural environment. The other side of the promotion of High Tech industries is that high-tech for preserving and managing the natural environment is also necessary.

(2) High Tech in Environment Conservation And Management Fields

Technological innovation has improved not only production technology but also the technologies of product testing and measurement, etc. For example, ultra-pure water which is used for semiconductor production requires a high level of technology in its production process, and the development of high-precision instruments for inspecting and measuring purity is also making progress. Technology for automating the monitoring of the environment has been introduced, and systems that are capable of collecting reliable data over a long period of time are in place.

Research is also proceeding into the elimination and substitution of substances as represented by CFCs which destroy the global environment in the production process and whose management and treatment poses problems.

(3) Necessity of Establishing of Treatment on and Disposal Systems for Hazardous Waste

Normally, hazardous wastes are treated and disposed of by specialist treatment businesses, but in Malaysia, these businesses have not been fostered, so currently, many enterprises have stored and managed them on the factory site. The problem of the treatment of hazardous waste is often indicated as a major problem even in interview surveys. The treatment and disposal of hazardous waste overseas is regulated by the Basel Convention*), and as a rule, treatment and disposal systems must be established in the home country. The promotion of research and development into the treatment of hazardous waste and the establishment of treatment and disposal systems are also major incentives for the attraction of foreign enterprises.

(4) Trends in International Standardization of Environmental Management (ISO14000****)

The response to environment conservation and management has moved away from a response based on technological innovation to the regulation of movement of hazardous waste across boundaries. Today, it is developing in the direction of introducing standardization in environmental conservation management in business activities.

Currently, the work of establishing international environmental standards is progressing. The details involve the systematic management and measurement of the environmental activities of enterprises and their transmission to the outside. This standard is ISO14000, and it is commonly called the Environment ISO.

Taking the opportunity of the April 1992 enactment of the BS7750**) (Environmental Management System) national standard which started in the U.K., this standard spread to the EU, and on 10th April 1994, the EU regulation/EMAS***) (Eco-Management and Audit Scheme) came into operation. Making its standard similar to these developments, the ISO started establishing its standard on EMAS in June 1993.

This standard will affect product design, methods of manufacturing, and selecting of raw materials and also will influence ways of collecting and publishing environmental data. For enterprises that provide services such as manufacturing and selling products overseas, failure to observe this newly enacted standard may result in severe trading difficulties. Further, to all intents and purposes, it will become a domestic standard, and is predicted to affect even enterprises that do not engage in overseas trading or in business overseas.

The details of this standard, in other words ISO14000, are currently undergoing specific investigations and, in September 1994, a first committee draft was produced on Eco-Management Systems. In October 1994, a second committee draft was produced on eco audit. If all goes well, the international standard is expected to come into force in April 1996 in eco-management systems and eco-audit.

Therefore, as many enterprises have adopted the ISO9000 series, their response to ISO14000 must be investigated in Malaysia too from the current stage. At the same time, the study and training systems accommodating this standardization must be constructed as soon as possible.

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* Basel Convention

Under the Convention on Unlawful Transboundary Movement of Waste Material and Its Treatment (commonly called the Basel Convention) which was adopted by the United Nations in March 1989, waste materials in 47 categories that should be regulated are cited as waste materials that are highly dangerous to safety. The convention targets waste materials of the types in the 47 categories, but the standard for determining that a waste material is noxious or dangerous depends on whether it exhibits the qualities indicated in the list of noxious characteristics (expressiveness, combustibility, acidity, corrosiveness, toxicity etc.).

Therefore, when considering a response to the Basel Convention, it is essential to understand the conditions of occurrence of the 47 categories of waste material and details of its dangerousness, harmlessness, or the method of collecting and reusing the waste material.

Annex I Categories of wastes to be controlled

Waste Streams

Y 1 Clinical Wastes from medical care in hospitals, medical centers and clinics
Y 2 Wastes from the production and preparation of pharmaceutical products
Y 3 Wastes pharmaceuticals, drugs and medicines
Y 4 Wastes from the production, formulation and use of biocidies and phytopharmaceuticals
Y 5 Wastes from the manufacture, formulation and use of wood preserving chemicals
Y 6 Wastes from the production, formulation and use of organic solvents
Y 7 Wastes from heat treatment and tempering operations containing cyanides
Y 8 Wastes mineral oils unfit for their originally intended use
Y 9 Wastes oils/water, hydrocarbons/water mixtures, emulsions
Y10 Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polychlorinated biphenyls (PBBs)
Y11 Waste tarry residues arising from refining, distillation and any pyrolytic treatment
Y12 Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish
Y13 Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives
Y14 Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on and/or the environments are not known
Y15 Wastes of an explosive nature not subject to other legislation
Y16 Wastes from production, formulation and use of photographic chemicals and processing materials
Y17 Wastes resulting from surface treatment of metals and plastics
Y18 Residues arising from industrial waste disposal operations

Wastes having as constituents:

Y19 Metal carbonyls
Y20 Beryllfum; beryllium compounds
Y21 Hexavalent chromium compounds
Y22 Copper compounds

Y23 Zinc compounds
Y24 Arsenic; arsenic compounds
Y25 Selenium; selenium compounds
Y26 Cadmium; cadmium compounds
Y27 Antimony; antimony compounds
Y28 Tellurium; tellurium compounds
Y29 Mercury; mercury compounds
Y30 Thallium; thallium compounds
Y31 Lead; lead compounds
Y32 Inorganic fluorine compounds excluding calcium fluoride
Y33 Inorganic cyanides
Y34 Acidic solutions or acids in solid from
Y35 Basic solutions or bases in solid from
Y36 Asbestos (dust and fibres)
Y37 Organic phosphorous compounds
Y38 Organic cyanides
Y39 Phenols; phenol compounds including chlorophenols
Y40 Ethers
Y41 Halogenated organic solvents
Y42 Organic solvents excluding halogenated solvents
Y43 Any congener of polychlorinated dibenzo-furan
Y44 Any congener of polychlorinated dibenzo-p-dioxin
Y45 Organohalogen compounds other than substances referred to in this Annex (eg. Y39, Y41, Y42, Y43, Y44).

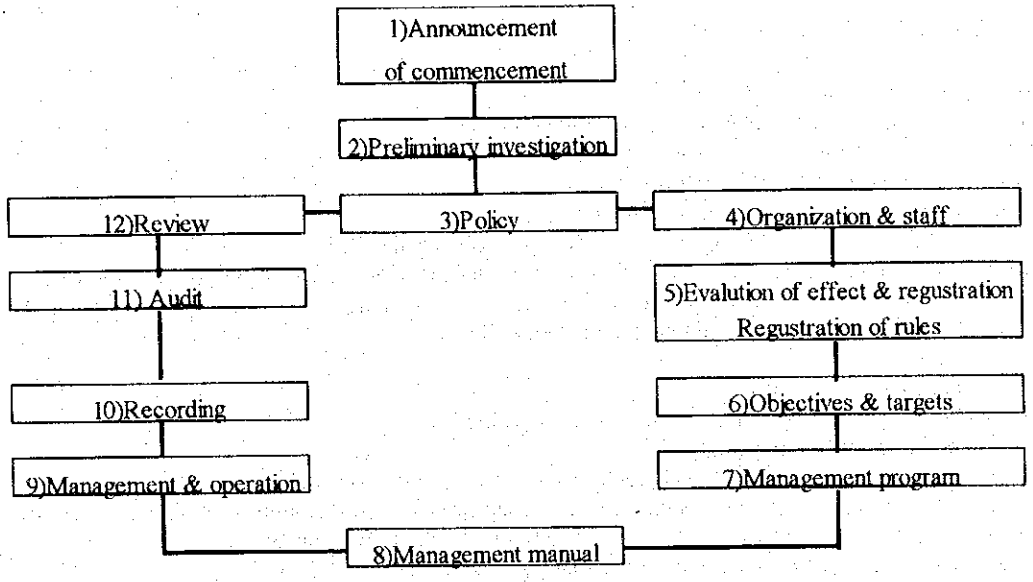
Annex II Categories of wastes requiring special consideration

Y46 Wastes collected from households
Y47 Residues arising from the incineration of household wastes

**) Outline of BS7750

In the U.K., BS7750, which is the standard concerned with an environmental management system that can be applied to all industrial categories including even distribution and service industries, came into operation in March 1992. After a one-year pilot program, in January 1994, a revised proposal was submitted. This BS7750 is the same as BS5750 which is the standard concerned with quality control systems in that it is an embodiment of the PDCA (Plan, Do, Check, Understanding and Action) of business management theory, and the environment audit is incorporated as its check function.
The background to the U.K. carried out this system was the need by enterprises to deal positively and to prove that they are dealing positively with the environment in response to growing pressure from many interested parties (such as employees, customers, local residents, environmental groups, shareholders, and the regulatory authorities). Points such as the success of the quality control system standard BS5750, the success of the ISO9000 series based on BS5750, and the fact that it supplements the environment management system of the EU standard draft may be cited. Currently, the approval institutions of this standard have been established in the U.K., the Netherlands, Denmark, etc., and a number of certification institutions have been approved. There are, in fact, said to be more than 10 or so sites (places of operations) that have adopted the BS7750 standard.

Elements in BS7750 standard

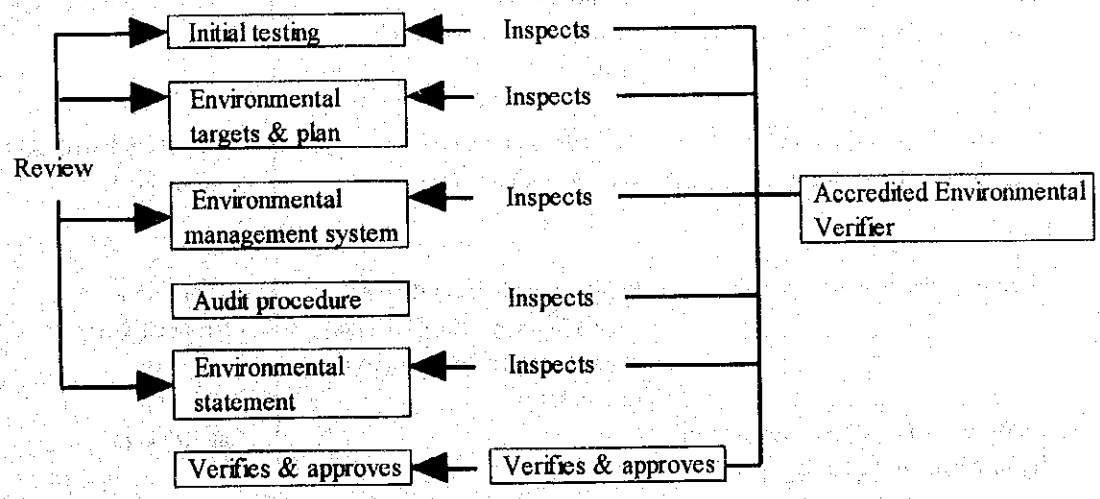


***) Outline of EMAS

The aims of EMAS are to evaluate the results of environment activities in industrial activities premised on the voluntary participation of the enterprises performing the industrial activities, to continuously improve those results, and to release related environmental information. For the results of environment activities to be continuously improved, the following will be implemented:

-The enterprises shall establish and implement environmental policies that take into account the sites involved, programs and management systems.
-Systematic, objective, and regular evaluations shall be made of the state of implementation of these activities.
-Information relating to the results of environmental activities shall be generally released.

EMAS framework



Details

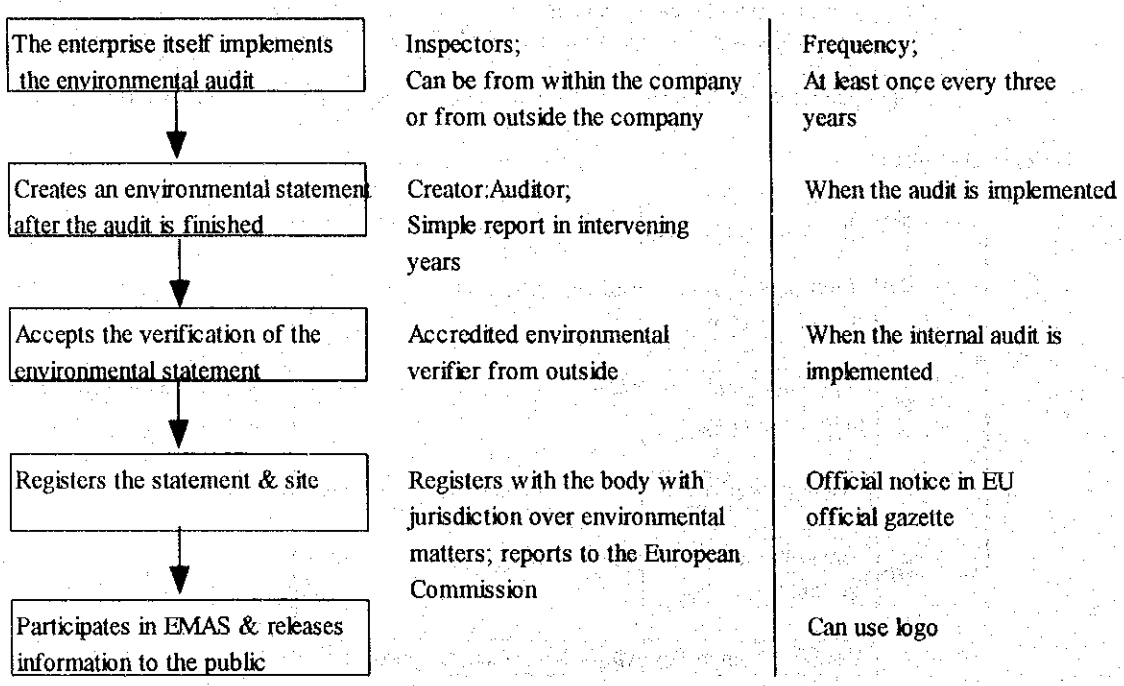
1) The unit of participation in the EMAS is the site.

2) A participating site prepares the following:
-It observes all relevant laws and regulations on the environment.
-It establishes an enterprise environmental policy.
-It conducts the initial environmental testing of the site.
-It prepares an environmental management program.
-It carries out the environmental testing or has an external party carry them out.
-It creates and environmental declaration and accepts the verification of an accredited environmental verifier.
-It registers the environmental statement with the body having jurisdiction over environmental matters in the country in which the site is situated, and releases it to the public.

3) Environmental impact statement
The environmental impact statement must include the following items:
-Description of the business activities of the site
-Assessment of all important environmental problems related to the business activities
-Approximate figures for the volume of energy, raw materials and water used, volume of pollutants and waste material discharged, noise pollution and other important burdens on the environment
-Other important items related to the results of environmental activities
-Description of the environmental policies, programs, and environmental management system of the enterprise implemented at the site
-Deadline for the submission of the next environmental statement
-Names of accredited environmental verifiers

4) Start of operation: 13th April 1995

Flow of EMAS participation



****) General situation with ISO14000

1) Structure of ISO14000
ISO14000-14009 Environmental Management System

ISO14010-14019	Environmental Audit
14010	General Principles of Environmental Audit
14011/1	Audit procedures -Part 1: Auditing of environmental management system -EMs
14011/2	Procedures for compliance/performance audits
14011/3	Procedures for auditing of environmental statements
14012	Qualification criteria for environmental auditor
14013	Management of environmental audit
14014	Initial review
14015	Environmental site assessments
ISO14020-14029	Environmental Labeling
ISO14030-14039	Environmental Performance Evaluation
ISO14040-14049	Life Cycle Assessment
ISO14050-14059	Terms and Definition
ISO14060-14069	Reserve

2) Environmental Management System (EMS)

An environmental management system (EMS) is a system whereby in order to adopt environmentally harmonious type conduct, the enterprises voluntarily incorporate into the management system the elements that promote environmentally harmonious type conduct.

Environmental management here is regarded as "the side involved with the establishment, application and maintenance of environmental policies within the overall functions of management" and in that respect, in relation to an environmental management system, is defined as "the organizational components, authority, methods, procedures and resources used to apply environmental management".

The objectives of EMS go way beyond matters relating to the end treatment of the processes of air pollution, water contamination prevention and waste material management by a manufacturing plant. They include the relationships of all the organization's activities with the environment such as the products provided by the organization, services and financial affairs, materials procurement, and R & D. Therefore, an environmental management system cannot function unless it is integrated with all other operations.

The structure of EMS has the same kind of principles as ISO9000. Quality control, however, is a matter that concerns the relationship between the supplier and purchaser, but environmental management targets the relationship between the organization and society as a whole. Further, it is essential to note that environmental management in particular has a much stronger connection with the laws and regulations of each country.

Comparison of the standards on quality control systems and environmental management systems

	Quality control	Environmental management
For internal management	ISO 9004	ISO 14000 (Guideline)
For external expression (verification)	ISO 9001/2/3	ISO 14001 (Specification)

3) Environmental Audit

An environmental audit is the testing that EMS is actually in place and is functioning. Specifically, an environmental audit consists of the general principles of the environmental audit, the procedures for implementing the audit, the qualification requisites of environmental auditors, international standards relating to the audit plan.

4) Eco-Labeling (EL)

Eco-labeling is intended to spread environmentally harmonious type products by displaying the environmental harmoniousness of the product to boost the selection of environmentally harmonious type products by consumers. In other words, the aim is to boost the development of environmentally harmonious type products through market forces.

EL is discussed under the three types in ISO standards.

TYPE I: Called the Seal Programme or Practitioner Programme, this type of EL has a system for certification of the environmental constituents of a product in relation to previously established standards (verification standards) by neutral institution.

TYPE II: Applies to independent claims on environmental advertising, etc. of a manufacturing industry in relation to the environmental constituents of its products. Environmental claims includes all environmental claims occurring in marketing, symbols, graphics, packaging symbols, product manuals, technical documents,

publicity, advertisements, television commercials, etc.

TYPE III: Determines indices in advance, and indicates on an Environmental Report Card the level of use of problem products in categories such as volume of resource consumption, amount of energy used, matter released into the air, matter released into water and solid waste ,etc.

5) Environmental Performance Evaluation
Environmental performance evaluation is the evaluation of the results of the environmentally harmonious type conduct of an enterprise. There is a rush to develop objective tools to measure the environmental performance of enterprises.

6) Life Cycle Assessment
Life cycle assessment is the analysis of the total effects of the manufacture of a product, its uses and its scrapping on the environment and the evaluation of the relative importance of these effects.
The ISO standard on life cycle assessment forces the decision-making of an enterprise take environmental problems into consideration more than ever before and will produce a huge volume of detailed information on environmental effects of industry activities.

III.5.4 Movements toward World Standardization and Law of Product Liability (PL)

(1) Movements toward World Standardization

With economic globalization and borderlessness, movements toward world standardization is thriving, aimed at removing technical obstacles to trade. When the Tokyo Round of GATT was formally signed in 1979, it was decided that the determinations of international standards would be applied in the standards and regulatory technical criteria of each country.

In the beginning, world standardization started in the electronics field with the establishment of the International Electrotechnical Commission (IEC) in 1906. For other fields, in 1947, the International Organization for Standardization (ISO) was established. That current system is completed for electrical and electronic fields to be taken up by the IEC and for other fields to be taken up by the ISO. The ISO alone has determined approximately 5,300 standards up to the present.

Current movements to standardization are concentrated on the three issues of matters relating to quality control, matters relating to environmental management and matters relating to safety.

(2) European market unification and world standardization

The background of the recent movement toward world standardization is closely connected to the attempt by countries in the European Union (EU) and European Free Trade Association (EFTA) to make unification standards within the European area for the integration of European markets. The EU often anticipates world standards in many cases, and European standards and world standards substantially overlap, because the EU has been central to world standards since the historical background starting with the industrial revolution, because it has a market of more than 300 million people and because it has many nations. For example, 40% of the standards set by the European Standardization Committee (CEN) which is in charge of European standards overlap with the ISO and IEC standards, and 72% of the standards set by the European Electrotechnical Standards Committee (CENELEC) are the same as the IEC standards and 17% are based on the IEC standards.

In that sense, the CE marking which is currently constituted in the EU is very instructive for understanding future world standards.

(3) World standards on quality control

Standards on quality control have been implemented in every country with a history of industrialization. The IEC and ISO were established to coordinate these standards. However, these standards were about the quality of products themselves. In the 1970s, the movement that began to appear in the countries of Europe and the U.S. was aimed at strengthening business competitiveness and simultaneously establishing product reliability and safety by improving quality control systems. In 1987, the ISO 9000 series was formulated by the ISO, based on the U.K. and U.S. standards. The ISO 9000 series systematically guarantees the quality control systems themselves.

The ISO 9000 series is characterized by the fact that it does not limit industrial categories to manufacturing industries and that software aspects such as structures within a company that guarantee quality are given serious consideration. Further, even after the standards are adopted, enterprises must undergo a fact-finding survey every six months.

At present, since enterprises that export to world markets, particularly within the EU area, are often required to adopt these standards as a mandatory condition for doing business, enterprises exporting to the European market must adopt them. Therefore, the manufacturing industry is moving globally to adopt the standards. The adoption of the standards or setting up the organizations for adopting them is happening in Malaysia too.

(4) Standards on environmental management

Standards on Environmental management are being standardized because of the heightened interest in the world environment; this line of thinking did not exist in the past. Initially, standards from the developed countries that "no ecological dumping will be permitted" were fairly severe, but as a result of the opposition from developing countries that "they are heavier shackles on the developing countries", the ISO 14000 series is to be issued in July 1998, advocating that countries make efforts in accordance with the country's technological level.

(5) Standards on safety

1) CE marking and the Law of Product Liability

There is still no movement towards a world standardization on safety. But, in Europe, safety

standards are being issued in each product field. This is called the CE marking system, and it is prescribed for each field by the EN (European Norm) directives that integrate the range and level of safety regulations within the EU area. Products that conform to these standards are affixed with a CE mark seal. Products that come within a field for which an EN directive is in force will no longer be able to be distributed or sold within the EU area if they do not display the CE mark. Presently, these directives are limited to the fields of machinery safety, toys, construction materials, simple pressure vessels, personal protective equipment, etc., but are intended to expand gradually to other fields as well in future.

These CE marking standards have the potential to become virtually world standards. The first reason is that European standards sooner or later will be on the agenda of the ISO because the European standards are likely to anticipate world standards, as already stated. A second reason is that the CE marking has closely relation with Product Liability (PL) laws. PL laws have been enacted in more than 30 countries. These laws clarify the responsibilities of enterprises in relation to safety. In these countries where PL law has been set down, the EN virtually apply even in areas where the EN are not obligatory. If a manufacturer, aware of the possibility of danger, ventured to produce and export a product for which measures to counter the danger are not taken and which was made under lower standards regardless of the fact that the manufacturer was able to make a product that conformed to the EN, the manufacturer would not be able to escape the pursuit of responsibility for an accident occurring as a result of the product. In other words, in this sense, the standards by CE marking are already the standards of countries that have a PL law and that export there.

2) CE markings for electrical and electronic products

Malaysia has not enacted a PL law, but exports a great deal to Europe and countries that have a PL law, so it is natural that CE marking has much effect on the Malaysian manufacturing industry. Especially the electrical and electronics fields which have the greatest exports are the most serious. CE marking in this field consists of three directives namely the safety of machinery directive, the electromagnetic compatibility (EMC) directive, and the low voltage electrical appliance directive.

The safety of machinery directive is targeted at products that have exposed moving parts. It came into operation on 1st January, 1995, but affects a few products. The next EMC directive requires that the electromagnetism produced by a machine does not interfere with the use of communication equipment (electromagnetic interference [EMI]) and requires that the

machine has resistance above a fixed level for obstruction of an electromagnet (electromagnetic susceptibility [EMS]). The targeted products cover an extremely wide range from home electrical products, televisions, radios, mobile phones, etc. to industrial machinery which build in motors and CNC machine tools. This directive is to come completely into operation on the 1st January 1996. Finally, the low voltage electrical appliance directive is targets at household and electrified products with AC power voltages of 50 to 1,000 V and DC power voltages of 75 to 1,500 V. It will come completely into operation on the 1st January, 1997. This is a safety standard concerned with physical, thermal, mechanical, and electrical properties.

(6) Standards testing and certification demand expected for the Techno Centre

To obtain accreditation under the ISO and the EN, a company must undergo testing and measurement by a registered testing body or its agent or have a testing organization within the company for that purpose and conduct tests and measurements there to make a self declaration. Currently, generally accreditation is under the former method.

Therefore, this centre can be expected to perform testing and measurement services for a company to gain accreditation. In this case, the field with the highest demand is the EMC field. The reason for this is that firstly, it is a new standard that starts from the 1st January, 1996, and in that sense, there are not yet testing and measurement organizations in existence anywhere in the world. The standards of many countries made a fair amount of the standards on EMI obligatory, but were uncritical with the EMS. So new demand for testing and measurement will rise. In addition, at present standards target only finished goods for testing and measurement, but in future, it is predicted that testing and measurement at the component level shall also be necessary for a product to satisfy the EMC standard. On top of that, more and more products will be targeted for EMC testing and measurement because even products in which electronic parts have not been assembled are likely to have electronic incorporated as the conversion to high-tech proceeds.

Secondly, demand for facilities by enterprises will be high because measurement facilities are extremely costly and because it is difficult for individual enterprises to get them ready. Currently, except for some products, it is almost impossible to have products inspected and measured for the EMC in Malaysia or Singapore, so foreign enterprises take the products to their home country and have their own company or another testing and measurement

laboratory carry out the measurement and testing. However, the facilities of their home countries cannot catch up with the demand for testing and measurement because of the relationship with the issue of CE markings even if the facilities operate at full force. Therefore, there are rapidly increasing expectations of facilities that can do complete testing and measurement in Malaysia.

Thirdly, the area around Penang has a fair degree of concentration of electrical and electronic industries which are Malaysia's leading industries. And electronic-related enterprises can be expected to locate in the KHTP. This means that there is expected to be adequate demand for testing and measurement.

CHAPTER IV

CONCEPT FOR TECHNO CENTRE

IV CONCEPT FOR TECHNO CENTRE

IV.1 Strategic Management Plan for Techno Centre

IV.1.1 Goals and Basic Policies

(1) Goals of Kulim Techno Centre

The first objective of the Techno Centre is to provide state-of-the-art technical support to attract and ensure the operations of high tech industries in Kulim Techno Park, and secondly to provide services to promote industrial deepening to enhance value-added productivity of manufacturers in the northern region of Malaysia. Equipped with state-of-art facilities and expertise, the Techno Centre should become a national centre of excellence in dedicated fields of manufacturing. The Techno Centre should be a dynamic and open institution which becomes a regional hub for international network of technological innovations.

(2) Target Industries

High-Tech industries cover a wide range of industries including mechatronics, electronics, new materials, bio-engineering, and information technologies. If the Techno Centre should support all these High-Tech industries, the requirement for manpower and facilities of high caliber would be enormous. However, the resources for the Techno Centre are limited. It takes a long time to train capable researchers and technicians and the analytical equipment is very costly. It is necessary to choose target industries to maximize the limited resources.

The Techno Centre is only a supporting institution for R & D activities, therefore the Techno Centre itself cannot create High-Tech industry. Despite the future potential of bio-engineering, the Techno Centre cannot function without the existence of a bio-engineering firm.

As described in the analysis of the needs in the Chapter III, hard disk drive and semiconductor industries have become leading industries in northern Malaysia. In the KHTP, three wafer fabrication plants are expected for the first time in Malaysia. Other electronics industries in the vicinity are shifting to higher value-added products. The Techno Centre can contribute a great deal to these industries by supporting R & D activities.

It is a conservative strategy to focus on electronics industries which have clear potentials. Nevertheless, such strategy does not exclude the possibility for expansion into other industries. The staff and equipment required for the support of electronics industries are also necessary for ceramics and bio-engineering though they are not sufficient. When a new industry emerges in Malaysia, it is a matter of additional investment.

(3) Aggressive Approach for Technological Build-up

If the choice for target industries is a conservative one, the approach for technological building for the Techno Centre should be an aggressive one.

As described in Chapter III, Malaysian industries are undergoing structural transformation. The Techno Centre should not miss these golden opportunities by responding to the changes quickly and flexibly.

One of our proposals (described later) is the establishment of the Mechatronics Testing Centre. This Centre is to provide testing services for CE marking that will be required by EU. Since EU standards are not enforced yet, the Techno Centre has a chance to acquire a large market by preceding other institutions. If the Techno Centre successfully initiates the testing services for CE marking, the lead will have a pre-emptive effect for other similar institutions to take a risk.

The equipmentplanned for the Surface & Material Analysis Centresuchas TEM (described later) and SIMS(described later) are not only very expensive but also require highly skilled operators. Nevertheless it is an imperative to acquire such analytical capability and skills to promote High-Tech industries and close the gaps with advanced industrialized countries.

(4) From Failure Analysis to R & D

The volume of R & D activities is small in Malaysia at present. The ultimate goal of the Techno Centre is to support R & D activities. However, if the Techno Centre is solely dedicated to the support for R & D activities, the Techno Centre will not be able to avoid having idle capacities. As described in Chapter III, analysis and testing for the quality control in High-Tech industries have grown to a sizable market. Although R & D and quality control have different purposes, the processes have much in common. In quality control, the detection of defects is only the first step and the ultimate goal is to find the cause for the failure. The research capability beyond simple physical and chemical analyses for diagnosis is also an expertise necessary for R & D.

For the above reasons, our strategy is to focus on failure analysis needs arising from quality control at an initial period. The experience and know-how acquired through providing failure analysis services will become a valuable asset for R & D activities in the future.

(5) Regional Technological Core

As our analysis of High-Tech industries suggests, Southeast Asia and the Malay Peninsula should be regarded as one integrated manufacturing location for multinational corporations. In deciding the functions of the Techno Centre, it is necessary to consider competitions and cooperations with other countries such as Thailand and Singapore. The creation of the regional network for manufacturing should extend beyond the confines of KHTP as the highway connection greatly enhances access to other areas. The justification of extended territory arises from both demand and supply. There will be the manufacturers from outside the industrial estate seeking highly specialized services of the Techno Center. The exchanges with these outside firms will contribute to the creation of a larger network of manufacturing know-how. On the supply side, the Techno Centre needs to expand its revenue base to financially justify the facilities and services that meet various advanced needs of high tech firms. Therefore, in planning the Techno Centre, the geographic boundary should include not only Northern Malaysia, but Southeast Asia as well.

Value added in manufacturing is tantamount to knowledge production. The base for knowledge production rests on a sound foundation of knowledge exchange environment. These intellectual activities eventually lead to improvements and innovations.
Techno Centre should serve as a gateway to all the facilities and services in the Kulim High Tech Research Community.
It should establish linkages to other major High Tech hubs such as Silicon Valley, Tsukuba, Massachusetts, and establish advisory groups, and a roster of experts to assist the firms, plan forums and seminars to stimulate intellectual activities.

IV.1.2 Strategies for Rapidly Advancing Technologies

(1) Needs to Review Equipment Plan After 5 Years

The facilities planned for the Techno Centre are most advanced scientific equipment because the centre is intended to service High-Tech industries. Technological development in these industries are so rapid that the product cycle has shortened to less than a year in most products. Accordingly, production equipment becomes more and more sophisticated. Analytical equipment increases capacity, resolution, and accuracy to meet increasingly demanding technological needs. As a consequence of technological development, it is quite probable that the current selection of equipment become obsolete in a few years. Another implication of technological development is that the facilities at the Techno Centre are likely to lose their competitive edge unless continuous up-grading is carried out. Though we have planned the second stage expansion to increase the capacity of the Techno Centre, professional re-assessment of the equipment purchase plan is highly recommended after a few years.

(2) Development of Expertise To Cope With Advanced Technologies

What is most crucial in developing capabilities to support High-Tech industries is the development of expertise to utilize the advanced equipment. For example, advanced analytical equipment often requires careful preparation of test piece. To provide failure analysis requires an expertise to consult on production problems for the client and a wide

knowledge on production as a background. It is necessary to have a practical plan for human resource development. The development of human resources in highly scientific fields cannot be achieved through formal training, but depends on on-the-job training. It is no exaggeration that the success of the Techno Centre relies on the human resource development system including training, and incentives. The problem of obtaining qualified professionals who train other people is a common big problem for both KHTP and the Techno Centre. What is aggravating the situation is the current shortage of work force in Malaysia. One practical solution is to provide incentives and remedy legal framework for inviting foreign professions to solve the bottleneck.

(3) Competition and Complementarity

The Techno Centre competes with other similar institutions but also supplements with each other. One of the facts discovered through our surveys was that there exist a large volume of calibration needs from electronics industry alone. SIRIM has not fully responded to this growing needs in the region. Judging from the current situation, it is possible to designate the Techno Centre as a local institution to cater for the factories in the vicinity of the KHTP. However, since SIRIM is not under gradual expansion in Penang, calibration was eliminated from the function of the Techno Centre to avoid the duplication of investment.

Similarly, in providing analysis services, the Techno Centre should co-exist with other institutions such as PORIM and FRIM for bio-engineering and Malacca for Aerospace engineering. Though these fields present potentials in the future, it remains as a study item at present for the Techno Centre. At the initial phase of the Techno Centre, its technological capabilities will be limited, therefore affiliations with other research institutions and laboratories become indispensable means for maintaining service standards and absorbing expertise.

IV.2 Functions and Services

IV.2.1 Functions

As seen in the previous section, Techno Centre supports those manufacturing sectors which locate facilities in KHTP and in its vicinity. Its ultimate goal is to heighten Malaysia's industrial structure. To accomplish this, it is necessary to define Techno Centre's role taking into account the directions of the nation's policies regarding industrial development, science/technology, human resource training, as well as findings via studies on the needs of corporations which are already established.
We propose five functions be assigned to Techno Centre.

R & D support

This is the most important function. Considering the demand, its task, for the time being, would be to support a part of quality control, analyzing, testing, and deficiency examinations.

Incubation

This is the function which assists in the creation of Malaysian enterprises with truly competitive technologies. This task is widely interpreted, including high-tech supporting industries, and prototype product industries.

Human Resource Development

Malaysia has been implementing various measures to meet this need -- one of the most crucial issues today. Techno Centre provides high level training in the production field in order to deepen industrialization in the region.

Information

As seen in Chapter III, there is a strong demand for information, and the demand is believed to become more intense in the future. Techno Center will satisfy this trend.

Exchange

Association among enterprises is imperative to promote corporate activities. Human networks can be created through association among different industries and researchers. This contributes not only to the development of KHTP, but also to elevation of Malaysia's entire industrial structure.

Through our surveys, three areas of emerging needs have surfaced for the Techno Centre. These emerging needs are arising from High Tech Product Shift, R & D Shift toward Industrial Deepening, and Social & Environmental Shift. Functions and services of the Techno Centre are examined along these target areas.

As explained in the analysis of structural transformation of manufacturing sector in the northern region of Malaysia, the manufacturing sector is undergoing changes in two directions, first, a shift toward more high tech products and second, an industrial deepening toward R & D. There is an external change that is taking place as people are becoming aware of more environmental and social hazard of products and manufacturing processes.

Techno Centre has to provide services along these three dimensions to assist manufacturing sector to adapt itself to new market and social requirements.

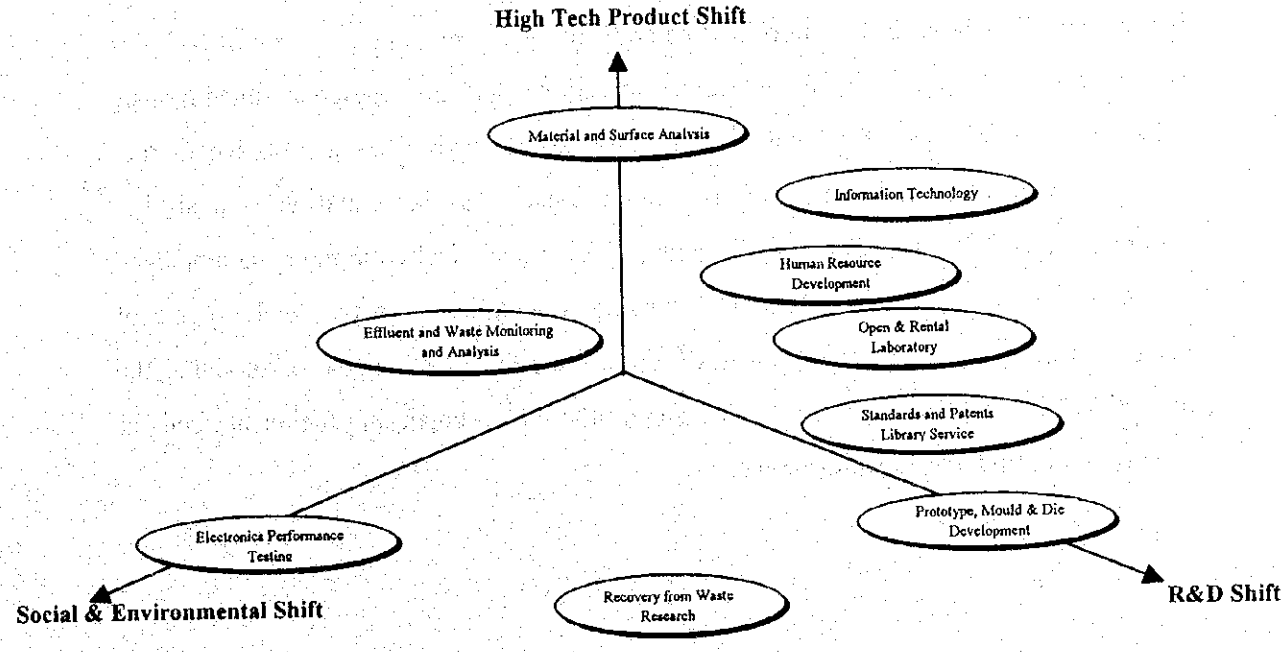


Figure IV.2.1 Three Shifts and Services of Techno Centre

As products in the northern region shift toward high tech products, there is an expected increase in analytical needs to check parts and products quality and contamination, and to monitor water and air. Material and surface analysis becomes a crucial element in the support of high tech transformation. As conventional moves toward R & D, various needs arise in human resource development, information service, and supporting industry development. Smaller start-up firms need more public support in technology and finance. As societies becomes more and more conscious of environment and safety, there are collective needs to monitor and certify products and by-products coming out of manufacturers. Product testing needs have emerged from social changes based on more stringent Product Liability framework. Figure IV.2.1 represents the relationship between these emerging needs and functions offered by the Techno Centre.

IV.2.2 R & D Support

(1) Material & Surface Analysis Service

As described in the section on technical requirements in focused survey in Chapter III, the semiconductor and hard disk drive industries contract out currently a large proportion of analysis to Singapore and some to the U.S. and Japan. Lack of facilities and expertise is hindering efficient local operations and the engineers unanimously expressed a strong need for local support for analysis needs. As a tentative market analysis shows, the hard disk drive industry alone constitutes a large market for analysis. Material and surface analysis requires a high precision analytical equipment accompanied by expertise to conduct. Although we do not know exactly what types of manufacturing will emerge in KHTP in the future, the facilities capable of servicing the hard disk drive industry should be able to meet the most demanding technical needs at angstrom and PPT level measurement.

(2) Testing for Electronics Products

As EU implements stringent testing requirements for any sales within Europe, there are new testing demands such as for electromagnetic interference and electric hazards. These tests require a special facility of large investment such as an electromagnetic shield room. Electronics testing should center around product performance test since it is difficult for any individual factory to own for its expense and infrequent uses. Such a facility does not at the moment exist in Southeast Asia, thereby making the Techno Centre a unique institution which attracts a wide number of customers. It will have a good promotional impact for KHTP as well as for the Techno Centre.

It takes concerted efforts and time to build a reputation for the quality of manufacturers. National standards and testing services to support them are the essential means to achieve this goal. When a local producer faces manufacturing problems, analysis of materials and parts become an essential tool for troubleshooting. Access to testing service becomes a crucial element in industrial deepening. Full local production capabilities will not happen without problem solving capabilities. The outlay of the facilities and the scope of services should be examined carefully to match the needs of the manufacturers both inside and outside of the KHTP.

(3) Monitoring for Environmental Control

Industrial waste and effluent, as an inevitable consequence of large concentration of manufacturing establishments, could cause damage to the surrounding environment and human settlements. High-Tech industries especially tend to use various rare toxic gases and liquids and present a potential risk to the environment. Therefore, stringent pollution control and waste management are prerequisites in advanced industrial estates. However, pollution control is a cost element in production at the same time. It is necessary to facilitate investors with their compliance with pollution control as much as possible. Therefore, the Techno Centre should provide efficient and prompt effluent testing for factories. At the same time, standard testing services required for pollution control should constitute stable revenues for the testing division of the Techno

Centre. The KHTP has a common solid waste depot as its unique feature in Malaysia. The analysis of deposited waste is a requirement for acceptance at the depot.

Electronics industries in Malaysia do not present many environmental hazards. However, the High-Tech Product Shift will involve more delicate processes in manufacturing. The target industries of the Techno-Centre, i.e., hard disk drive and semiconductor industry, use a large volume of purified water. The analysis of water at the intake and after the purification is an important process for quality control. At the same time, waste water analysis is essential for pollution control.

Independence and Inter-dependence of Three Testing and Analysis Centres

The three areas of testing and analysis are proposed to be an each independent centre. Such division comes from a technical specialization. However, actual testing and analysis needs from production and R & D often require various services that involve different specialties. After finding a problem with a product after testing, material and chemical analyses may be employed to find out the cause for the failure. In other words, the three areas of specialties have to be well coordinated to provide quality in testing and analysis services of the Techno-Centre.

IV.2.3 Incubation

Taman Technologies Inc. currently conducts incubation of new ventures. It plans to move into a newly constructed technology park in Kuala Lumpur and plans to engage in accommodating 150-60 new ventures. In view of the objective of building indigenous manufacturing capabilities, there should be some incubation functions in the northern region. Since small firms are not as mobile as the larger firms, it is better to offer local assistance for local ventures from Penang and Kedah regions.

KHTP has a tentative agreement with MTDC, a local venture capital firm based in KL to set up a function to support ventures in the northern region. It may be also possible to collaborate with Taman Technologies to exchange services and information.

Supporting Industries

The concentration of electronics industries in northern region of Malaysia, centering around Penang area, has generated a market size has begun to spur local supporting industries and production machinery industries in the neighboring areas. Backward integration in industrial linkages has taken place; the components industry and supporting industry have sprung up. Coupled with a strong push from the Government to increase local content and encouragement from the final assemblers, both local and foreign firms have entered into the field of supporting industries.

Typically the factories to produce casings and parts have emerged. These industries include plastic moulding, metal forming, aluminum die casting, coil making, PCB and PCB assemblers. Malaysia can provide a broad range of these basic supporting services, but assemblers and supporting industries unanimously agree that the industry suffers from lack of capability to produce complicated products. Local vendors can supply single one-sided PCB, but cannot supply double-sided or multi-layered PCBs. The lack of expertise is severely felt in tool and die making and complicated PCBs. The situation is most acute in mold and die making of which more and more accuracy is demanded by user industries. Penang recently opened a course in mould making technologies at the Penang Skill Development Centre with the cooperation of mostly Japanese enterprises in response to the shortage in expertise. Since it will take a long gestation period in human resource development, it is necessary to bring in a qualified firm from abroad to develop practical expertise locally to meet demand immediately.

In modern industry, the proportion of assembly cost is increasingly becoming smaller. For instance in electronics industry it is known to be less than 10 % of the total production cost in general. Multinational companies are constantly looking for alternate production sites to stay competitive. Their location decisions are based on total production cost, but not on an individual process cost. Local parts procurement reduces not only the production cost of parts themselves but also the costs of logistics as well. Therefore, having a good base of supporting industries itself becomes an attraction for foreign investors.

Providing local procurement assistance to final assembler should lead to promoting the establishment of supporting industries at the same time.

The Techno Centre should provide office space for incubation and retail and open labs to facilitate R & D activities of these start-up firms as well.

IV.2.4 Human Resource Development

The most common problem that the firms surveyed faced was shortages of both operators and skilled engineers. Some firm in Perai has to transport some workers from Ipoh with two bus connections spending two hours every day. The labor turnaround at operator level runs between 4-6%, incurring a large sum of recruiting and training costs. The turnaround among engineers is much lower, but shortage is a serious problem in upgrading manufacturing processes in Malaysia.

In this region there are plans of two new training institutions, i.e., Polytechnic and JMTI training centre in addition to the Skill Development Centre in Penang. Adding another training function in this area should be examined carefully not to create unnecessary duplication. Nevertheless, in view of labor pooling, it is desirable to have a local training institute to cater to more specific needs and assure a steady supply of technicians and engineers in terms of investment promotion.

It is a difficult task to set up curriculums for training the technicians and engineers suited for various local firms. The curriculum should have some universal applicability to the majority of firms.

The training to be offered at Kulim should correspond to the specific needs to assist industrial deepening in the region. Since the next steps for Malaysian manufacturing are to acquire process engineering technologies and product development technologies, the training should incorporate the elements as follows;

Suggested Training Courses

- Production planning and management

- Material handling and inventory control
- General machining techniques
- Numerical control machining
- CAD and CAM
- Quality control
- Electronics
- Analysis and Testing

IV.2.5 Information Services

A well organized library is a traditional source of information for research activities. Although computer-based databases have replaced the role of library services, the traditional media still has an advantage in readability and searches. The many industrial firms interviewed voiced the need for easy reference to industrial standards from various countries such as the U.S., Japan, England and Germany. Especially, smaller firms that conduct subcontract jobs from various multinationals expressed their serious needs. Local firms with some R & D activities have complained of the lack of access to technical information sources such as standard text books and journals on materials and electronics. However, due the limited number of users, the library in the Techno Centre cannot be extensive as owned by universities. The journals must be limited to the specialized fields of the KHTP such as electronics and information technology.

Rarely are companies surveyed connected on the Internet. Those on the network are usually the subsidiaries of multinationals using the network for communication with their headquarters. Assistance in information technology and network services from Information Technology Centre should improve connectivity of those firms located in KHTP. On-line databases and the Internet should handle the bulk of research needs since it saves both money and space.

Many firms surveyed voiced their lack of information on the local availability of parts, tools, and services and their prices. These basic information services are crucial both to

large corporations and to the development of supporting industries in Malaysia. Therefore, information service at the Techno Centre should include Procurement / Vendor Information Service as on-going survey cum information service.

Besides these physical outlays, the crucial element in effective research is a well-trained librarian who knows the ways to find the items that researcher look for. A librarian should be proficient in database search as well.

IV.2.6 Exchanges

Personal network is not visible. Nevertheless it is the basis for any investment or R & D. In that sense the Techno-Centre should become a focal point for personnel networks. Specifically the Techno-Centre should start with informal meetings, salons, and forums of entrepreneurs, engineers and researchers, and proceed to more formal expert networks. Organizational effort should contribute to further prompt intellectual activities and investment opportunities.

Table IV.2.1 Scope of Services at Techno Centre

FUNCTION	SERVICES	
R&D SUPPORT FUNCTION	Testing and analysis	Surface analysis Condition analysis Microspic observation
	Electronics testing	Electromagnetic interference test Electromagnetic susceptibility test
	Environmental monitoring	Industrial waste and effluent test
	Product and material testing	Electronic test Material test Environmental impact test
INCUBATION FUNCTION	Incubation room rental Prototype production Secretary service (copy, type, fax, accounting etc.) Venture capital advisory Market survey Office furniture and equipment rental Patent and legal advisory Technical advisory Debt guarantee advisory Start-up advisory	
SUPPORTING INDUSTRIES FUNCTION	Laboratory rental	
HUMAN RESOURCES DEVELOPMENT	Seminar & training	Managing seminar Technical seminar Upgrading seminar Advanced technology seminar Skill training (hi-class, mid-class, lo-class)
	Advanced technology inspection tour	At private industry At research institute (incl. overseas trip)
	On-job special training	At selected industry
INFORMATION SERVICE FUNCTION	Database reference Linkage with information network through IT Centre Library (technical books, journals, industrial standards, etc.) Information on regional industries Computer workstation rental	
EXCHANGE FUNCTION	Intra-industry exchange forum Joint research promotion forum Academic forum Industrial exhibition, fair Membership research society	

IV. 3 Organization

Organization is a system of human resources to achieve specified objectives and services effectively and efficiently. The Techno Centre does not require a large number of personnel but rather a few well-qualified experts especially in research and analysis, and management.

The organizational structure of the Techno Centre is based on three factors, i.e., functional division, partnership division, and financial viability division.
A partnership with a private firm is desirable where possible, but no single firm offers a variety of services that the Techno Centre offers. Even within the scope of testing and analysis, expertise needed for chemical analysis and material analysis rarely exist within the same company. Private firms tend to specialize in a narrow band of expertise. Therefore, analysis and testing services are divided into three distinct centres. The services that the Techno Centre offers has a varying degree of financial viability. As suggested in the section of public-private partnership, the forms of corroboration need to change depending on the degree of profitability. Some services such as human resources are more financially self-sufficient than other services. Information Technology Centre will become a part of the Techno Centre when it is completed, but currently is under planning by the UTM. The rest of the services which has a characteristics of public service are grouped into one centre, i.e. Industrial Network Centre.

In Addition to these 6 centres, our proposal is to set up one sales company. A privatized sales arm will be more efficient and dynamic to changing needs. There is a need for an organization to coordinate 6 independent centres to achieve the maximum use of the facilities and expertise at the Techno Centre.
The suggested organizational chart in Figure IV.3.1 is the division of functions and services according to these criteria. There are 6 centres and one independent marketing arm. The independent marketing body has a purpose of maximizing the coordination between different centres to make the operation as financially sustainable as possible. SISIR, a Singaporean research institution employs a similar organizational setup. In the

future when AMREC and MIMOS come into a full swing, access of private sector to the expertise of these institutions will be greatly enhanced through market oriented organization.

The outlines of six centres are as follows;

1) **Mechatronics Testing Centre**

Conduct safety tests for electric and electronic devices.

2) **Material & Surface Analysis Centre**

Conduct material and surface analyses for devices materials for High-Tech industries such as hard disc drive and semiconductor.

3) **Environmental Analysis Centre**

Testing and analysis for environmental control and chemical analysis for general industries.

4) **Human Resource Development Centre**

Provision of highly specialized short-term courses.

5) **Industrial Network Centre**

Library / Database service, promotion and information service for supporting industries, incubation, and exchange programmes.

6) **Information Technology Centre**

Human resources development, research, and technology transfer in the field of information technologies, affiliated with the USM.

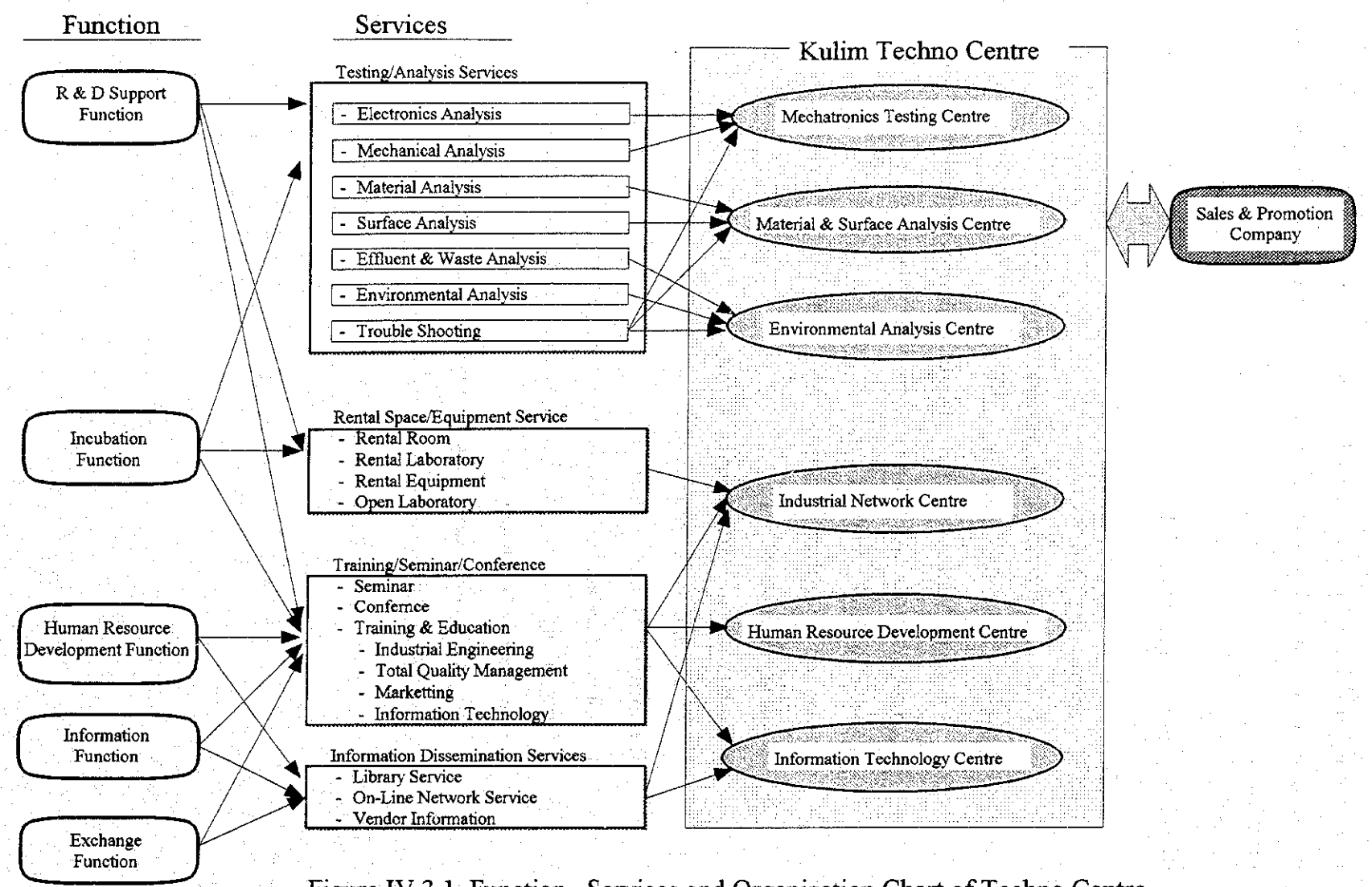


Figure IV.3.1 Function , Services and Organization Chart of Techno Centre

IV. 4 Formation of Techno Centre

IV. 4. 1 Basic Policy in Management of Techno Centre

Key elements for the success of the Techno Centre are scientific expertise, marketing prowess, flexibility to rapidly changing needs, and coordination with other institutions. These capabilities are achieved not only through the ability of each personnel and facility, but as an organization and access to networks. In view of total system of management of the Techno Centre, a few important issues are presented in the development of the Techno Centre as an institution.

(1) A Few Important Issues

Expertise Requirement

Analytical needs of high tech industries cannot be met only with the installation of high performance measurement machines without the accompanying expertise. Through our surveys from established institutions in Japan, the experts mentioned the period of 5 to 10 years of building expertise when started from the scratch. This period requirement is too long to meet the immediate needs of industries that are to be located in KHTP and already existing hard disk drive industry in Penang area. The only solution to shorten the period of expertise development is to invite well-experienced organizations to take part in the provision of professional services of Techno Centre. Private corporations in industrialized countries do already provide such services of high quality. The surveys in Japan have identified a few companies in each category of specialty which have know-how and staff to offer the services planned at the Techno Centre.

Public-Private Partnership

The goal of the Techno Centre is to provide the technical and laboratory services of highest level in Asia. High level services are often highly specialized, not always providing a volume to justify economical operations. Nevertheless, these services are likely to prove to be one of crutial elements in attracting High-Tech manufacturers. In the fast changing world of technologies, public institutions in any country find it difficult

to keep up with the developments in technologies and to provide efficient management in marketing and human resource development. Private sector's participation is crucial in providing high level services with efficiency, but public goals and financial viability conflict with each other in management. Techno Centre has to provide the mechanism to remove risks for these companies to participate.

Lowering Risk for Private Participation

Public-Private partnership of differing format appears to be a workable solution to solve the above-mentioned dilemma of financial viability and public service to upgrade the manufacturing sector in the region. As one alternative, the government can form a company that invests in the facilities and commission a private company to operate the facilities to offer services. In another format where the services have better market, the publicly owned company could invest in the facilities and rent or lease them to a private company.

Many other formats to ensure the quality in services and efficiency in management should be seeked on a case-by-case basis.

Role & Responsibility

Public-private partnership often requires coordination among different characteristic sectors, such as coordination with public sectors, with industrial circles, and with academies. The function of above coordination is indispensable at the planning stage, launching stage, and operation stage. On each stage coordination with correspond organizations shall be needed. Federal government represented by EPU will play an important role for coordination at the project formation stage and implementation stage, Management structure shall be set up the structure which private companies can function along with their objectives and capabilities. This needs efficient and responsible organization and management. If the government support in various aspects including finance, management itself shall be independent from government interference.

(2) Basic Policies in Developing Operating Systems

* Private sector-like projects which benefit the public
* Joint work with overseas enterprises
* Incentives to encourage private enterprises
* Client mediation, and functions to promote affiliations
* Recruiting superb management personnel

Private sector-like projects, which benefit the public

Techno Centre's task is to satisfy its clients' demands. In this concept, it has characteristics similar to those of the private sector. Techno Centre provides services seeking profit. The service is not excessive, but it is appropriately priced, and of high quality.

Joint work with overseas enterprises

Techno Centre employees must have expertise with advanced knowledge and know-how. Training such personnel can not be done overnight, and Malaysia does not find many qualified people in the country (particularly in private sectors). It is necessary to consider hiring from overseas, carrying out joint management with foreign enterprises, and assigning works outside the Centre.

Incentives to encourage private enterprises

Techno Centre projects must invite private enterprise participation in management. It is necessary to prepare an environment that encourages their participation, such as risk reduction and the providing of incentives. For example, it is important to reduce their investment costs in the initial stage (e.g. leasing facilities and machinery), and to establish advantageous measures in management (e.g. low interest rates for leasing). These considerations would alleviate the burden of investment to initiate operations and ease private enterprises' fear of participating in the Techno Center project on its own.

Client mediation, and functions to promote affiliation

Techno Centre supports not only private individuals and enterprises, but also government

and university research bodies both in Malaysia and from overseas. Therefore, the Centre should act as a "mediator" for all clients, as well as a "window of opportunity." To perform this duty, Techno Centre should establish a board comprised of specialists, and a section which works as a mediator. This is to promote ties in information, human resource development, and funding among industry, government agencies, and research organizations.

Recruiting superb management personnel

Selecting appropriate Techno Centre management personnel is the key to the success of this project. All managers should have outstanding abilities over a wide range of expertise. Techno Centre must be headed, most of all, by a person who is thoroughly knowledgeable in development research and information technology, and should be able to grasp this project as a private business. Should it be difficult to find suitable personnel, recruiting qualified persons from overseas should be also considered.

(3) Creating the Techno Centre Organization

Techno Centre projects often have a strong public aspect such as contributing to regional industry, fostering high tech enterprises and supporting the upgrading of the technology of supporting industries. Therefore, it is desirable to establish the Techno Centre with capital from sources such as governmental or public bodies. Moreover, if a project is sufficiently attractive for a private enterprise to participate in the Techno Centre, the private enterprise may possibly extend its operations to the administration of the Techno Centre.

In the light of high specialization, the capacity to supply high quality services and adaptiveness in accommodating enterprise requirements, it is essential for each centre to be a project under the guidance of the private sector. Attracting enterprises to which the project of the relevant centre will be entrusted is important for achieving this.

Given the above, the establishment of the body that will manage the Techno Centre overall may be considered as follows. In broad terms, there are the two types: direct investment in the Techno Centre and the establishment of a foundation. These can be further divided into three cases according to the investing or contributing body.

Generally, forming a fund has a stronger public flavour. Further, a method that is also possible is for the Techno Centre, as a mix of both types, to be established by investment from each body with a fund to be created separately.

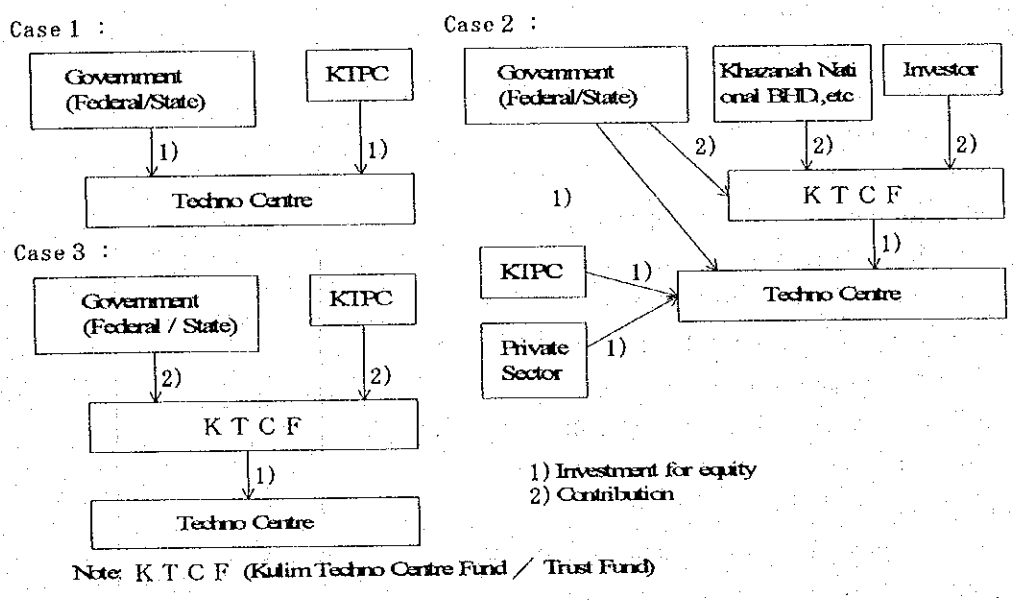


Figure IV.4.1 Proposals for Techno Centre organization

IV.4.2 Management Structures

The Techno Centre consists of six centres, a sales promotion company, and management divisions for facilities. Except for ITC (where USM is the operation body), the operation body is not fixed. Accordingly, at this stage, a number of cases have been considered based on the above basic policies in relation to the operation and management structures of each centre.

(1) Techno Centre management structure

A comparison of the relative merits of a public and private body conducting the management operations of the Techno Centre is summarized in Table IV.4.1. A public body is, in general, superior in the points that it is not a captive to business profit and that its projects are highly likely to be helped along and to be able to receive many public support measures. On the other hand, a private body is superior in improving demand for services and in its adaptiveness to enterprise requirements. Therefore, a joint public and

private body may also be included as well as public bodies to study of Techno Centre management structure.

Table IV.4.1 Relative merits of public bodies and private bodies

Item	Public body	Private body
Fostering and securing people of talent		
HRD and Recruitment		○
(Shortening period for learning techniques and skills)		
(Ability to recruit high salaried people)		○
Human network		
(Links with regional industry circles)	△	△
(Links with international industry circles)		○
(Links with administration circles)	○	
Ability to improve demand (Business ability)		○
(Links between enterprises)		○
Adaptiveness to enterprise requirements		
(Ability to analyze enterprise requirements)		○
(Ability to change around a project)		○
Project continuity (Securing stable investment)	○	
Ability to support projects		
(Assistance measures with public funds)	○	

Notes: Circle: Superior, Triangle: Equivalent

There are two kinds of project formation ; one is to operate alone and the other is to commission. In both case the facilities, plant and equipment are owned by Techno Centre. The former (called the Total Management Type) is the case where a single body (regardless of whether it is a public or private body) implements the entire Techno Centre project. However, it is impossible for one private enterprise to have the know-how and technology for all centre projects. Even if all Techno Centre projects are carried out in the form of joint ventures (JVs), there is the problem of a projects not being carried out in fields where the allocation of profits coming from each centre and profitability are low. As a result, the original objective of synergistic effect from an organic association of six centres is reduced, and the development effect of the Techno Centre itself is also considered unlikely to yield adequate results. Therefore, this case has been ruled out.

The latter consists of the type where the owner of facilities and equipment rents rooms to a consignor and leases plant and equipment and the case where only the project is

commissioned (Figure IV.4.2). However, the Commission Type involves complications in establishing preconditions and at the same time, for the Techno Centre manager, may be expected to develop into a more unstable operation than the Lease Type (with major effects on the operation of facilities and plant and equipment).

Note that the sales promotion company is assumed to be a private organization because it requires a private enterprise sense most of all.

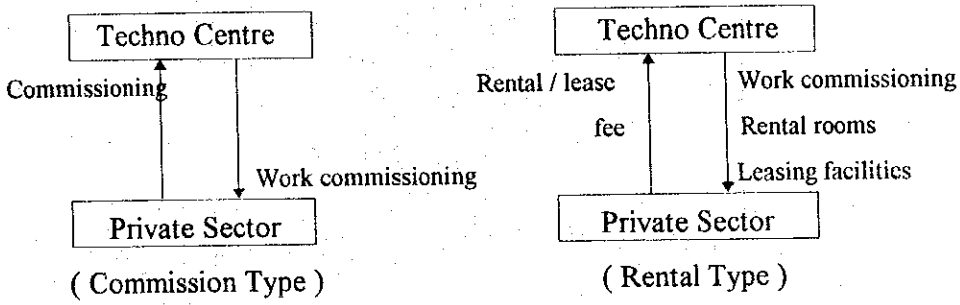


Figure IV.4.2 Relationship between Techno Centre and each centre

The management structures were set as shown in Table IV.4.2 and Figure IV.4.3.

Type 1 (Total Management Type) is the type whereby a public body carries out the entire project. Because it is difficult to foster people with a high degree of talent in a short period, project startup is delayed. However, it is relatively easy to receive public assistance.

Type 2 (Lease Type Management I) is where a public body purchases Techno Centre facilities and plant and equipment, manages the entire Techno Centre, and commissions private enterprises with the projects of each centre. At this point, for three centres (the Mechatronics Testing Centre, the Material Surface Analysis Centre and the Environment Analysis Centre), it is desirable that the work consignee simultaneously carries out the management of the relevant centre because specialized technology is required for the management of the facilities and plant and equipment prepared. For the other centres, the work consignee only carries out the project and does not manage the facilities or plant and equipment.

A private enterprise case may be hypothesized also for the management of the entire

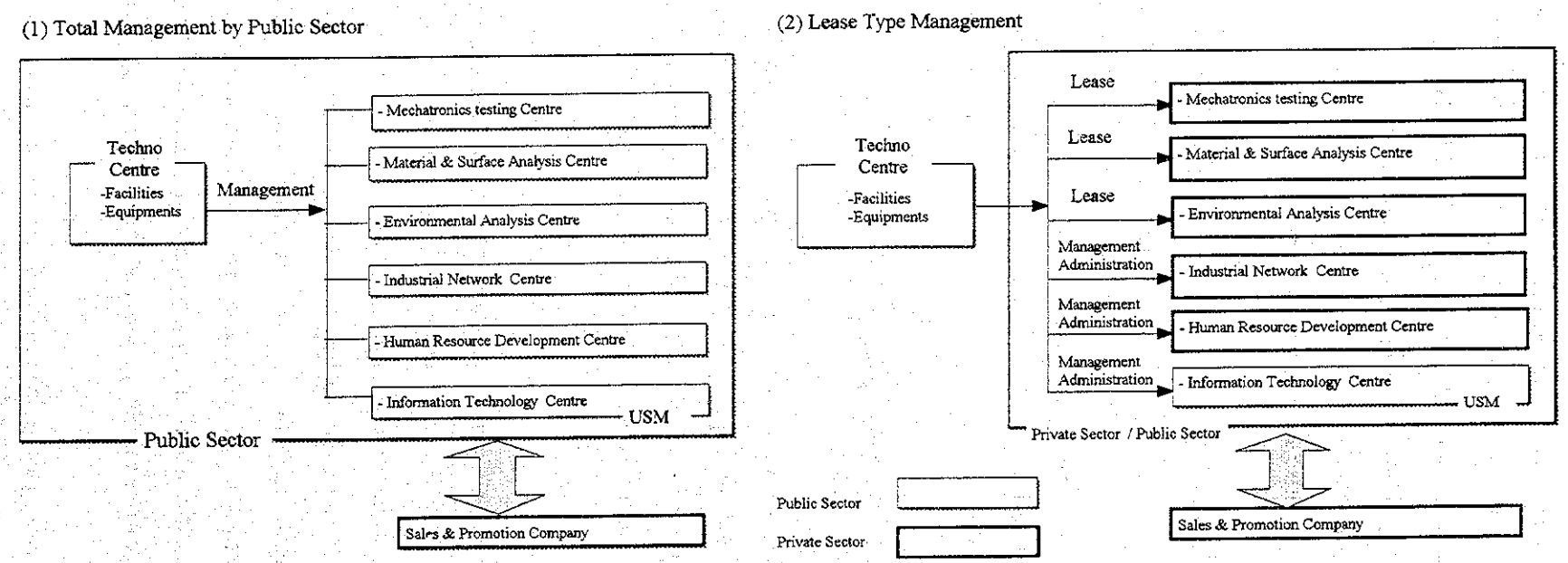


Figure IV.4.3 Techno Centre Operation Structure

Techno Centre and for the purchasing of the facilities and plant and equipment, but in the interview survey, no enterprise replied that they wanted or were capable of participating in this field because of its high risks. Therefore, it was ruled out as an investigation type.

Table IV.4.2 Techno Centre Management Structure

	Techno Centre facilities, plant and equipment purchasing and overall operation and management	Operation and management of each centre of Techno Centre	Characteristics
Type 1	Public	Public	The startup of each project is delayed, and it is difficult to foster people of talent in a short period. Project continuity is easy to secure and a project can be grasped over a long term span. Public assistance is easier to obtain than with other types.
Type 2	Public	Private	Public assistance is difficult to obtain because of the strong complexion as a private enterprise project. Superior in aspects of opening up demand and securing people of talent. Able to respond accurately to the requirements of the private sector When a problem arises in the operation or management of the Techno Centre overall, it is difficult to determine whether the problem lies with the public side or the private side.

(2) Implementation Structure of Techno Centre

Implementation is conducted by bodies and organizations involved with the projects carried out by Techno Centre and by boards that provide support and guidance.

The public bodies involved are the federal government, state governments, government-type research bodies such as SIRIM and MIMOS, and universities such as USM and UTM. Private bodies would be enterprises that have extended their businesses into the KHTP and peripheral enterprises, that will be involved with the exchange, guidance, advice and financial support.

The boards listed below must be set up. A detailed implementation structure is shown in Figure IV.4.4 and a detailed list of members is as shown in Table IV.4.3.

Board of Academic Science and Technology

The Board of Academic Science and Technology is the body that investigates and brings about specific responses and policies to the tasks listed below in promoting projects. This board is the kernel for liaising with the Techno Centre. Below it are technical committees that conduct the individual research of each centre, and a public board, industrial board and international committee that promote the projects.

Primary matters for investigation

-Investigation of Techno Centre projects for the promotion of process development and product development

-Specific investigations and selection of facilities and plant and equipment to be installed by the Techno Centre

-Survey research of testing and analysis requirements

-Future targeted industrial fields and directions in their accommodation

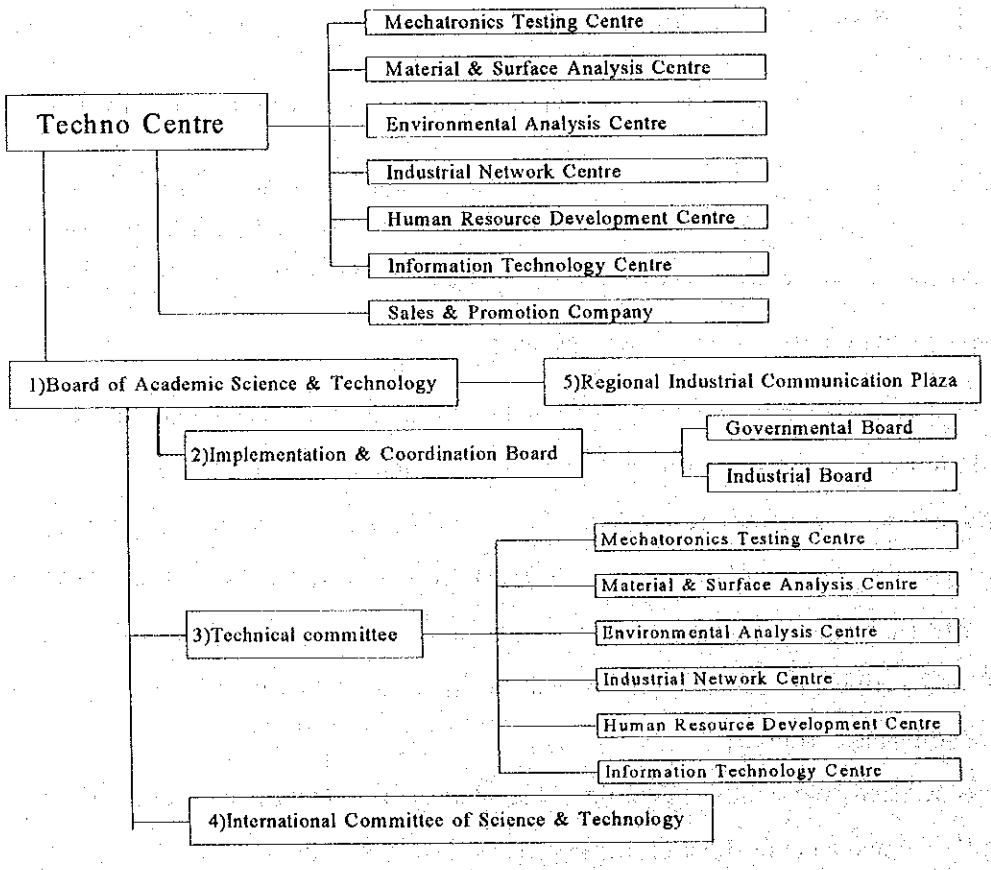


Figure IV.4.4 Structure of Techno Centre project promotion

Implementation & Coordination Board

The Implementation & Coordination Board is the board that investigates the direction of promotion and support of Techno Centre projects by the administration and industry. Below this are the Governmental Board for Techno Centre and the Industrial Board for Techno Centre.

Technical Committee

A technical committee investigates the direction of a project for each centre (six centres). This committee shall be consist of scientists and engineers in each field.

International Committee of Science and Technology

To widen the horizons of the international science and technology aspects, a science and technology conference consisting mainly of researchers and a science and technology management conference consisting of government officials will be set up. Each conference will exchange information on world trends in similar facilities to the Techno Centre, and as well as reflecting the information in Techno Centre projects, will investigate the possibility of project liaison and joint projects.

Regional Industrial Communication Plaza

The Regional Industrial Communication Plaza primarily creates opportunities for exchanges between regional industries and the Techno Centre. It raises the level of use of the Techno Centre by engaging in activities such as introducing the details of current Techno Centre projects and introducing the uses of plant and equipment provided, and their range of uses.

Table IV.4.3 Proposed members on each board & committee

	Government						Private		
	a)	b)	c)	d)	e)	f)	g)	h)	i)
1)Board of Academic Science and Technology	○	○	△	△	△	○			○
2)Implementation & Coordination Board	○	○	△	△	△	○	○	○	○
3)Technical Committee			△	△	△	○	△	△	△
4)International Committee of Science and Technology	○			△	△				○
5)Regional Industrial Communication Plaza		○	○ △	○ △	△	○	△	△	○

Note: Administrator (○), Engineer(△)

a) Federal Government (EPU,MOSTE,MIDA,MITI .,etc)
b) State Government (Kedah,Penang, Perak)
c) Governmental Research Institute (SIRIM, MIMOS .,etc)
d) University (USM, UTM, etc)
e) Kulim Techno Centre (Six Centres)
f) Related Organization (KSDC,KTPC.,etc)
g) Tenant in KHTP
h) High-Tech Companies in North Region
i) Industrial Organizations (Chamber of Commerce .,etc)

IV.5 Roles of Related Organizations

The roles of organizations related to the Techno Centre must be examined from the viewpoints of four different levels. These levels are, 1) Industrial Estate as the KHTP development level, 2) regional level such as Kedah, Penang, and Perak, 3) the Malaysian national level, and 4) the international level.

From the viewpoint of industrial estate development level, related organizations are considered as tenanted high-tech industries and R & D facilities, of which KSDC and KTPC are the current project nuclei.

The regional level, includes the Kedah State Government and the enterprises and public research institutions that are located in northern Malaysia.

On the national level, this project was a J/V between the federal government and the states and was not simply a industrial estate development, but has the possibility of having close connections with national industrial development and scientific and technological development. Therefore, the associated departments of the federal government and government-related research institutions and universities would be related .

On the international level, further research is required, but overseas research institutions and higher education institutions are related organizations. Further, if the operation of each centre in the Techno Centre described in the next section, in particular, the operations of three testing and analysis centres, are entrusted outside, the majority will be sought outside Malaysia. If that occurs, in anticipation of the proposal in the next section, private testing and analysis centres overseas can also be considered related organizations.

Next, if the connections between these related organizations and the Techno Centre are arranged in order, they are as indicated below.

From the viewpoint of the industrial estate development level, tenant enterprises (high-tech indusries) and R & D companies are users of the Techno Centre and are the core of the exchange network implemented by the Techno Centre. MIMOS and SIRIM (AMREC) which are to be located in the KHTP, are expected to cooperate as users in each project implemented by the Techno Centre (described below as cooperation in

exchange projects and the distribution of information). The KTPC and KSDC are the project promotion parent bodies for the construction of the Techno Centre and have responsibilities for construction (expense burden to be separately investigated). The KTPC and KSDC are also at the centre of operations of the Techno Centre (however, this is impossible under current staffing levels and budgets, requiring some action to be taken).

From the viewpoint of the regional level, the Kedah State government should be the nuclethe U.S. of one party; but, up to now, it has rarely participated directly at all. When the fact that the Techno Centre is expected to have an impact directly and indirectly on the development of the state and the fact that it will contribute to the industrial development in the IMT-GT (Indonesia, Malaysia and Thai growth triangle zone concept) which is being promoted in the northern states are taken into consideration, participation in the financial aspects and system aspects are considered to be necessary. The SIRIM branch office (Penang) is currently implementing calibration. The testing and analysis centres proposed in this report are generally regarded as centres for which calibration is not performed. Accordingly, the Techno Centre is assumed to be in a complementary relationship with the SIRIM branch office. Private enterprises located in the northern region are the the users of the Techno Centre. Their cooperation is expected as members of the workshops Industrial Network Centre. The Penang and Perak State governments are expected to cooperate in the Techno Centre, taking into consideration the IMT-GT mentioned above.

From the viewpoint of the international level, the USM is to participate in the project as an IT centre, and the UTM is to participate in the project as a higher education institution. At the construction stage, the central government departments of EPU and MOSTE are expected to coordinate the government departments involved. Since it is considered that it will be difficult for the KSDC and KTPC which are the parent bodies of the project promotion to meet all the expenses in the initial stages when investment is great, some financial support will be requested. Coordination of the many government departments involved in the operation stage will also be required. MIDA has been involved as the nuclethe U.S. in promoting foreign investment into KHTP up to now. Its role will not change greatly in the future , but it is expected to secure tenant enterprises (including R & D companies) for the Techno Centre. SIRIM (headquarters) is the body promoting not only R & D, testing and analysis, but also standardization such as ISO

9000, MS. This centre is attempting to carry out the recognition of world standards for the export of Malaysian industrial products by conducting testing and analysis, mainly of electronics. In that sense, its liaison and complementary roles are considered adequate. TPM, which is located in KL , is a specialized incubation body. This centre, however, is not considered to have incubation as a function on its own account. As mentioned above, enterprises that are incubated are generally considered to be small-to-medium size enterprises and small enterprises. Therefore, enterprises that have budded in the northern regions have a fairly tough time in moving to KL (TPM). In that sense, establishing an opportunity for incubation within the KHTP has meaning because the Techno Centre has rooms and equipment for lease. However, as mentioned above, the project itself is regarded as placing expectations on the MTDC, in relation to which it can be expected to liaise with TDM. This liaising will operate to facilitate the formation of a mutually complementary relationship.

The private enterprises located in KL and Selangor are expected to move to KHTP or to move some of their functions into the Techno Centre.

From the viewpoint of the international level, it is important to promote liaising with testing and research institutions outside the country or to actively promote their moving into the Techno Centre. It is important to form an environment in which R & D activities can be easily implemented by enterprises located in the KHTP or by high tech industries (including those already in the neighbourhood) that will probably move into the KHTP. Therefore, if these enterprises are financed by foreign capital, attracting the testing and research institutions (possibly as a branch) of their mother countries is assumed to make the R & D activities easier. Liaising with overseas higher education institutions and international associations is also extremely important in implementing R & D activities. The fact that groups of enterprises that can conduct the testing and analysis proposed at the Techno Centre are hardly present at all in Malaysia, and the fact that it coincides with the government policy to aim for privatisation , mean that liaising with overseas private testing and analysis institutions (including commissioned operations) is a matter of urgency. Private overseas enterprises are also potential investors in the KHTP, and may also become users of the Techno Centre.

The following table summarises the above.

Table IV.5.1 Roles of each body

	Each type of body	Relationship with the Techno Centre
Viewpoint of industrial estate development level	Tenant enterprises, R & D companies	Users
		Users, cooperation
	MIMOS / SIRIM	Parent bodies of project promotion, operation
	KTPC / KSDC	nuclei
Viewpoint of regional level	Kedah State government	Cooperation (financial support)
	SIRIM branch office	Complementary (cooperative) and liaising functions
	Private enterprises	Users
	Penang and Perak State government	Cooperation, liaising
Viewpoint of national level	USM / UTM	Project participation (liaising, cooperation,use)
	EPU	Project promotion (coordination)
	MOSTE	Project promotion (cooperation)
	MIDA	Project promotion (cooperation)
	SIRIM	Liaising / complementing
	TPM,	Liaising / complementing
	Private enterprises	Tenant
International level	Research institution	Tenant, liaising
	Higher education institution	Use (liaising)
	Private testing & analysis institutions	Use (operation of part of the facilities)
	Private enterprises	Users, tenants
	Associations, etc.	Liaising
	Foreign government	Cooperation