Prospects for the Development of a High Technology Industry In Cyprus

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Contents

1 ABSTRACT 1
2 EXECUTIVE SUMMARY 1
3 INTRODUCTION 1
4 CYPRUS 2
4.1 A BRIEF HISTORY 2
4.2 THE ECONOMY 4
4.3 THE ECONOMY TODAY 7
4.4 TOURISM IN CYPRUS 7
4.5 STATISTICS ON CYPRUS 9
5 HIGH TECHNOLOGY DEVELOPMENT IN OTHER COUNTRIES 11
5.1 ISRAEL 12
5.2 MALTA 17
EUROPEAN COMMUNITY 21
5.3 SINGAPORE 22
5.4 MALAYSIA 25
5.5 HONG KONG 32
5.6 CONCLUDING NOTES 33
6 PREPARING CYPRUS FOR TECHNOLOGY 39
6.1 TECHNOLOGY AND THE ECONOMY 39
6.2 CYPRUS – LOOKING INTO THE FUTURE 52
6.3 CYPRUS HIGH TECHNOLOGY PARK 66
7 CONCLUSIONS 70
8 APPENDICIES 72
APPENDIX I - STATISTICS ON CYPRUS 72
APPENDIX II - BACKGROUND INFORMATION ON PEOPLE 73
APPENDIX III - GROVE CONSTRUCTION 74
APPENDIX IV – CASE STUDIES 77
APPENDIX V - TECHNOLOGY EDUCATION - FLORIDA 82
APPENDIX VI – SOURCES OF ENVIRONMENTALLY FRIENDLY INFORMATION 83
APPENDIX VII - LIST OF INCENTIVES OFFERED BY INVESTIGATED COUNTRIES 85
APPENDIX VIII – FRAMEWORK FOR EVALUATING THE SUITABILITY OF THE ENVIRONMENT OF A COUNTRY FOR PROMOTING TECHNOLOGY ENTREPRENURSHIP (used by Massachusetts Institute of Technology): 87
REFERENCES 89

TABLE OF FIGURES

FIGURE 4.1 - ISRAEL INFRASTRUCTURE NETWORK. 15
FIGURE 4.2 - MALTA INFRASTRUCTURE NETWORK. 18
FIGURE 4.3 - SINGAPORE INFRASTRUCTURE NETWORK. 23
FIGURE 4.4 - MALAYSIA INFRASTRUCTURE NETWORK. 27
FIGURE 4.5 - HONG KONG INFRASTRUCTURE NETWORK. 32
TABLE 5.1 - COMPARISONS BETWEEN CYPRUS, MALTA, ISRAEL, SINGAPORE, MALAYSIA, AND HONG KONG. 34
FIGURE 4.6 – LAND COMPARISONS BETWEEN SELECTED COUNTRIES. 35
FIGURE 4.7 – POPULATION COMPARISONS BETWEEN SELECTED COUNTRIES. 35
FIGURE 4.8 – LITERACY COMPARISON BETWEEN SELECTED COUNTRIES. 35
FIGURE 4.9 – GDP PER CAPITA COMPARISONS OF THE SELECTED COUNTRIES. 36
FIGURE 4.10 - COMPARISONS OF PERCENT GDP SPENT ON DIFFERENT SECTORS OF SELECTED COUNTRIES. 36
FIGURE 4.11 – BUDGET REVENUES AND EXPENDITURES OF THE SELECTED COUNTRIES. 36
FIGURE 4.12 – PERCENT UNEMPLOYMENT RATE OF THE SELECTED COUNTRIES. 37
FIGURE 4.13 - PERCENT GDP REAL GROWTH RATE OF THE SELECTED COUNTRIES. 37
FIGURE 4.14 – IMPORTS AND EXPORTS OF THE SELECTED COUNTRIES. 37
FIGURE 4.15 – MILITARY EXPENDITURES OF SELECTED COUNTRIES. 38
FIGURE 4.16 – PERCENT GDP SPENT ON MILITARY EXPENDITURES OF THE SELECTED COUNTRIES. 38
FIGURE 5.11 – COMPARISON BETWEEN ETHIOPIA AND THE US USING THE PER CAPITA FUNCTION IN 1790 40
FIGURE 5.12 – THE EFFECT OF OUTPUT PER CAPITA WHEN TECHNOLOGICAL CHANGE IS INTRODUCED BETWEEN 1790 AND 1990 41
FIGURE 6.31 - CYPRUS HIGH TECHNOLOGY PARK NETWORK. 70

LIST OF TABLES

TABLE 4.1 - MALTA IMPORTS AND EXPORTS 1994 [4.31] 21
TABLE 4.2 – OUTLINE OF MALAYSIA'S LONG TERM PLANS [4.51]. 26
TABLE 4.3 - MALAYSIA'S TRADE WITH OTHER WESTERN EUROPEAN COUNTRIES [4.52]. 30

1 ABSTRACT

This project presents the history and current situation of Cyprus, as an introduction to Cyprus' economic status. An investigation of the management of technology in Israel, Malta, Malaysia, Singapore, and Hong Kong follows; these were chosen due to their developmental success and their similarities with Cyprus. Technology, as a common factor for their accomplishments, its importance on the economy, and implications are discussed. The conclusion of the study proposes changes for Cyprus and its treatment of technology.

2 EXECUTIVE SUMMARY

This project first covers the history of Cyprus and its current economic situation in Section 3 emphasising the economic dependence on the tourism industry. Through statistics, the tourism sector is compared to other areas of the economy, showing an apparent neglect on the development of the industrial and service sector.

In Section 4, the high technology sector is discussed, as well as its influence in Israel, Malta, Singapore, Malaysia, and Hong Kong. These countries compare to Cyprus by either their size or situation (political, economical, etc.) and are good examples of how the introduction of the high technology industry has changed their economies. A good understanding of the importance of high technology and its repercussions in a country's overall infrastructure and structure is developed to emphasise the transcendence of actively incorporating technology into a nation. This section has been developed to educate the reader to the recent changes the world has been experiencing, and to show the latest economic trends. In Section 5.2 the main focus of this project is developed, which is to propose changes in the economic structure in Cyprus to create a better and more stable environment. These changes involve concentrating on the high technology sector, stimulating the service industry, and promoting Cyprus as a conference hub for Europe, the Middle East, and Africa. Goals for the country are discussed and the pertinent procedures to achieve them are introduced. The underlying paradigm for all the goals is for Cyprus to become the most '*environmentally efficient*' country in the world.

The successful execution of the *masterplan* proposed, requires the close and planned collaboration between the government officials, the public and private sector, and the Cypriot community. It is necessary to build the appropriate infrastructure in Cyprus, such as a *High Technology Park,* that will allow the incubation of technology in Cyprus. These will act as a catalyst to promote the sustainable growth and economic development that will serve as the basis for Cyprus' welfare and that of its population.

3 INTRODUCTION

In recent years, Cyprus has managed to maintain a relatively high standard of living that has been mainly due to the increase and the development of tourism on the island.

Although tourism has supported the economy of Cyprus, as was seen in the Gulf War, it is a sector that is highly sensitive to political and external changes in the area. It is extremely important then for Cyprus to become economically independent from external disruptions and fluctuations.

One independent and less developed sector in Cyprus is that of industry. It is a more stable segment of the economy involving business interactions, both on the island and internationally. However, this sector is currently under increasing pressure due to the latest changes in Cyprus. This pressure will become even more apparent when Cyprus becomes part of the EU because of the obligations and requirements established by the Union and the economic level of the other member states.

This project examines the importance of technology and the possibility of the introduction of high technology in Cyprus. It *first introduces* the history and economy of Cyprus. It then *examines* what high technology is and what *positive effects* it has had on various countries. Finally, demonstrating that technology is invaluable, suggestions are made into the possible future changes in Cyprus and its present structure. Foreseeing that through Cyprus' immersion in the high technology, the country will increase substantially its future opportunities and guarantee its sustained growth.

4 CYPRUS

4.1 A BRIEF HISTORY

Cyprus has centuries of active history, as it has always been both a focal point of conflict, and co-operation of various civilisations. This is mainly due to its geographical location, climate, and culture of the island. The oldest known remains of settlements from cultural activity in Cyprus date back to the Neolithic Age (7000-3900 BC). The first settlers on the island were the Khirokitians.

During the Bronze Age (2500-1050 BC) Cyprus had its first taste of wealth due to the exploitation of copper. Soon, trade developed with the Near East, Egypt, and the Aegean, introducing cattle, horses, and bronze-making into Cyprus. A highly personalised pottery style was born promoting Cyprus' image. During the later stages of this period, sophisticated literature city-states were developed in Engomi-Alasia, Kition and other locations.

In 1450 BC the Egyptians, after a brief 50 year rule by the Hittites, began to dominate the island. Shortly after 1400BC, Mycenaean merchants from Greece reached the island. A mass migration of Achaean Greeks followed during the 12th and 11th centuries BC. To date, their influence dominates the island through the spreading of the Greek language, religion, customs, town planning, architecture, metallurgy, and pottery. Legend has it that the first Hellenes who settled in Cyprus were the heroes of the Trojan War. This period also introduced the first division of the island into seven city kingdoms including Salamis (the capital at the time), Paphos, Kition, and Kurion. Despite the future occupations that were to come, Cyprus has remained predominantly Greek in culture, language, and population.

During the Archaic and Classical periods (750-325 BC) Cyprus was ruled by the Assyrians (750-612 BC), the Egyptians (568-525 BC), and the Persians (525-333 BC). Between 333 BC and 325 BC the city kingdoms of Cyprus welcomed Alexander the Great, King of Macedonia, allowing Cyprus to become part of his empire. In this period Cyprus developed stronger contacts with the Hellenic world by taking part in the Olympic and Panathenaic Games, as well as by making a name for itself in sculpting in the Cities of Delphi and Lemnos. Pilgrims began to gather from all over the ancient world to worship the Goddess of Love and Beauty, Aphrodite, at the temple of Palepaphos.

Later, Mediterranean events moved Cyprus under the Hellenistic state of the Ptolemies of Egypt. They abolished the city kingdoms and unified Cyprus with Paphos as the capital. Prior to the birth of Christ, the expanding Roman Empire takes dominion of Cyprus. Paul, the Apostle, and the Cypriot Apostle Barnabas converted Cyprus into a Christian country; the second country to do so after Palestine. The Christian religion spread throughout Cyprus, and has remained so ever since. Three hundred years after the appearance of Christ, the Roman Empire splits into two, leaving Cyprus to be ruled by the Eastern Roman Empire known as, Byzantium.

In 1191 the self-proclaimed 'Emperor' of Cyprus, Isaac Comnenus, was inhospitable to the survivors of a shipwreck that involved ships of Richard, the Lionheart's fleet. Richard, in retaliation, defeated Isaac, and took possession of Cyprus. He married Berengaria of Navarae in Lemesos crowning her Queen of England. A year later, he sold the island to the Knights Templars who resold it, at the same price of 100,000 dinars, to Guy De Lusignan (deposed King of Jerusalem). The Frankish period (1192-1489) so began, bringing the Catholic Church in to replace the Greek Orthodox Church. The city of Ammochostos became one of the richest in the Near East.

The Lusignan period ended in 1498 when Queen Caterina Cornaro creed Cyprus to Venice. The expanding Venetian Empire, that was not to survive, held Cyprus for its strategic position that strengthened their commercial activity. Their rule over Cyprus was to last less than a century (1489-1571), but they were to leave behind many significant changes including the walls surrounding both Nicosia and Ammochostos. The latter was considered to have been a work of excellent military architecture at the time.

In 1571 the Ottomans occupied the island. Ever since this period, there has been a settlement of Turkish minority in Cyprus. In 1878 the Treaty of Berlin gave Cyprus to the British. By this the Ottomans attempted to secure British support in their conflict with Russia. In 1914 though, Turkey entered the First World War on the side of Germany. This allowed the British Government to annex Cyprus turning it into a Crown Colony in 1925. On Oct 1, 1960, after many struggles, Cyprus obtained its independence in accordance with the Zürich-London Treaty. The treaty included Cyprus' membership to the United Nations (UN), the Council of Europe, the Commonwealth, and the Non-Aligned Movement. However due to the unworkable constitution, friction developed between the two communities on the island involving both Greece and Turkey. Eventually, after the short-lived Greek coup against the government, Turkey invaded and occupied about 40% of the island.

On the 4th of July 1990, Cyprus submitted an application for full membership into the EU. Accession talks are currently underway.

4.2 THE ECONOMY

The history of the Cypriot economy, in terms of an independent country, dates back only to 1960 when Cyprus received it's independence from the British. The initial status of the Cyprus economy was poor, unstable, and dependent mostly on agriculture rather than on manufacturing. At the time, severe hidden unemployment (32%) and underemployment led to mass emigration. This economic instability also led to an outflow of financial capital, which further hindered the development of the economy.

In reaction to this status, the Cypriot government adopted the basic principles of planning that were embodied in Five-Year Development Plans. Between 1961 and 1966, the objectives of the First Five-Year Plan was to restore confidence in the economy by upgrading the economic and social infrastructure. The Second Five-Year Plan (1966 - 1971) emphasised the improvement of the standard of living of the population, and upgrading the social services.

The main objectives of the First and the Second Five-Year Plans were achieved and resulted in sustained growth, accompanied by conditions of external and internal economic stability. The agricultural production doubled and the industrial production, as well as, the exports of goods and services more than tripled. Tourism became the largest single foreign exchange earner. During the period between 1960 and 1973, the government also promoted major investments in infrastructure projects like dams, roads, airports, ports, electricity, communications, and so forth. Unemployment fell, reaching a level of 1.2% in 1973 and inflation during this period was on average 2.4% per annum. Consequently, the accumulated foreign debt in 1973 was relatively low, at a level equivalent to 7% of GNP.

The recovery of the Cyprus economy was not to last. In 1974 the Turkish invasion took place, resulting in the occupation of about 40% of the island. This not only disrupted the economy by the displacement of population and seizure of property, but it also led to the loss of the most productive lands in both agriculture and tourism. In addition to these misfortunes, were the loss of Famagusta - the only deep-water port of the island that handled over 80% of the general cargo - and the closure of the new Nicosia International Airport.

The invasion provoked an economic dislocation depicted by an 18% per annum decrease in the GDP for a two-year period. Unemployment jumped to around 30% of the economically active population, and mass poverty increased subsequently. The most counterproductive effect was that Cyprus returned to a dependence on foreign sources for raw materials, consumer goods, and financial resources. These changes fostered a feeling of political and economic uncertainty both at a local and international level. The immediate role of the Government was to provide relief assistance to the refugees, halt the slide of the economy, and lay foundations for the economic recovery of the island. Consequently, the intervention of the Government in the economy became more intensive and the financial aid came mostly from foreign sources reinforcing Cyprus dependence on external aid.

Fortunately, the results of the measures adopted by the government were positive and by 1978 full employment conditions had been re-established. From 1975 through 1981, the economic rate of growth averaged 10% in real terms annually due mainly to the foreign demand for goods and services. In an attempt to compensate for the lost productive capacity and the loss in economic and social infrastructure, Cyprus invested regularly more than 30% of the GDP in these areas. This led to new employment opportunities, and by 1981 the unemployment rate was down to 2.6% of the economically active population.

It is important to highlight that the recovery of the economy was not solely a result of the government's efforts, it can also be attributed to several other factors. Cyprus' geographical position in the Mediterranean gave it a logistic advantage in the booming Arab markets. In addition, the Lebanese crisis of 1975, favourable weather conditions during that period, and high international market prices. Another contributing factor was foreign aid.

Internally, the recovery of the economy can be attributed to the entrepreneurial capabilities of Cypriots. As the entrepreneurs took advantage of the rising export opportunities, the trade unions accepted a substantial cut in wage levels. This, in addition to the diligence, perseverance, the self-sacrifice and hard work of the people, led to these productive results. This success though had its price, since the increased dependence of the country on foreign financial resources. This was reflected by a relatively large and growing foreign debt (about 7% of the GDP in 1981) and inflationary pressures. Furthermore, the rapid recovery in conjunction with the world-wide rise in inflation led to large increases in domestic prices. The combination of all these forces required the government to take further action to control the economy encompassed on the Fourth Emergency Plan.

The Fourth Emergency Plan (1982-1986) was what the Government sought as a solution to the situation that threatened further progress. This plan aimed at restructuring the economy, focusing on capital rather than labour intensive projects while solving the problem of external and internal instability by pursuing a more restrictive fiscal policy. The results surpassed the objectives and targets of the plan, for example the GDP, that had a growth rate in the plan of 4% per annum, was in actuality 6%, which can be attributed to the performance of tourism on the island. Unfortunately, not all goals were achieved manufacturing, for instance, due to the export segment was lower than expected. Unemployment continued to rise at 2.5% per annum and in 1986 it reached 3.7%, depicting the imbalance of the supply and demand of the labour market. Inflation rapidly fell to a low of 1.2% in 1986.

During the latter part of the plan (1987 - 1988), due to the context implementation of the Customs Union Agreement with the E.U, there was a reduction in import tariffs. This led to a rapid export growth in the economy, which in turn further created a large number of new employment opportunities reducing unemployment to 2.8% by 1988. Imports themselves were also affected and rose to a level lower than the total demand, and in 1988 imports eliminated the current account surplus of 1987.

The Fifth Development Plan (1989 - 1993) was set up to balance sectorially and regionally high growth under conditions of economic stability in price level and Balance of Payments. Its major objectives depended on the technological upgrading and the enhancement of competition in accordance to the Customs Union Agreement between the European Union and Cyprus and the subsequent agreed gradual dismantling of trade barriers.

In 1991 the world witnessed the Gulf War, even though it caused a substantial fall in the economic growth in 1993, the major quantitative developmental targets were achieved. The demand in private consumption increased, as well as the growth rates in the private service sectors such as: telecommunications, financial institutions, insurance, business, and social services. Tourism, on the other hand, was subjected to various fluctuations displayed in its unreliability and sensitivity to its surroundings. The agricultural results were below the expectations, as a result of the structural weakness of the system, the deterioration of competitiveness, and abnormal weather conditions. Unemployment, which was particularly severe in 1990, caused changes in the Government policy, leading to a rise in foreign workers from 1.5% in 1988 to 5% in 1992.

During the 1994 to 1996 period, the growth rate displayed large fluctuations. According to the Plan, the demand rate of growth should have been driven by the external demand, rather than private consumption. Behind the target was the requirement for investment, as well as the restructuring in favour of machinery and equipment. The difference between domestic savings (fall) and investment expenditure (rise) widened, indicating increased dependence on external sources for the financing of investment. The rate of improvement of labour productivity was contained to 1.8% on average between 1994-1996, though the target had been planned at 2.8%. This development indicated a deviation from the intention to utilise high technology and modern methods of management, design, production and marketing. This resulted in a decline in the export sectors, particularly in manufacturing. The rate of increase in labour costs was lower than the estimated, but above those displayed by the E.U.

Summarising, the targets that were achieved in this period were the rate of growth of G.D.P., the rate of unemployment, and the rate of inflation. The structure of production, particularly in manufacturing, the fall in domestic savings as a percentage of G.D.P., the restrained increase in productivity, and the widening deficits of the current account all deviated from the targets of the Plan.

4.3 THE ECONOMY TODAY

Today, Cyprus is preparing for accession into the EU. The Cypriot Government has therefore taken steps to restructure and modernise the Cyprus economy. In its Strategic Development Plan (1994-1998), it has concentrated on three principle objectives:

1) Encourage Cyprus / EU relations over and above the Customs Union Agreement (see Note #1), gradually adjusting to the Acquis Communautaire according to the criteria set by the Maastricht Treaty, to continue accession negotiations.

2) Promote a change in the Cyprus economy toward competitiveness and modernisation to achieve a satisfactory growth rate by the technological upgrading and restructuring.

3) Develop the environment and culture, and the general quality of life in Cyprus.

Note: The Customs Union Agreement is the main factor shaping the business environment by setting up most of the rules in the business world. It is a promoter of globalisation.
Among the strategic objectives specified for developing the economy was the specialisation in new products with export potential, the wider use of advanced technology, and the institutional harmonisation with the EU. In regards to the manufacturing sector, co-operation between enterprises is promoted due to the small size of the majority of the industrial units. Attention is also placed on exports, new markets, and market niches. The encouragement between social partners is essential to promote new technology, and to adopt modern methods of production and management. As Stefan Wagstyl proposed: "Increasingly, companies are seeing alliances as an alternative to the risk and expense of acquisition and the slow process of growing business from scratch". Simultaneously, there is the objective of full utilisation of the native and local sources of labour including the encouragement of the return of Cypriot expatriates, in order to reduce foreign employment.

4.4 TOURISM IN CYPRUS

Tourism has played a major role in the island's economy. Even today the number of tourists coming to Cyprus is on the increase, although the rate of increase is lower than the past. This is a good sign insofar as the interest in Cyprus is concerned. The 'quality' of tourist also has changed and is increasingly consisting of 'cheaper' tourists (tourists that are not spending as much during their stay in Cyprus). This is clearly depicted by the fact that the number of tourists in 1995 increased by 1.6% compared to the previous year, while the estimated revenue remained at the 1994 level. It is also good to point out that the majority of tourists were from the professional, technical and administrative occupational groups, coming from the middle income class and mostly between the ages of 30-55. This is important as it shows us that people come to Cyprus for business also, which is a fact that should be considered as a high tech industry is contemplated.

Although tourism has boosted the economy of Cyprus, it is also a sector that can be affected significantly by changes in the region, as happened during the 1991 Gulf War. In 1990 there were 114,377 excursionist arrivals, in 1991 the number dropped to 88,083 (a fall of 23%), total tourism arrivals diminished by 11.3%. Considering that in 1995 tourism represented 40.1% of the total receipts from exports of goods and services, this variability had a definite impact on the economy. In addition, the tourist industry has come to a stage that it has saturated the island and, in some cases, has destroyed the natural beauty of the island.

If Cyprus were to continue to promote tourism, it would have to change the way Cyprus itself is promoted. The danger seen in the present situation is the growth of cheaper tourists; with the cost of living on the increase, and the economy in an acceptable shape, will these tourists be able to account for this current trend in the future? It would only seem that in order to maintain the same profit level, more tourists would have to be attracted to Cyprus, which would in turn, force the construction of more accommodations and hence, result in additional destruction of the environment. This is a vicious circle that will make things worse.

Cyprus must, in the future, offer something exceptional and extraordinary like ecotourism. The world is changing continuously, and one of the most sensitive subjects today is the environment. Tom Peters in his book "IN SEARCH OF EXECLLENCE", it states ‘Clean and green engenders growth, profit and lasting competitive advantage’. Businesses today use the phrase ‘environmentally friendly’ as an advantage, or promotional tool for their products. World-wide, countries recycle, and stricter laws on waste have been placed on companies. The concern for the environment has never been more significant to society as today.

The tourism industry, if it is to survive, and develop in the future, must concentrate on the environment. The replacement of old underused hotels should be renewed through an ecostructural approach. The expansion of new facilities should be limited to certain areas, and these restrictions enforced. The new developments are to incorporate structures that, not only compliment the environment, but also are most efficient in their usage. This means that the systems used like air-conditioning units, heating units, and the like, work under conditions that are most beneficial to the environment. The goal would be to create a hotel industry that is ‘environmentally friendly’.

The benefits of the ‘environmentally friendly’ goal are many, and compliment not only tourism, but other economic sectors as well. For tourism it would be a powerful promotional tool that, if marketed correctly, will bring people from all over the world.

There is an increasing trend for holidays to offer an escape from noise and air pollution of their everyday life in the cities and industrialised areas. These people are willing to spend their money, and would be willing to return in the future, if the holiday place offers peace, harmony and tranquillity. With this in mind, an aim could be for the beaches of Cyprus to become cleaner (programs can be developed to achieve and sustain this objective), in order that they obtain the 'Blue Flag' certification which will help boost promotion from the travel agencies. Certifications of this type also help hotel owners to obtain loans locally and internationally due to the high environmental standards of the area (very important for the hotel industry). A cleaner environment will also reflect on a better quality of holiday in the eyes of a tourist, and their view on the Cypriots themselves. The attraction will not be limited to tourists vacationing, but also specialists who are interested in learning more about the systems running the hotels. This in turn can promote special conferences on various subjects like 'Efficient Water Treatment Systems', 'Using Solar Energy in the Hotel Industry', 'The Advantages and Disadvantages of Ecotourism on the Tourist Industry' and many, many more. Ideally, Cyprus can become not only a living example, but also an experimental base for environmental projects that are to be implemented throughout the Middle East and other areas of the world that are of similar climate.

The goal of an '*environmentally friendly*' place should also involve educational institutions that can perform the research, development, and production necessary for the development of these systems. Naturally this will involve the industrial sector of Cyprus, as they will be involved in the construction and testing of these systems. The development of distillation plants or biological treatment plants would save energy in buildings and produce the much-needed water for the gardens and plants of Cyprus. And this type of project will continue its domino effect into other areas of the community. And most importantly of all, these changes will give the people of Cyprus something to be proud of. What has been listed is just a brief list of ideas that support the proposed argument. There are other projects that can be undertaken to change the direction in which Cyprus is heading in respect to the tourism industry.

4.5 STATISTICS ON CYPRUS

The latest statistics of Cyprus that are in circulation are mainly of the year 1995, with the exception of Foreign Trade. For the definitions of term used, please refer to Appendix A.

erring to the Census of Establishments, Volume 1, published by the Ministry of Finance's Department of Statistics and Research, the main findings can be summarised as followed:

1) A total of 64,932 establishments were enumerated; an average increase of 4.1% per year since 1989. With the exception of mining and quarrying, the number of establishments rose in all sectors.

2) The number of enterprises rose to 58,226, resulting in an average increase of 4.2% annually since 1989.

3) The average size per enterprise decreased to 4.3 persons from 4.6 persons in 1989; 56% of the total enterprises comprised of only one person, 95% of the total enterprises employed less than 10 persons, and less than 1% of the enterprises employed 50 or more persons.

4) The main sectors that employed persons were wholesale and retail trade (almost 27% of the total), the community social and personal services (25%), manufacturing (13%), and hotels and restaurants (12%).

5) Employment rose in all major sectors aside from mining, quarrying, and manufacturing. The largest increase was a 7.9% increment in financing insurance and business services followed by hotels and restaurants (with 5.6%), transport (with 4.8%), and wholesale and retail trade (with 3.7%).

6) Manufacturing was the only sector with a considerable loss of employment (almost 3800 persons, an average of 1.4% per year). This was mainly absorbed by the clothing and footwear industries.

7) The number of women entering the labour market is continuously on the rise reaching a total of 39.4% of the total labour force.

The Census of Establishments, Volume 2, published by the Ministry of Finance's Department of Statistics and Research, with the following data:

1) 38% of all establishments were located in Nicosia, 29% in Limassol, 16% in Larnaca, 10% in Paphos, and 6% in the district of Famagusta. Of the total, 71% of the establishments were located in urban areas.

2) The greatest growth of employment was in the Famagusta and Paphos areas (7% and 6.6% respectively), and the smallest increase of 1.6% was in Larnaca.

3) Employees in Offshore companies rose to 3,875, 50% belong to foreign nationals while the other 50% are Cypriot personnel. 58% of the offshore companies are located in Limassol, while 34% are located in Nicosia.

4) The offshore companies main sectors of economic activity were the wholesale and retail trade (59%), finance and business services (25%), and transport (10%).

5) The number of foreign workers has been rising substantially over recent years. It was almost five-folded in 1995 compared to the figures of 1989. About 1/3 of the foreign workers were employed in personal services (particularly as domestic servants), while a comparable percentage were employed in the sector of trade, restaurants and hotels. 10% were employed in manufacturing.

Regarding Labour Statistics for 1995, the Ministry of Finance's Department of Statistics and Research provides the subsequent information:

1) Employment increased by 3.4%
2) Foreign workers accounted for 8.5% of the total working population.
3) Unemployment remained at around 2.6%
4) The rate of increase of wages was lower than the previous two years at 6.6% (largest increases being in financing). The median monthly salary increased to CY£562/month up from CY£532/month in 1994.
5) Normal hours of work were reduced to 39.1 per week compared to 39.2 in 1994.

According to the data presented by the Ministry of Finance's Department of Statistics and Research, Foreign trade was subject to the following variations:

1) Total imports rose by 11.2% (to CY£ 1,857mn)
2) Total exports rose by 16.8% (to CY£ 649mn)
3) Trade deficit rose by 8.4% (to CY£ 1,208mn)
4) Imports for home consumption rose 9.2% (to CY£ 1,456mn)
5) The EU countries supplied CY£ 902mn worth of goods (CY£ 862.8 in 1995), but decreased in the percentage of total imports to 48.5% (from 51.7% in 1995).
6) Domestic exports fell to CY£ 228.5mn (down from CY£ 238.6mn), while re-exports rose sharply to CY£ 420.6mn (up from CY£ 316.9mn in 1995).
7) The EU countries absorbed 57.2% (CY£ 126.6mn) of Cyprus domestic exports (down from 60.8%), while the Arab countries accounted for 19.8% (CY£ 43.8mn), up from 18%.

Please refer to Appendix I for more detailed information and graphs on the above information.

5 HIGH TECHNOLOGY DEVELOPMENT IN OTHER COUNTRIES

According to the Institute of Technology in Nicosia, the definition of high technology is:

> *High Technology is the industry that, through innovation and novel ideas of individuals, generates new products or services that benefit existing operations, and open up new markets.*

High technology companies are enterprises engaged in activities or in the production of goods in areas of new and emerging technologies. This includes engineering, pharmaceuticals, food, medical, and others. The basic principle of high technology is *not* that it must add a very high value to the service or product as profit, but *rather the value* *requested be highly competitive and enhances productivity and cost efficiency to the purchaser.*

In order to analyse the advantages of the high technology industry and its infrastructure, case studies of what other countries have accomplished with the introduction of high technology and how they have been able to do it successfully will be studied. The countries discussed here are Israel, Malta, Singapore, Malaysia, and Hong Kong as an independent body due to their location, position, economic history, or success in the high technology field.

5.1 ISRAEL

Israel started out as a largely collectivist economic system, and expanded into the marketplace through a slow and steady process of liberalisation. The Israeli industry began naturally with agriculture and defence to gain self sufficiency in the supply of food and to endorse security and stability. These goals were greatly surpassed and today they are known *internationally* in the fields of irrigation and conservation technology, aeronautics and telecommunications, and state-of-the-art radar systems and weaponry. Israel has welcomed the information age by developing, and keeping up to date their industries, and has revolutionised their technological sector by the efficient utilisation of their human resources and advanced R&D capabilities.

Due to the high technology industry, the export of goods and services reached US$31.3 billion in 1996-the highest per capita exports in the industrial world. High technology today is 66% of the Israel's industrial output, and 60% of the total industrial exports. Israel's economy today is an export driven economy; the ability to sell and succeed in the international marketplace depends on their products being better priced and more innovative than those of their competitors. The future growth of Israel's economy depends on the growth of the industrial sector. The Israeli government has formed policies that offer well sponsored investment incentive programs. The government believes that the needs of the high technology industry can be met by a combination of a strong academic infrastructure along with their support for R&D;

> "The concept is simple; by sharing the risks involved in pursuit of the state-of-the-art research and development with the industry, the government has created a means for such industries to flourish" - Dr. Yehoshua J. Gleitman, Israel's Chief Scientist [4.41]

One of the factors contributing to the successful development and support of the high technology industry in Israel is a culture that emphasises education. This has led to the development of a good school system highly complimented by universities and institutes of science and technology. The Israeli's institutes of higher learning are focusing more on applied research and less on fundamental research.

Their current status has been reached in part, by the influx of almost one million former Soviet Union immigrants. These immigrants have helped increase the percentage of engineers in the Israeli population to 6%; the highest in the world. With this highly educated labour force, Israel now has the qualified manpower for scientific and technological applications. This multinational mix of the population has contributed to the development of the economy as many researchers have brought with them a variety of past experiences and thought processes acquired in different parts of the world. As a consequence, the Israelis were also given an advantage by becoming 'more open' to change and more willing to offer foreign investors the opportunity, equity, and participation to fund profitable local ventures. This has moved them from their traditional way of thinking based on the principle of 'If you have something good, keep it to yourself' [4.42].

The Israeli government places importance on international industrial R&D co-operation. This is mainly due to the advantage of the reduction of costs and risks involved. It also enhances the operating, marketing, and development of the product in those international markets. Today, there are more than 50 venture capital firms in Israel, with over US$ 2 billion under management, while eight years ago, there was only one venture capitalist fund with US$ 30 million. This can be accounted to the exemption of Israeli capital gain taxes for foreign investors, says Finance Minister Yaacov Neeman [4.42]. This has attracted some of America's best known investors: AT&T pension fund, Massachusetts Institute of Technology Endowment Fund, Boston Hancocks Ventures and Chase Capital. This has also created an effect within the industry of take-overs and mergers; Cordis, a wholly-owned subsidiary of Johnson & Johnson has merged with Biosense Inc. (in Haifa) with an estimated US$400 million of Johnson & Johnson shares. Seimens paid US$30 million for Ornet. American Applied Materials Inc. purchased Orbot Instruments for US$285 million. Using the Bi-national Research and Development (BIRD) Program, Israel has developed strong business partnerships with many U.S. companies. The number of Israeli companies on Wall Street is over 100, and, after Canada, it is the second largest foreign representation, well ahead of Germany and Japan.

Israel has the advantage of offering most of the research being done in-house. For example, the Federal Drug Administration has approved Israel's hospitals for clinical trials. This has attracted multinational companies like Merck, Bayer, and Hoffman LaRoche to profit from the world-class reputation that these hospitals enjoy in the international medical community. The advantages found in having things done in-house are the speed at which results can be obtained, the easy interaction between researchers of different disciplines, and the amount of revenues that can be made.

> "*Clinical trials are a tool for creating funds for research and development. Large companies like Bayer and LaRoche have budgets greater than that of Israel and it is a substantial business for the hospital. Working with these companies exposes our staff to international expertise.*" says Gad Gilat, Professor of Science and Co-ordinator of Clinical Trials at Asaf Harofe Medical Center, and later added "*A department head may organise trials which earn a profit for the hospital of 40-50% of the budget*".[4.42]

In 1996, each electronic engineer produced sales of US$800,000, mostly in exports. Therefore an additional 1000 engineers could lead to a growth in exports of US$800 million [4.42]. But with such an expanding high-tech industry, the need for engineers has exceeded the supply of engineers, presently Israel's institutes of higher learning are graduating about 1,300 engineers and computer specialists a year. The Israeli Industry and Trade Ministry has estimated the shortage of high-tech labour to be over 3000 engineers [4.42]. Israel has therefore started looking for skilled staff from foreign Jewish communities to meet its growing shortage of high-tech workers. The Jewish Agency, acting alongside companies such as Intel, IBM, and Tower semiconductors is helping to seek new engineers and programmers by tempting skilled people to immigrate to Israel. Figure 4.1 shows the Israeli infrastructure network for the support of its high technology sector.

Explanatory Notes:

1) Office Of Chief Scientist (OCS) – Under the Ministry of Industry and Trade, the OCS is responsible for implementing government policy regarding support and encouragement of industrial research and development (R&D).
2) Israeli Investment Center (IIC) – promotes the production capacity, efficient utilisation of economic resources and capabilities, and full use of existing plant's capacity; It encourages growth in the Israeli economy by concentrating on the implementation of government policy and supporting the establishment and operation of technological incubators. It also improves the balance of payments by reducing imports and increasing a) exports, b) immigrant absorption, c) planned dispersion of population d) job creation.
3) Center for Business Promotion (CBP) – Responsible for publicising the advantages of Israel.
4) Israel Center for Industrial Research and Development (MATIMOP) – promotes the development of advanced technologies in Israel and on creating fruitful partnerships through industrial co-operation, joint ventures and contract R&D.
5) Center for Assistance in Innovation and Invention – Active within the framework of MATIMOP, it assists both Israeli and new immigrant scientists.
6) Law for the Encouragement of Industrial R&D (1994) -This law has been set up to bring in know-how and create jobs in the local market while keeping control of what is created in Israel. It encourages and supports industrial R&D.
7) Israeli Export Institute (IEI) – a public non-profit organisation that provides information and instruction for exporters and manufacturers who are trying to enter foreign markets. They promote exports by organising exhibitions abroad and sponsoring overseas activities.
8) Bi-National Israel-American Industrial Research and Development Fund (BIRD-F, est.1977) – a capital base of over US$ 100 million contributed by the Governments of Israel and the US. It has been set up to support and encourage industrial co-operation between Israeli and American companies. A board of governors, including Israeli and American government officials, oversee the activities.
9) Center for Technological Initiative – encourages and supports the establishment and operation of technological incubators.

10) Other Governments – signed agreements between the Israeli Government and other Governments to advance industrial R&D.
11) Canada-Israel Industrial R&D Foundation – a bi-national fund with CAN$ 3 million to support joint projects submitted jointly by Canadian and Israeli companies.

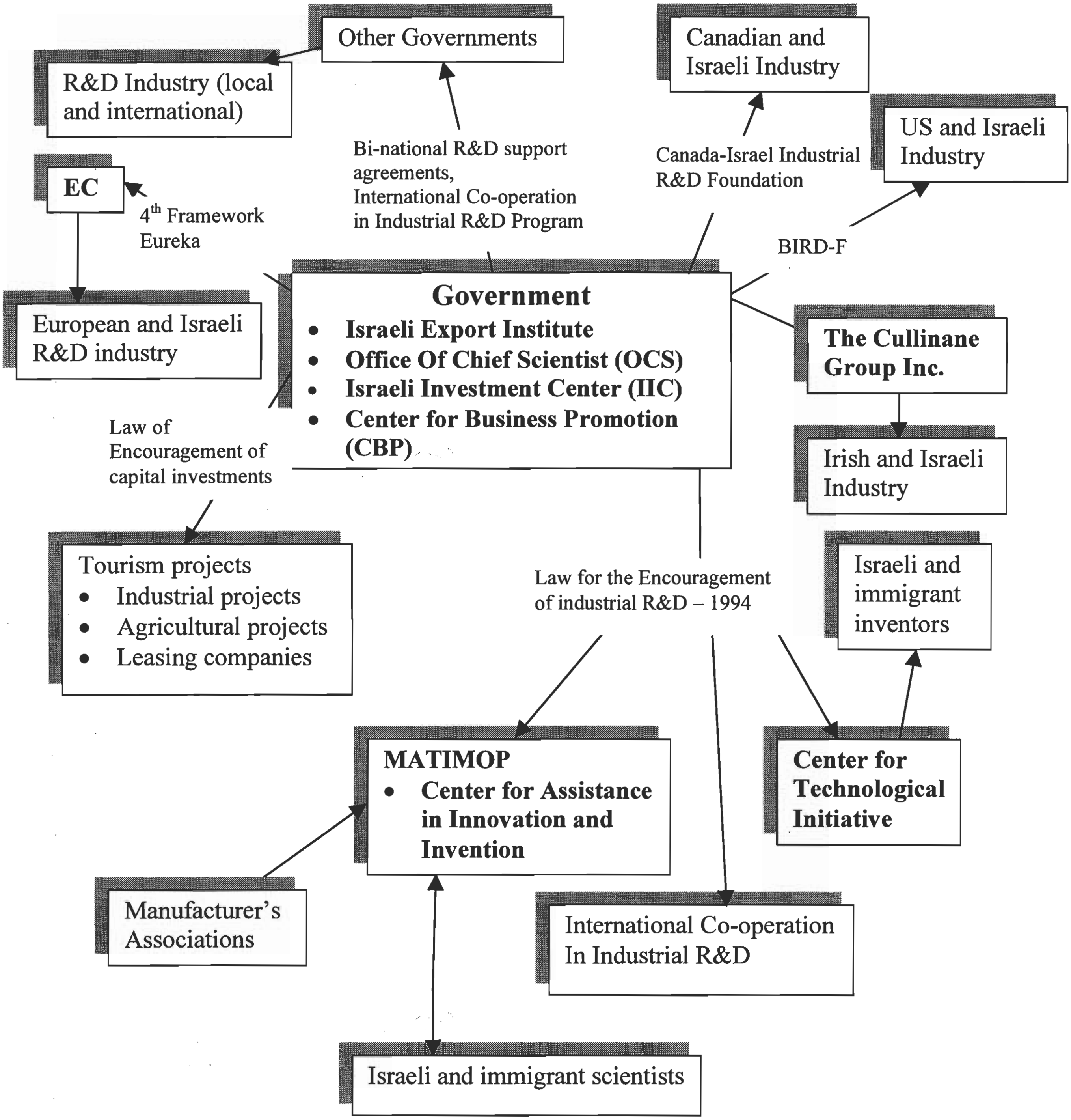


FIGURE 4.1 - ISRAEL INFRASTRUCTURE NETWORK.

The Ministry of Industry and Trade operates the Israeli Investment Center (IIC) and the Center for Business Promotion (CBP) to attract investments and channel them into areas of potential growth. The IIC promotes the establishment of the Israeli infrastructure by expanding industrial enterprises, agricultural projects, and the construction of factories, hotels and tourist enterprises. The CBP focuses its efforts to attract foreign investors by publicising the advantages of Israel.

Within the Israeli Government there is the **Office of Chief Scientist** (OCS). This body is responsible for the signing of **Bi-National R&D Support Agreements** between Israel and countries like the U.S.A., Canada, Austria, France, Holland, Portugal, Singapore Spain, and with EUREKA. The OCS has signed an **International Co-operation in Industrial R&D Program** with many countries to provide access to technology and know-how that is otherwise unattainable. This program is between two companies; one local, and one foreign, and is supported by both governments. The OCS also creates market feasibility studies and aids the transition from R&D to sales for start-up companies. It receives assistance from MATIMOP.

EUREKA is a prestigious program consisting of the participation of 22 European countries on international research projects.

MATIMOP is highly active in the implementation of the bilateral agreements for joint industrial R&D. MATIMOP is the main technology clearinghouse in Israel serving business seeking international co-operation. Within its framework is the **Center for Assistance in Innovation and Invention** that assists both Israeli and new immigrant scientists in the earliest stages of their projects. The OCS, the Ministry of Science and The Ministry of Absorption established this centre.

Bi-national Industrial R&D Foundation (BIRD-F) has been set up between the US and Israeli governments to promote R&D between the two countries by granting up to 50% of R&D expenses (up to US$1.5 million). It has a capital base of US$100 million, contributed by both governments.

Canada-Israel Industrial R&D Foundation (CIIRD-F) – Funds project up to 50% of R&D expenses of joint projects between Canadian and Israeli companies.

The Cullinane Group Inc. invests in emerging high technology companies in the both the Republic of Ireland and in Northern Ireland. Realising the similarity between Ireland and Israel, the Cullinane Group encourages joint ventures and business partnerships, and would like to establish a similar program as the BIRD Program.

The **Law for the Encouragement of Industrial R&D 1984** - was divided into the following areas;

a) Grant options
b) Assistance for Technological Incubators
c) Establishing Industrial Incubators
d) R&D projects carried out as sub-contractors.

e) Pre-Industrial Projects within the Framework of Academic Institutions.
f) Absorbing new immigrant scientists in Research Institutions serving Israeli Industry.
g) Market research and feasibility studies for Industrial R&D.

The **Law of Encouragement of Capital Investments** (1959-1997) served as a catalyst to accelerate the growth of the Israeli economy. It defined physical areas and special advantages to investments made in those areas in the form of grants, reduced taxes, accelerated depreciation, tax exemption, low rent etc. It concentrates in tourism projects, industrial projects, agricultural projects, leasing companies.

The **Center for Technological Initiative** (Incubator Program) operates under the OCS to create an atmosphere for entrepreneurs to work and develop their ideas. Within two years, the idea must be ready to operate independently. Each incubator is independent and legally non-profit, and the project is assisted voluntarily by experts in the field willing to provide their time, expertise and experience. Aid is also provided by the support of research from industrial or academic institutions.

In 1994, Israel was negotiating with its EC counterparts to allow Israeli companies to participate in the EC R&D program (4th Framework)**. In the same year, over half of Israel's import came from the EU, while just under a third of the exports were destined for the US.**

5.2 MALTA

Malta consists of three islands- Malta, Gozo and Comino, totalling an area of 316 square kilometres. Although the population of Malta is around 360,000, there has been a recent increase due to the return of Maltese who had previously emigrated to America, Canada, Australia and the United Kingdom.

The telecommunication system in Malta is one of Europe's most advanced including a full satellite direct dialling system. Housing standards are high, good quality office space and hotel accommodation is available. Tourism peeks at around 800,000 per year, and it has established a host centre for international agencies such as Regional Oil Competing Centre, the International Ocean Institute and the Foundation for International Studies. Figure 4.2 shows the Maltese infrastructure network for the support of its high technology sector.

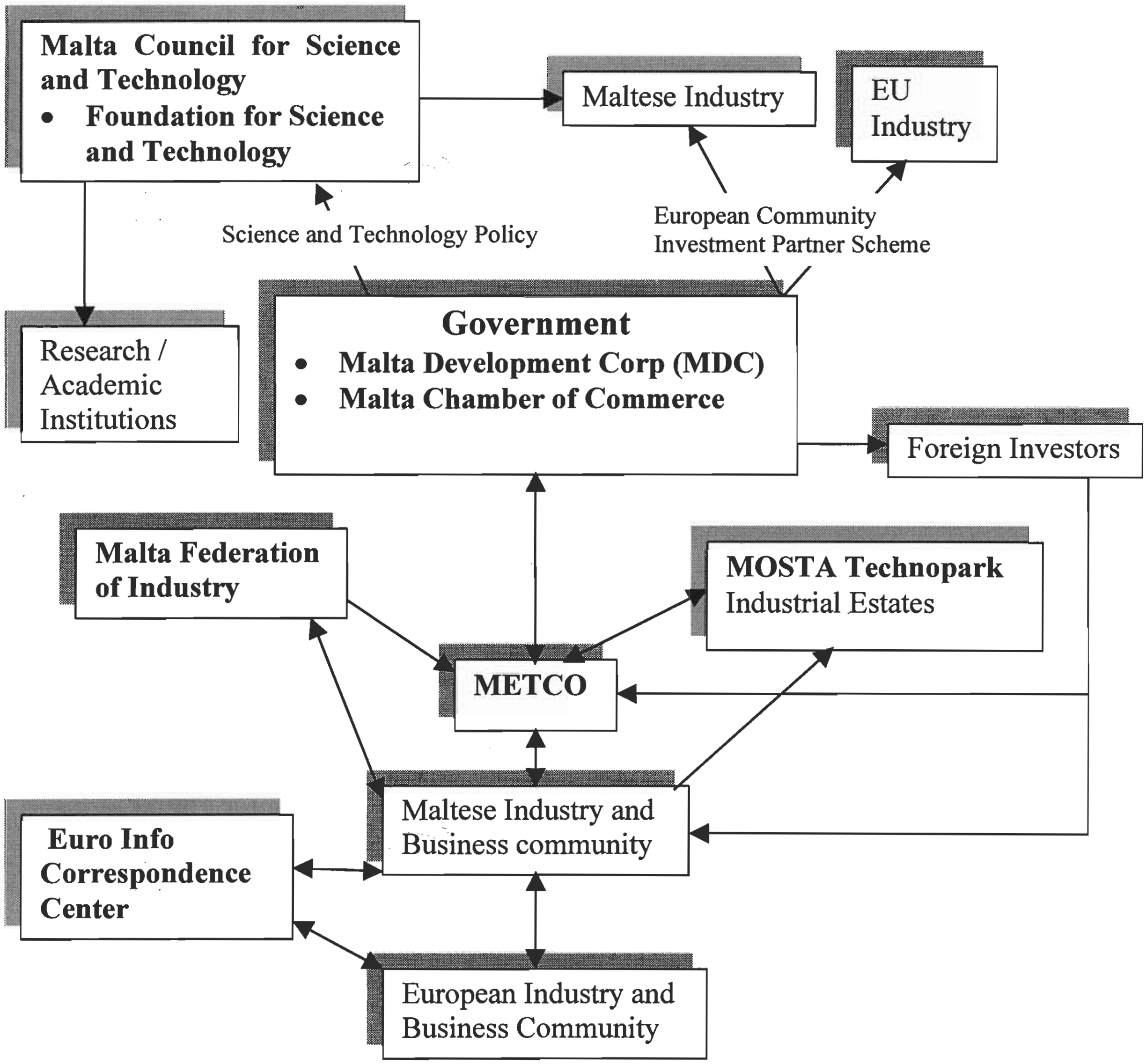


FIGURE 4.2 - MALTA INFRASTRUCTURE NETWORK.

Explanatory Notes:

1) Malta Development Corporation (MDC) – responsible for the implementation of Malta's Economic Development Plan.
2) Malta Chamber of Commerce - promotes and protects business interests in Malta.
3) Malta External Trade Corporation (METCO) – Serves as a national focal point for trade promotion and export development. It acts as an advisor to the government on international trade matters.
4) Malta Federation of Industry – represents the private sector in Malta.
5) MOSTA Technopark – industrial park offers advanced levels of factory premises targeting electronics and information technology companies.
6) Malta Council for Science and Technology (MCST) – Governing body of the FST. It co-ordinates enhancement and direction of science and technology and is guided by the Science and Technology Policy 1994.
7) The Foundation for Science and Technology (FST) est.1988 - Acts as the national advisory body to the government on science and technology related issues.
8) The Science and Technology Policy - set up by the government to promote science and technology in to the Maltese community.
9) European Community Investment Partnership Scheme (ECIPS) – A funding Programme to encourage joint ventures between Maltese and EU companies.
10) Bureau de Rapprochements des Enterprises (BRE) – run by the EC.
11) Euro Info Correspondence Center (EICC) – Promotes BRE.

The **Malta Development Corporation** (MDC) interconnects established foreign and Maltese manufacturing companies together to enable know-how transfer from larger companies into small and medium sized companies (SME's). It is a one-stop agency that assists companies especially those in their start-up phase. It is responsible for administering the incentive package for the manufacturing industry.

The **Malta Chamber of Commerce** promotes and protects business interests in Malta. It gathers and publishes information and statistics concerning Malta and promotes free competitive enterprise. It keeps close contact with international organisations and is a member of the International Chamber of Commerce, the Association of European Chambers of Commerce and Industry (EUROCHAMBERS), the Assembly of Mediterranean Chambers of Commerce (ASCAME) and the Maltese-Arab Chamber of Commerce.

METCO is a partnership between the Malta Chamber of Commerce, and the **Malta Federation of Industry**. METCO works closely with the Malta Chamber of Commerce, the Malta Federation of Industry, and the Maltese industry and business community, and helps integrate the local industry into the global economy. It acts as a Center for trade and business information, as well as an advisor to the government on international trade matters. It promotes propaganda globally for the Maltese trade, and represents over 90% of the country's exporters.

The **Euro Info Correspondence Centre** (EICC) assists, through the BRE connection, local enterprises in their search for partners. They also assist in the writing and checking of corporate profiles. EICC circulates the opportunities sent by the BRE, and, if necessary, supports businesses during their negotiations on corporate agreements.
The **Bureau De Rapprochement Des Enterprises** (BRE) is a service run by the European Commission in Brussels to assist SME's in their search for partners, BRE opportunities and participation in related activities. *Cyprus has a BRE correspondent.*

The **Malta Centre for Science and Technology** (MCST) advises the government on Science and Technology related issues. It is responsible for co-ordinating the development of science and technology in Malta by bringing together the Government, industry, and research/academic institutions. It has established many networks including the Energy Network, Science and Technology Education Network, Marine Resources Network, Biotechnology, International Relations, Biological Diversity Network, and the Science and Technology Popularization Network. Within the MCST's framework is the **Foundation for Science and Technology. MOSTA** Technopark has aided in the attracting of high technology to Malta by leasing factory units. It is *a long term* investment by Malta to attract foreign investment in the high technology industry.

The **Science and Technology Policy** is in place to boost the role of science and technology in Malta, by establishing and networking national priority areas of science and technology, establishing partnerships, and promoting a science and technology culture. The following page contains Table 4.21 with Malta's imports and exports for 1994. It gives an idea of the amount, and ratio of the imports and exports of Malta.

MALTA IMPORTS AND EXPORTS 1994 [4.31]

	IMPORTS	EXPORTS
	Lm	Lm
EUROPEAN COMMUNITY		
Austria	5,087,718	968,378
Belgium	12,483,167	23,578,628
Denmark	7,751,512	1,054,939
Finland	1,058,857	37,894
France	92,091,728	82,519,061
Germany	126,274,223	100,125,726
Greece	7,241,104	1,281,455
Ireland	8,484,604	704,797
Italy	284,435,893	205,572,980
Luxembourg	298,814	43,006
Netherlands	23,784,683	10,227,013
Portugal	3,517,465	629,026
Sweden	3,740,172	1,018,629
Spain	21,063,405	1,744,650
United Kingdom	161,290,200	49,300,059
EUROPEAN FREE TRADE ASS.	11,472,563	10,097,924
OTHER EUROPE	20,714,355	2,209,115
AFRICA	37,536,925	20,289,811
NORTH/CENTRAL AMERICA	63,983,298	67,431,653
WEST INDIES	107,323	192,579
SOUTH AMERICA	7,991,392	1,892,410
ASIA	139,236,839	75,304,479
AUSTRALIA/OCEANIA	2,870,115	609,218
SHIPS & AIRCRAFT	-	15,315,970
TOTAL	**1,042,516,355**	**672,149,400**

TABLE 4.1 - MALTA IMPORTS AND EXPORTS 1994 [4.31]

5.3 SINGAPORE

Singapore comprises of one major island, and more than 50 small adjacent islets totalling an area of 247 square miles. The population estimate of 1992 was 1.2 million. Singapore started out, after taking the recommendations from UN economists, as a trading centre. Agriculture was the major industry, and manufacturing was very weak. Since its independence, the government has decided to use manufacturing as the main engine of economic growth. Today Singapore produces a variety of goods including, chemicals, pharmaceuticals, electronic items, clothing, plastics, and rubber products. Tourism and industrial banking are important sources of foreign exchange revenue.

Due to the low costs of labour, a large number of foreign companies entered Singapore to set up manufacturing plants. In order to produce higher value-added goods Singapore slowly moved into high technology industries. To promote high technology, government bodies like the Economic Development Board, National Science and Technology Board, and the National Computer Board were set up. They attract high technology through the advantages of the present infrastructure, incentives, and low cost of labour.

Despite the regional financial crisis of 1997, Singapore had an economic growth of 7.8%. In order to be up to date on the present crisis, the Ministry of Trade and Industry is continuously in close contact with the business community through the Committee on Singapore's Competitiveness (CSC). The Ministry believes that the future economy will depend increasingly on information, and knowledge workers rather than material resources and capital. Figure 4.3 shows the Singaporean infrastructure network for the support of its high technology sector. Singapore, as Malaysia, has set up a plan to develop its nation into an interconnected smart island with, what is hoping to be, the best high technology infrastructure in the world. The IT2000 plan forecasts the interconnection of every home with fibre optic cables by the year 2000. This would allow electronic commerce (e-commerce) to become the norm, and allow citizens to option of paying their bills online. The infrastructure will link computers and other information appliances in homes, offices, schools, and factories across Singapore together. Singapore is laying down a UD$182 million broadband fibre-optic network to support this goal. Singapore hopes to attract commercial ventures through the advertising of the island as being one of the best places in the world to do business.

> "Singapore has, with the possible exception of Hong Kong…. The best communication infrastructure in the world", Larry Ellison, CEO of Oracle Corp.

Singapore is beginning to deregulate the government controlled Singapore Telecom its telecommunication industry.

Due to the authoritarian rule and controlled press, as id Malaysia's case, there are fears that there will be a shortage of innovators, due to the lack of competition. This means that prices will remain high for basic services such as Internet access, preventing the spread of e-commerce.

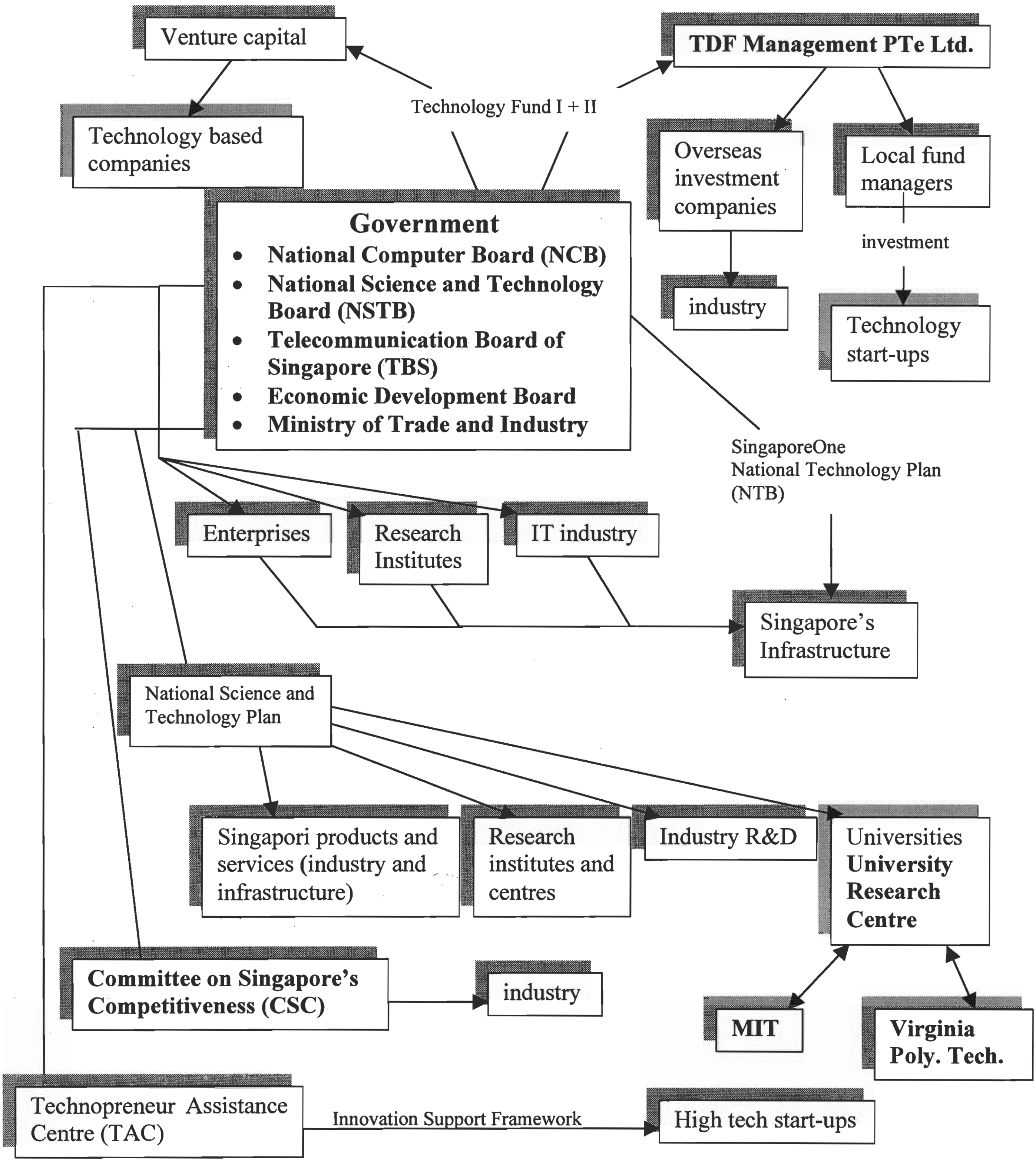


FIGURE 4.3 - SINGAPORE INFRASTRUCTURE NETWORK.

Explanatory Notes:
1) National Computer Board (NCB) – Concentrates on application development with active participation from the Information Technology (IT) industry and user-sponsors in various government ministries.
2) National Science and Technology Board (NSTB) – funds companies and research institutes.
3) Telecommunication Authority of Singapore (TAS) – Provides infrastructure development and facilitates the realisation of a cost effective and affordable broad band network platform.
4) Committee on Singapore's Competitiveness (CSC, est. 1997) – contains many private sector participants.
5) Technopreneur Assistance Centre (TAC, est.1996) – to assist in the development of ideas.
6) SingaporeOne (est. 1996) – A national high capacity network platform that is planned to deliver an unlimited range of multimedia services to the workplace, the home, and the school.
7) Technology Fund I + II – Funds set up to promote the exchange of technology.
8) National Technology Plan (NTB) est. 1991 – promotes R&D in Singapore.

SingaporeOne has been established in order to follow on the IT2000 masterplan that Singapore has in place to enhance the quality of life in Singapore by extensive use of Information Technology (IT). SingaporeOne covers both levels of networks/switches and applications and multimedia services. Examples of services include multifunction kiosks for government transactions, and one-stop government centres with video conferencing facilities. In regards to education, it supports distance learning and multiparty collaboration by students at different locations. One of the many goals is to have one computer to every two students by 2002.
SingaporeOne consists of two phases starting with a pilot program (duration 1996 – 2001) followed by a national expansion (duration 1999 – 2004). The **NCB, NSTB** and the **TAS** government bodies spearhead the operation.

The **National Science and Technology Plan** created by the **Ministry of Industry** to develop the science and technology capability in Singapore's infrastructure. This plan sets up major technology events to provide opportunities specifically for technology exchanges, up-stream technology trading, high technology business ventures and collaborative partnerships.

The **National Science and Technology Board** built the **Technopreneur Assistance Centre** as a first-stop for entrepreneurs of technology who want to develop their technology into reality. The **Innovations Support Framework** covers the entire process (initial idea conceptualisation, development, through to start up technology venture) for high technology start up businesses.

In 1997, the NSTB set up the **Technology Fund II** (S$ 100million) as venture capital for technology-based companies in their start-up stage. This follows the Technology Fund I that had been set up in 1995 with a base of S$ 50million.

The **Massachusetts Institute of Technology** (MIT) in consultation with the Singaporean Government have set up an extension program in Singapore. In November 1998, a memorandum of understanding had been made between **Virginia Polytechnic Institute and State University**, and Singapore Institute of Systems and Science on digital library related topics.

5.4 MALAYSIA

Located in the heart of East Asia, in the last two decades Malaysia has led the "tiger" nations that until currently, have experienced phenomenal growth. Propelled by massive capital investments, substantial productivity gains, and a business-focused "can do" government, the per-capita GDP of Malaysia's 18 million inhabitants has skyrocketed in the last two decades. Despite the financial crisis that has swept across Asia in 1997 leaving a path of unfinished projects in its wake, Malaysia is continuing its push of the US$ 10 billion plan in preparation of its entrance into the information age. In the 6 months prior to January 1998, the Malaysian Ringgit dropped 44% against the US$ and the Kuala Lumpur Stock Exchange Index lost half of its value [4.53]. In response to the crisis, Malaysia is still pushing for the completion of the MSC and has delayed projects like the US$ 6 billion dam. The attraction of the MSC as the most techno-friendly environment in the world has attracted more than 260 firms (as of Feb 1999) of which more than half are from overseas. Companies such as IBM, Oracle, and Sun Microsystems are enjoying incentives such as 5 year tax holidays and the importation of skilled workers (usually very restricted). Companies in the MSC will, for the first time, be allowed to be fully owned by foreign entities, and have the ability to import high technology goods tax-free. The MSC advisory committee has on board Bill Gates, and the heads of Netscape, IBM, Hewlett-Packard, and Compaq. Although shortages of trained people present a problem for the MSC, Malaysia (as with the US) is turning to India for programmers, but hopes to establish smart schools to produce managers who will be prepared to manage an information age economy. Challenging is also the training of Government officials who seem to be technophobic, but are starting to adapt to the information age and the Internet.

Malaysia's prosperity has been built on its transformation from an agricultural economy focused on rubber, palm oil, and petroleum to a manufacturing economy characterised by successes in Information Technology component and vehicle manufacturing and export. Malaysia is a cosmopolitan country with a sophisticated and wealthy domestic consumer market.

Since 1957, its Government has been a parliamentary democracy and Malaysia has a population of eight million of which two million reside in the capital Kuala Lumpur. Today the Government is a business-focused "can do" government, with a strong economy that has been being built over the past two decades. The diverse cultures of the population consisting of Malay (50%), Chinese (40%), and Indian (10%), have opened up channels to other countries. **In order to facilitate their affairs Bahasa Malaysia and English are now widely spoken.**

The Malaysian governmental body MIDA (Malaysia Industrial Development Authority) uses the basis of several structured plans to develop the industry and infrastructure of Malaysia. The underlying foundation to all the plans is the Vision 2020 agenda (refer to Table 4.1). The Vision 2020 is a national agenda that sets out specific goals and objectives for Malaysia's long term development. Its goal is for Malaysia to become a fully-developed, matured and knowledge rich society by the year 2020. Vision 2020 encourages innovation and helps companies, both local and foreign, to break into new frontiers by partnering global IT players and providing possibilities for mutual enrichment and success. One of the ways Vision 2020 is doing this is by the formation of the Multimedia Super Corridor (MSC) which tests the limits of technology and prepares Malaysia's future. The MSC will attract world-class companies and establish two cities within the 50X15-kilometer corridor; Putrajaya, and Cyberjaya. Putrajaya (population of 250,000) will use multimedia technologies to become a paperless administration. This goal is being led by the Prime Minister's office, which plans to become paperless by the year 2000. Cyberjaya supports 240,000 people and hopes to be a 'near zero emission city' through strict zoning policies and environmental guidelines. Companies locating in the MSC can expect an established local services industry, a work force with expanding skills and English fluency, and strong support and logistics infrastructure. They will also enjoy rock-solid political stability and access to strong cultural links to neighbouring markets through Malaysia's Malay, Chinese, and Indian populations. To follow will be a connection of the MSC to other cybercities both in Malaysia and internationally, creating a network of information corridors. Lastly, it expects that Malaysia will become a global test bed for new IT and multimedia applications, and become the platform for the International Cybercourt of Justice. Figure 4.4 shows the Malaysian infrastructure network for the support of its high technology sector.

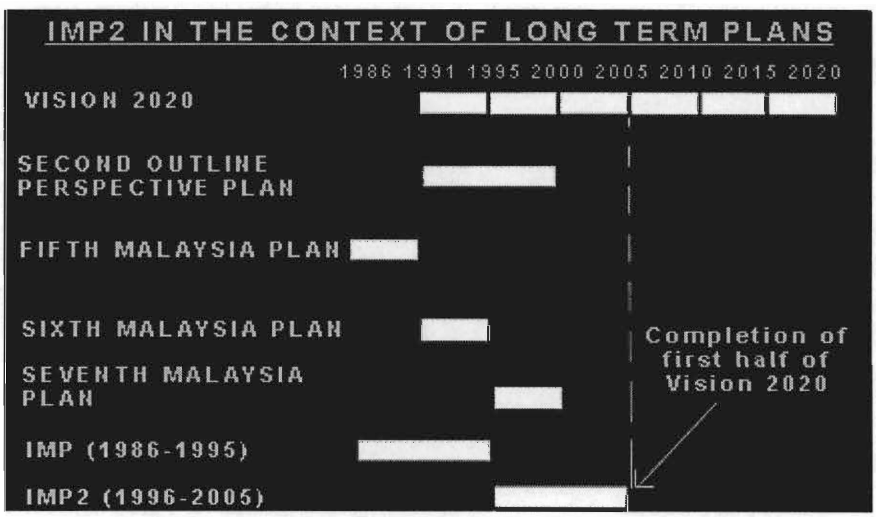


TABLE 4.2 – OUTLINE OF MALAYSIA'S LONG TERM PLANS [4.51].

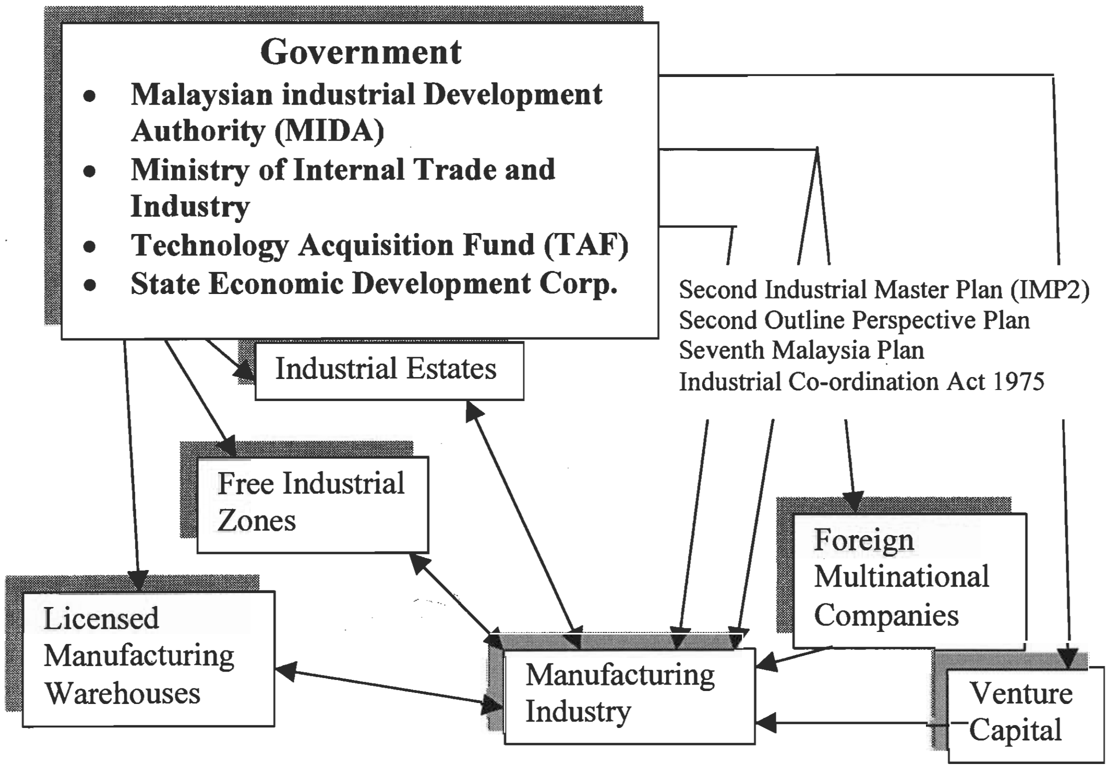


FIGURE 4.4 - MALAYSIA INFRASTRUCTURE NETWORK.

Explanatory Notes:

1) Malaysian Industrial Development Authority (MIDA) est.1967 – principle agency for the promotion and co-ordination of industrial development in Malaysia.
2) The Ministry of Internal Trade and Industry – interconnects the local manufacturing industry under the guidance of several plans.
3) Technology Acquisition Fund (TAF) – facilitates the acquisition of strategic and relevant technology by the Malaysian industrial sector. It provides partial funding to further promote efforts by the private sector to enhance their level of technology and production process.
4) Free Industrial Zones (FIZ) – provides special incentives for the manufacturing industry
5) Licensed Manufacturing Warehouses (LMW) – provides special incentives for the manufacturing industry.
6) Industrial Estates (IE) – provides special incentives for the manufacturing industry
7) Second Industrial Master Plan (IMP 2) 1996 – 2005 –to promote global orientation and enhance competitiveness in Malaysia.
8) Second Outline Perspective Plan (SOPP)
9) Seventh Malaysia Plan (SMP)
10) Industrial Co-ordination Act 1975 (ICA, est.1975) -to ensure orderly development and growth in the manufacturing sector.

The Malaysian governmental body **MIDA** uses the basis of several structured plans to develop the industry and infrastructure of Malaysia. **Venture capitalists** obtain permission and investment guarantee agreements from MIDA to invest in the local manufacturing industry. The **Ministry of Internal Trade and Industry**, under the basis of the same plans helps to interconnect the local manufacturing industry.

The Malaysian manufacturing industry have the option of working in **free industrial zones** (FIZ's), **industrial estates** (IE's), or **licensed manufacturing warehouses** (LMW's) to develop their businesses. In the July of 1997, 222 industrial estates existed with 72 new being planed at that time. Fourteen FIZ's had also been existing at that time. The State Economic Development Corp., regional development authorities, port authorities, and the municipalities aid all three categories. The local manufacturing industry can also obtain additional funding from the **TAF** (Technology Acquisition Fund). The **IMP2** is divided into two main strategies:

1) The Manufacturing Plus Plus Orientation, and
2) Cluster based industrial development

Manufacturing Plus Orientation – Encourages existing and future manufacturing companies to include R&D, production design, distribution, logistics and marketing in order to interconnect the industry and increase productivity and competitiveness. To increase the efficiency of industry by automation and mechanisation, technology development, upgrading skills, organisation and management.

Cluster based industrial development – to identify the clusters, enhance value added and the value chain, identify and develop key suppliers, and strengthen Malaysia's economic foundation.

The strategic thrusts of the IMP2

- Global orientation – increasing focus on the changing global market by becoming world scale and world class manufacturers.
- Enhancing competitiveness – focusing on cluster development through the deepening and broadening of industrial linkages and productivity enhancement.
- Improving requisite economic foundation – focusing on the development and management of human resources, technology acquisition and enhancing adsorptive capacity, physical infrastructure, supportive administrative rules, fiscal and non fiscal incentives and business support services.
- Nurturing Malaysian-owned manufacturing companies – through the increased participation of Malaysia-owned companies in the broad range of manufacturing activities specifically in the clusters that have been identified to be of strategic importance.
- Information intensive and knowledge driven processes – adaptation of information-intensive and knowledge driven processes in manufacturing and in related activities such as in R&D, product design, marketing, distribution and procurement.

The list of promoted activities for high technology companies under the **Promotion of Investments Act 1986**:

1) Advanced electronics

2) Equipment/instrumentation
3) Biotechnology
4) Automation and flexible manufacturing systems
5) Electro optics and non linear optics
6) Advanced materials
7) Opto electronics
8) Software engineering
9) Alternative energy sources
10) Aerospace
11) Food production and processing

Other Western Europe Countries		1994 (RM Million)				1995 (RM Million)				1996 (RM Million)			
		Exports	Imports	Total Trade	% of Total Trade	Exports	Imports	Total Trade	% of Total Trade	Exports	Imports	Total Trade	% of Total Trade
1	Switzerland	212.93	2,560.59	2,773.52	86.34	258.77	3,488.61	3,747.38	90.65	300.01	2,921.24	3,221.24	85.03
2	Norway	165.46	214.46	379.92	11.83	85.25	206.16	291.41	7.05	109.30	330.09	439.39	11.60
3	Cyprus	35.66	4.63	40.30	1.25	67.54	4.19	71.73	1.74	39.64	55.27	94.91	2.51
4	Malta	13.67	2.28	15.95	0.50	12.50	4.83	17.33	0.42	15.50	3.55	19.05	0.50
5	Iceland	1.44	0.40	1.85	0.06	2.77	0.54	3.30	0.08	3.58	2.69	6.28	0.17
6	Monaco	0.07	0.03	0.09	0.00	0.13	0.11	0.25	0.01	2.71	1.50	4.22	0.11
7	Liechtenstein	0.23	0.10	0.33	0.01	0.10	1.99	2.09	0.05	0.12	2.63	2.76	0.07
8	Gibraltar	0.16	0.01	0.17	0.01	0.18	0.01	0.19	0.00	0.16	0.08	0.24	0.01
9	San Marino	0.01	0.01	0.02	0.00	0.15	0.02	0.17	0.00	0.00	0.16	0.16	0.00
10	Greenland	0.16	0.01	0.17	0.01	0.01	0.01	0.02	0.00	-	0.03	0.03	0.00
TOTAL		**429.79**	**2,782.52**	**3,212.31**	**100.00**	**427.40**	**3,760.47**	**4,133.87**	**100.00**	**471.03**	**3,317.24**	**3,788.27**	**100.00**

TABLE 4.3 MALAYSIA'S TRADE WITH OTHER WESTERN EUROPEAN COUNTRIES [4.52].

YEAR	EXPORTS RM Million	% OF GROWTH	% OF M'SIA EXPORTS	IMPORTS RM Million	% OF GROWTH	% OF M'SIA IMPORTS	TOTAL TRADE RM Million	% OF GROWTH	BAL. OF TRADE RM Million	% OF MALAYSIA'S TRADE
1990	219.33	-	0.28	1,145.63	-	1.45	1,364.96	-	-926.29	0.86
1991	305.68	39.4	0.32	1,500.71	31.0	1.49	1,806.39	32.3	-1,195.04	0.92
1992	315.71	3.3	0.30	1,544.32	2.9	1.52	1,860.03	3.0	-1,228.60	0.91
1993	480.06	52.1	0.40	1,641.23	6.3	1.40	2,121.29	14.0	-1,161.16	0.89
1994	429.79	-10.5	0.28	2,782.52	69.5	1.78	3,212.31	51.4	-2,352.73	1.04
1995	427.40	-0.6	0.23	3,706.47	33.2	1.91	4,133.87	28.7	-3,279.07	1.09
1996	471.03	10.2	0.24	3,317.24	-10.5	1.68	3,788.27	-8.4	-2,846.20	0.96

TABLE 4.4 MALAYSIA'S TRADE OVER THE PAST (WITH WESTERN EUROPE) [4.53].

Note: Findings show that there is trade between Cyprus and Malaysia, there are no formal agreements (such as the Investment Guarantee Agreement, Avoidance of Double Taxation Agreement, Bilateral Payment Arrangement/Agreement, Air Services Agreement, Economic, Technical, Scientific, and Cultural Co-operation Agreement, and Shipping Agreement) between Malaysia and Cyprus.

Malaysia – basic facts

Population -18 million

Capital - Kuala Lumpur, 2 million people

Cultural makeup - 50% Malay, 40% Chinese, 10% Indian

Languages - Bahasa Malaysia, English widely spoken

Government - Parliamentary democracy since1957

Manufacturing - Exports electrical and electronic goods, vehicles and machinery, textiles and clothing.

Telecommunications - Licensed open competition for all environment telecommunications services

5.5 HONG KONG

Due to time constraints, a brief study of Hong Kong was performed to investigate the structure of how high technology is promoted. Figure 4.5 shows the Hong Kong infrastructure network for the support of its high technology sector.

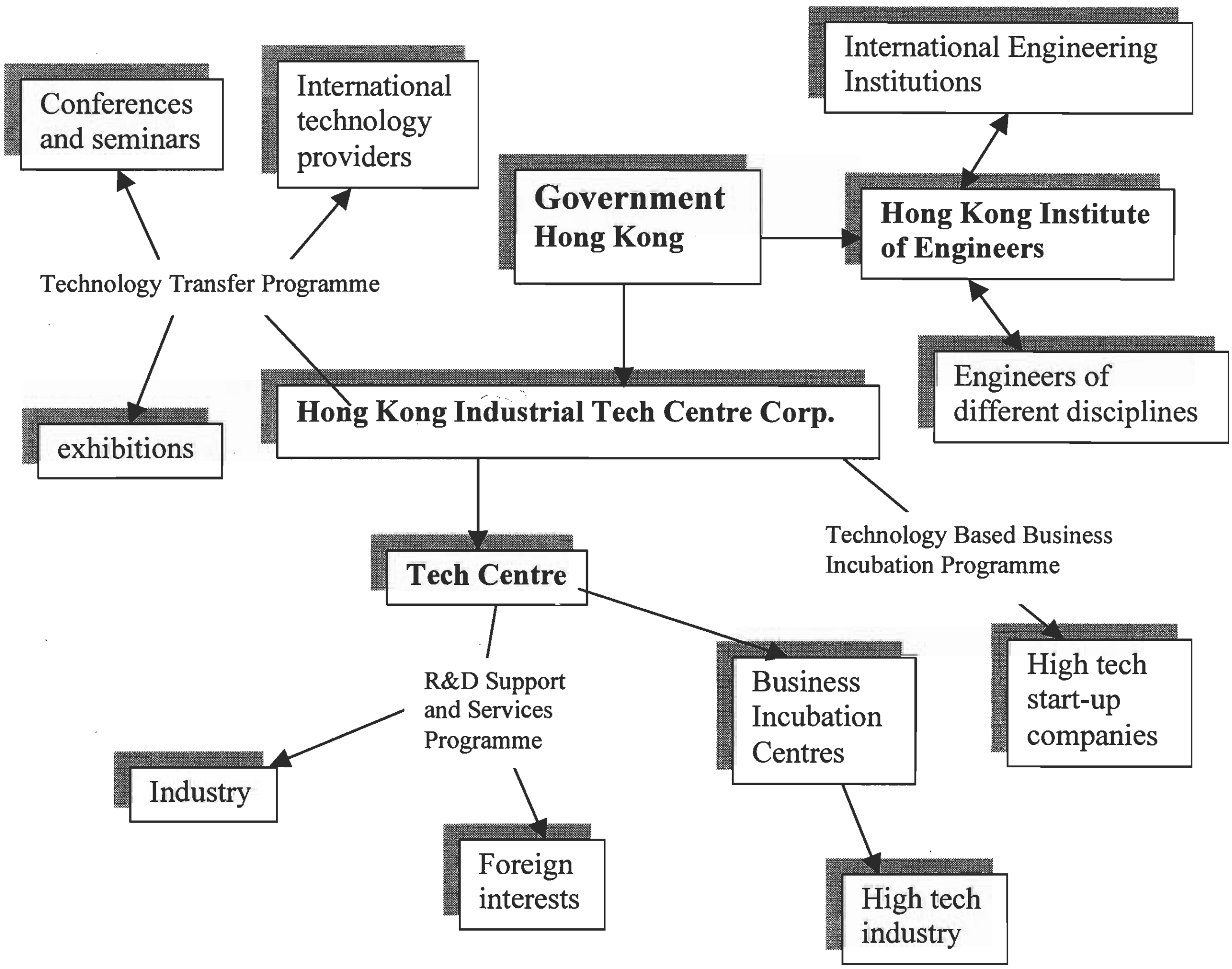


FIGURE 4.5 - HONG KONG INFRASTRUCTURE NETWORK.

Explanatory Notes:

1) Hong Kong Industrial Tech Centre Corporation (HKITCC, est.1993) – to facilitate and promote technology innovation and application of new technologies.
2) Technology Based Business Incubation Programme (TBBIP) – offers support and services in management, marketing, finance, infrastructure, and technical issues.
3) Hong Kong institution of Engineers (HKIE, est.1947) – interacts engineers from different disciplines with institutions and the government.
4) Research and Development Support and Services Programme (RDSSP) – provides testing and measuring equipment for incubators.
5) Technology Transfer Programme (TTP) – responsible for importing technology
6) Tech Centre – houses high tech companies.

HKTICC was set up by the Hong Kong Government to facilitate the promotion of technological innovation and new technology application in Hong Kong. In order to promote synergy and interaction at the **Tech Centre**, the HKTICC leases office space and conference and exhibition facilities to technology related companies. The Tech Centre houses more than 50 high technology start up companies. It houses exhibition, conference and catering, and offers services such as video conferencing, telecommunications and secretarial support.

In order to promote technical innovation and its application in the Hong Kong industry, the HKTICC has developed three major programmes;

a) **The Technology Based Business Incubation Programme** – designed to aid high tech start up companies by assisting in management, marketing, finance, infrastructure, and technical issues.
b) **Technology Transfer Programme** – assists in the transfer of technological innovation to Hong Kong and attracts international technology providers into Hong Kong.
c) **R&D Support and Services Programme** – provides testing and measuring equipment for incubatees to help companies the entry barrier and shorten the time to market of the products.

The **HKIE** sets the standards for the training and admission of engineers. It houses activities like seminars, talks, and meetings and is in contact with international institutions, to keep abreast of the latest developments in engineering.

5.6 CONCLUDING NOTES

This section covered various countries and has shown the impact of high technology on the development of these countries. In the last 50 years Israel has exceeded all expectations in growth and development, and has done so by using technology and science. Today, Israel is known as being the leader in many fields. The Israelis have built a solid foundation starting from the education system, up through the industry, government and high technology.

Malta has a history, economy, and location similar to that of Cyprus. Malta has already taken initiatives to introduce high technology into its economy and has set up a high technology park that is already seeing the benefits of the change.

Malaysia and Singapore have focused on the information age and IT in order to make themselves the leader in Asian and international markets. Although Hong Kong was not studied in depth, it has been said that it contains the most advanced interconnected network in the world.

Comparisons between the different are given below and in the following Figures:

	Cyprus	Malaysia	Singapore	Hong Kong	Israel	Malta
Land (sq.km)	9240	328550	637.5	1092	2030	320
Population (thousands)	749	20932.9	3490.4	6707	5644	379.6
Literacy %(over 15)	94	83.5	91.1	92.2	95	88
Independence	1960	1957	1965	None	1948	1964
GDP (purchasing power parity), billions US$	9.75	227	84.6	175.2	96.7	4.9
GDP real growth rate (%)	2.5	7.4	6	5.5	1.9	2.8
GDP per capita (purchasing power parity)	15000	11100	24600	26800	17500	12900
GDP % agriculture	4.4	14	NEGL	0.1	2	5
GDP % industry	22.4	45	28	16.1	17	34
GDP % services	73.2	41	72	83.8	81	61
Unemployment rate (%)	3.3	2.6	3	3.1	7.7	3.7
Budget revenues(US$ Billions)	2.9	22.6	16.3	19	55	1.3
Budget expenditures(US$ Billions)	3.4	22	13.6	14.1	58	1.5
Exports (US$ Billions)	1.3	78.2	125.6	180.7	20.7	1.7
Imports (US$ Billions)	3.6	78.4	133.9	198.6	28.6	2.8
Military Expenditures (US$ millions)	405	2500	4030	NA	9300	65.5
Military Expenditures - % GDP	5.4	2.6	4.3	NA	9.5	2.7

TABLE 5.1 - COMPARISONS BETWEEN CYPRUS, MALTA, ISRAEL, SINGAPORE, MALAYSIA, AND HONG KONG.

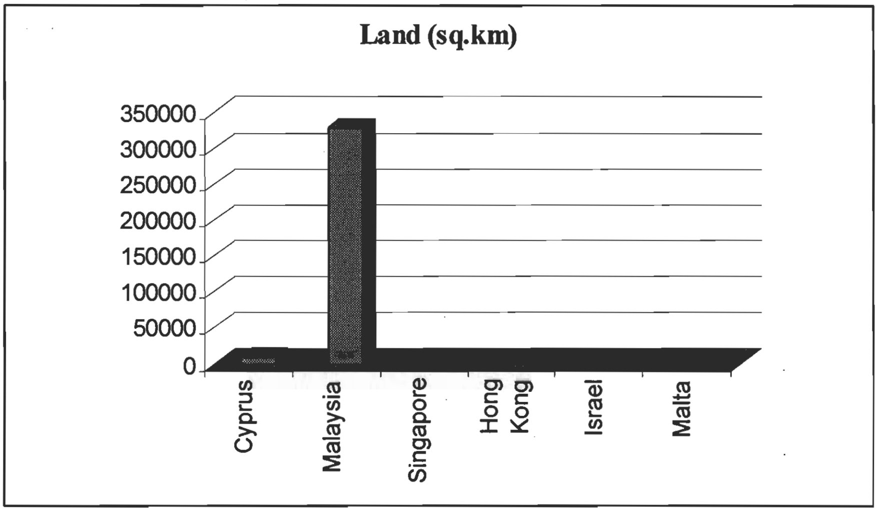


FIGURE 4.6 – LAND COMPARISONS BETWEEN SELECTED COUNTRIES.

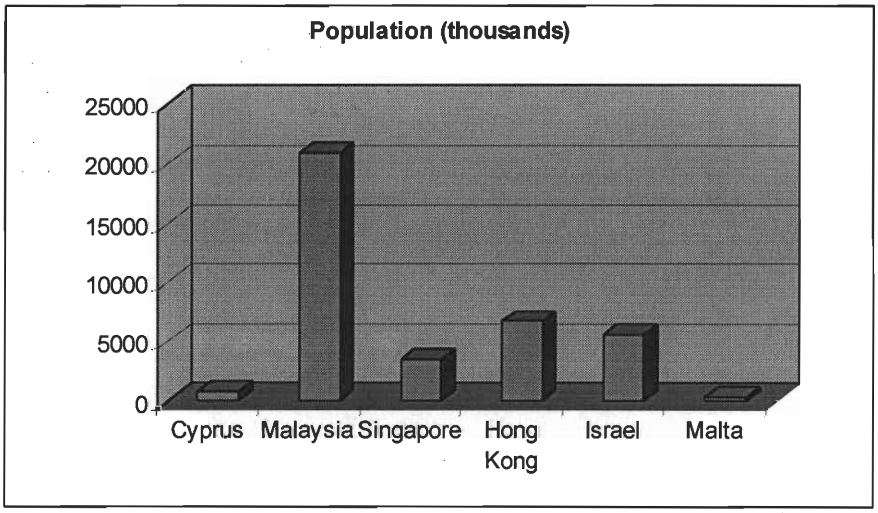


FIGURE 4.7 – POPULATION COMPARISONS BETWEEN SELECTED COUNTRIES.

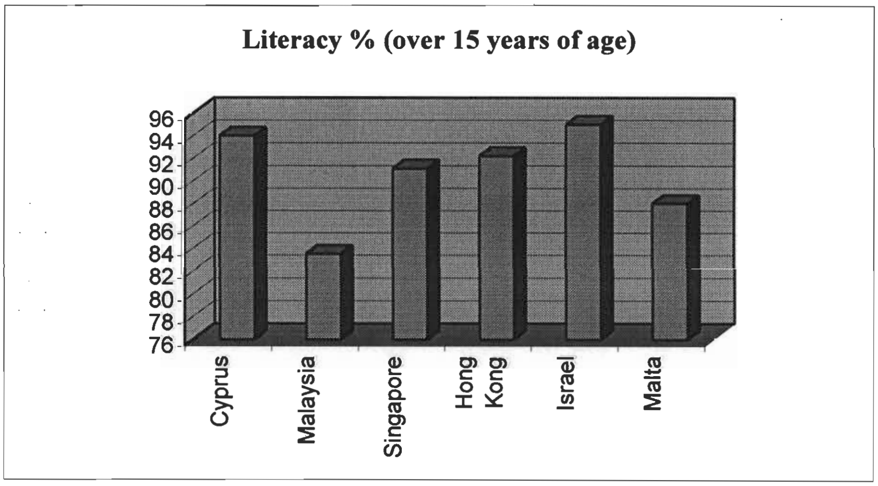


FIGURE 4.8 – LITERACY COMPARISON BETWEEN SELECTED COUNTRIES.

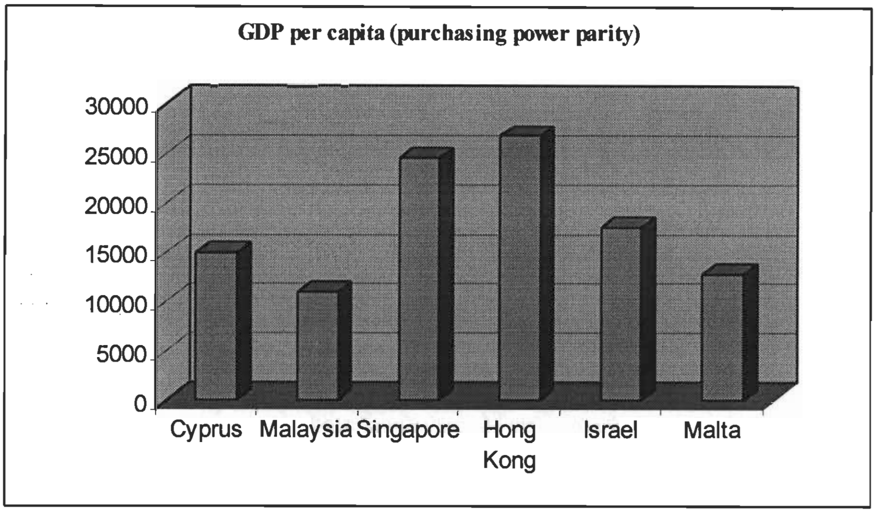


FIGURE 4.9 – GDP PER CAPITA COMPARISONS OF THE SELECTED COUNTRIES.

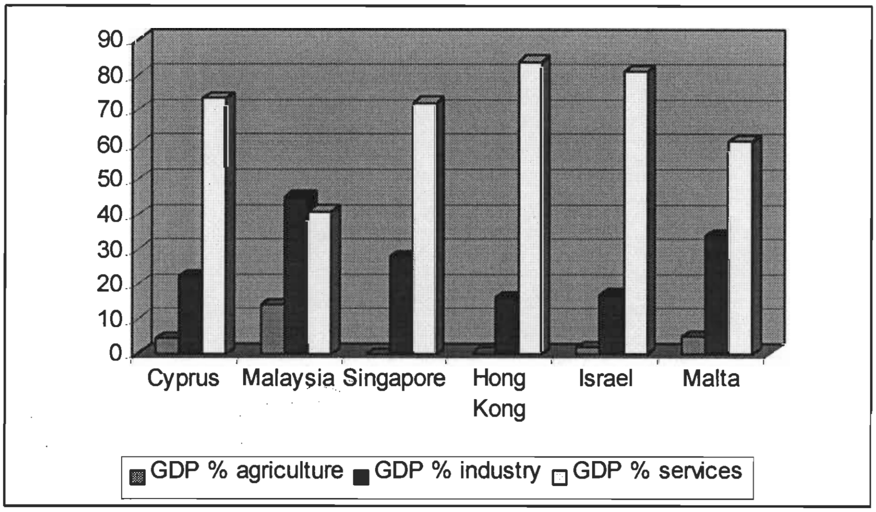


FIGURE 4.10 - COMPARISONS OF PERCENT GDP SPENT ON DIFFERENT SECTORS OF SELECTED COUNTRIES.

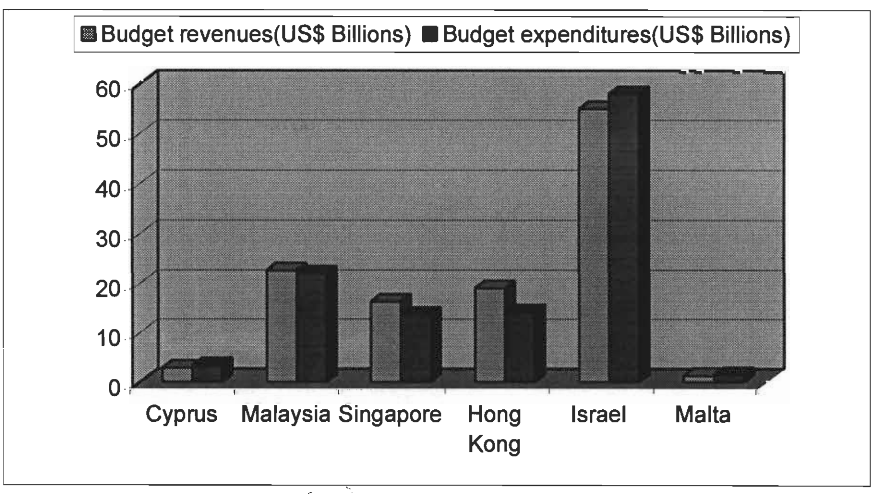


FIGURE 4.11 – BUDGET REVENUES AND EXPENDITURES OF THE SELECTED COUNTRIES.

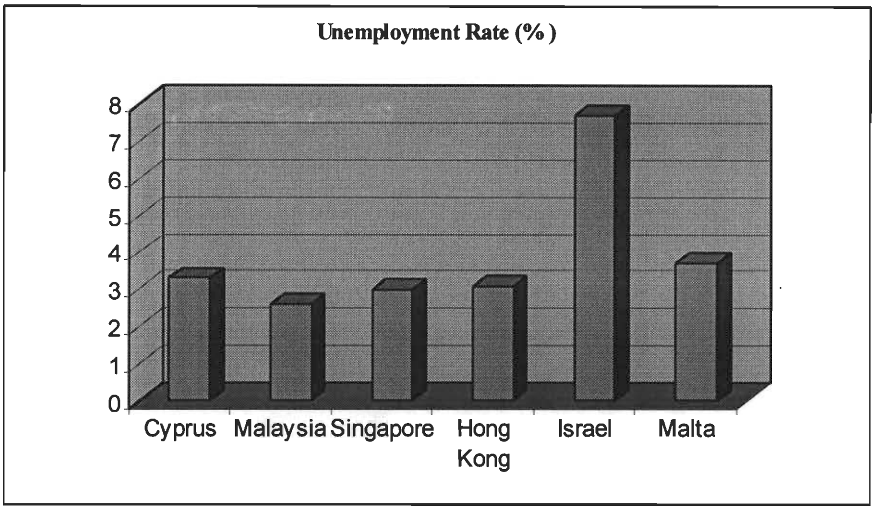


FIGURE 4.12 – PERCENT UNEMPLOYMENT RATE OF THE SELECTED COUNTRIES.

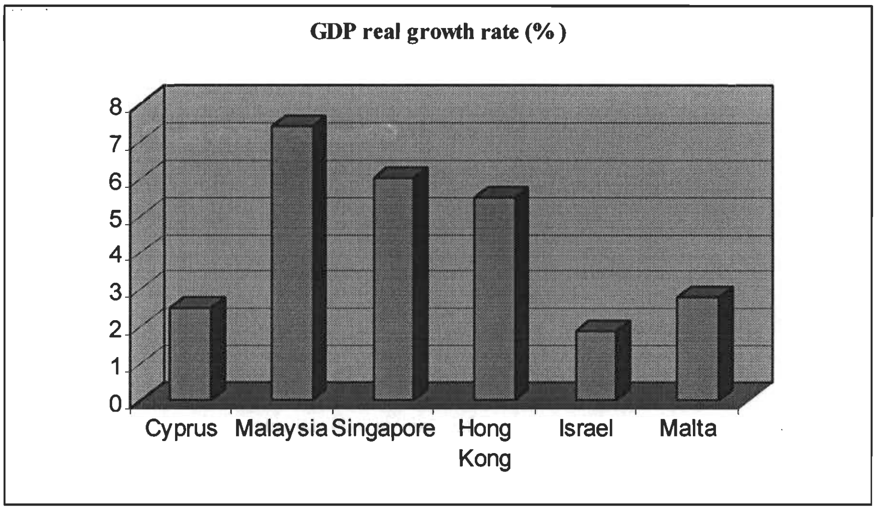


FIGURE 4.13 - PERCENT GDP REAL GROWTH RATE OF THE SELECTED COUNTRIES.

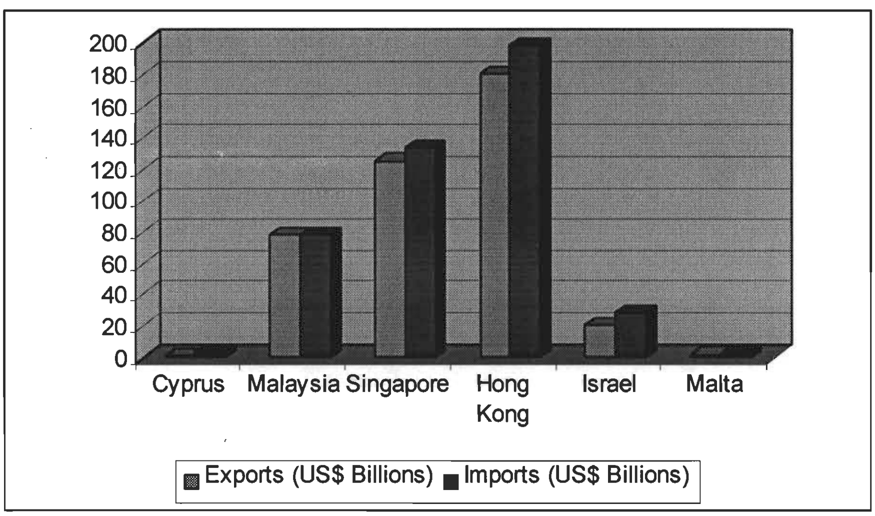


FIGURE 4.14 – IMPORTS AND EXPORTS OF THE SELECTED COUNTRIES.

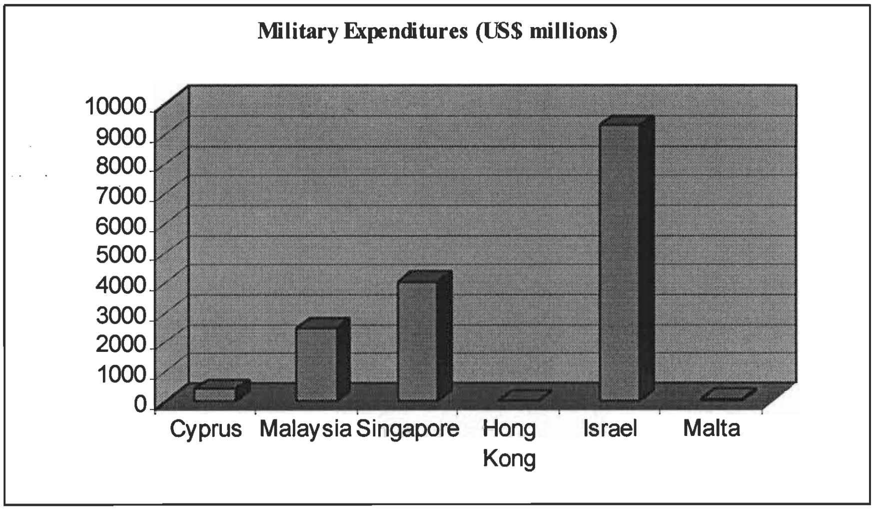


FIGURE 4.15 – MILITARY EXPENDITURES OF SELECTED COUNTRIES.

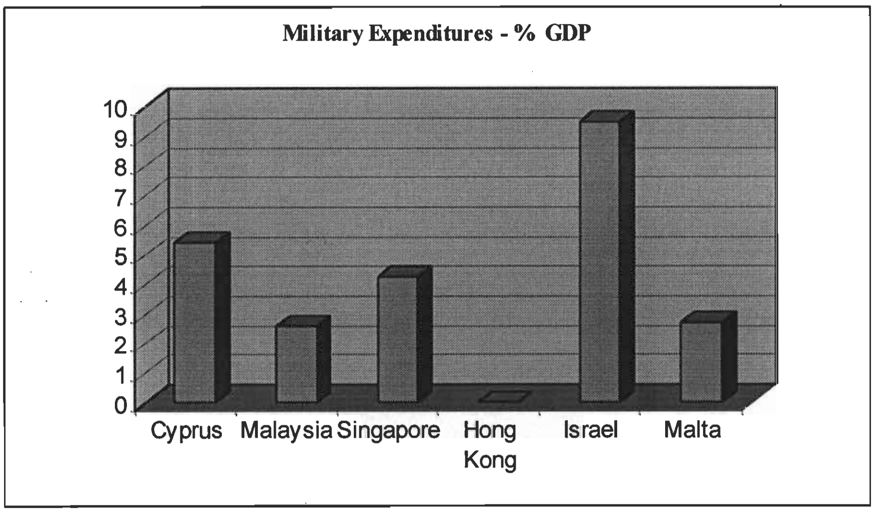


FIGURE 4.16 – PERCENT GDP SPENT ON MILITARY EXPENDITURES OF THE SELECTED COUNTRIES.

6 PREPARING CYPRUS FOR TECHNOLOGY

This section investigates the importance of technology and science in general, and its effects on a country. Section 5.2 describes the application of this analysis to the case of Cyprus.

6.1 TECHNOLOGY AND THE ECONOMY

Basic macroeconomic principles indicate that a country's output depends on its resources, and the methods it employs to transform these into output [5.11]. A country has three types of resources: *land, labour*, and *capital*.

1) In the case of Cyprus, the *land* is limited and its potential is already being exploited.
2) The *labour* resources in Cyprus have not been exploited to their fullest potential, leading at times to a brain drain from the country. People with specialised knowledge and skill are either leaving Cyprus, or find employment in one of those areas that require a lower level of specialisation and skills.
3) Lastly, *capital* resources, which are responsible for rapid and sustained economic growth, are divided into two categories – physical and human.
   a) Physical capital (highways, dams, factories, buildings, tractors, and machinery) in Cyprus is well developed. However, it can always be improved due technological advances.
   b) Human capital is the accumulated knowledge and skills of the working population. Cyprus has a significant amount of human capital, which as mentioned previously, is either not being exploited or has left the country.

To understand how these resources affect a country's economy, economists use the Production Function as an indicator. To study the behaviour of the per capita output, economists use the *per capita function* (See Figure 5.11). This graph shows how two countries using the same technologies can vary its output per capita with its capital per capita. Along the horizontal axis is the Capital per Capita while along the vertical axis is the Output per Capita. Output per capita is simply the country's GDP divided by the working population.

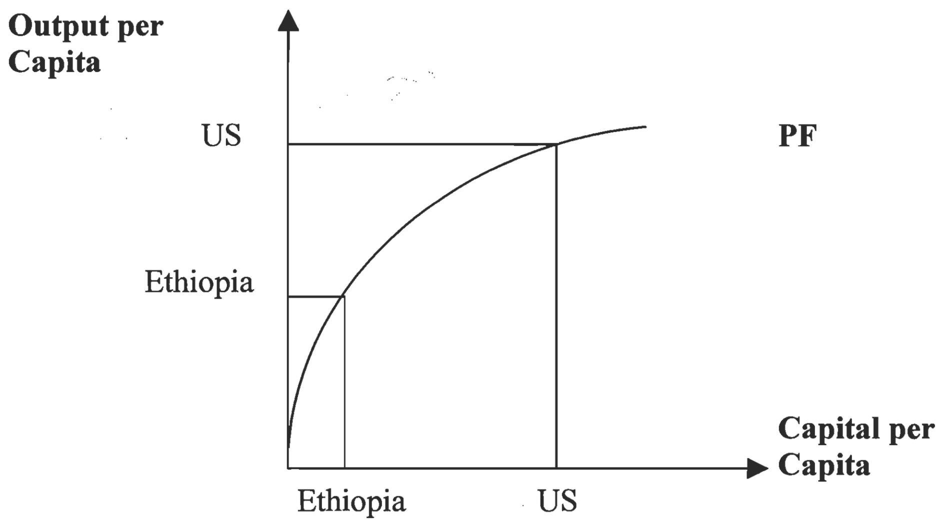


FIGURE 5.11 – COMPARISON BETWEEN ETHIOPIA AND THE US USING THE PER CAPITA FUNCTION IN 1790

If a country does not change its technology, it can only move along the Production Function (PF) line in production capacity. Here, for instance, we see as an example the comparison between Ethiopia and the U.S.A.. In 1790 the production function of both countries were more of less the same. Over the centuries, the USA incorporated technological change increasing its capital per capita resulting in an enormous output per capita change. This growth in output per capita is due to the dramatical increase in per capita stock of capital equipment, and to the improved techniques of production (adaptation of technological change)(See Figure 5.12). For Ethiopia to attain as much output per capita as the USA, it would have to increase its capital per capita to match that of the USA. The faster the pace of technological progress, the faster the production function (PF) shifts upwards. Technological change not only brings about a greater output per capita, but also a greater percent of income invested in a country. Today, most countries are moving toward the service industry rather than the manufacturing industry to increase their output per capita. The PF line is dependant on three different factors: The autonomous growth factor (technology change), the index of capital input (used for replacing or changing capital stock), and the index of labour input (production capability per capita). The autonomous growth factor increases as the technology change makes the labour and capital input more efficient and effective [5.13]. Increasing the index of capital input can be done by the encouragement of savings and investment within the country.

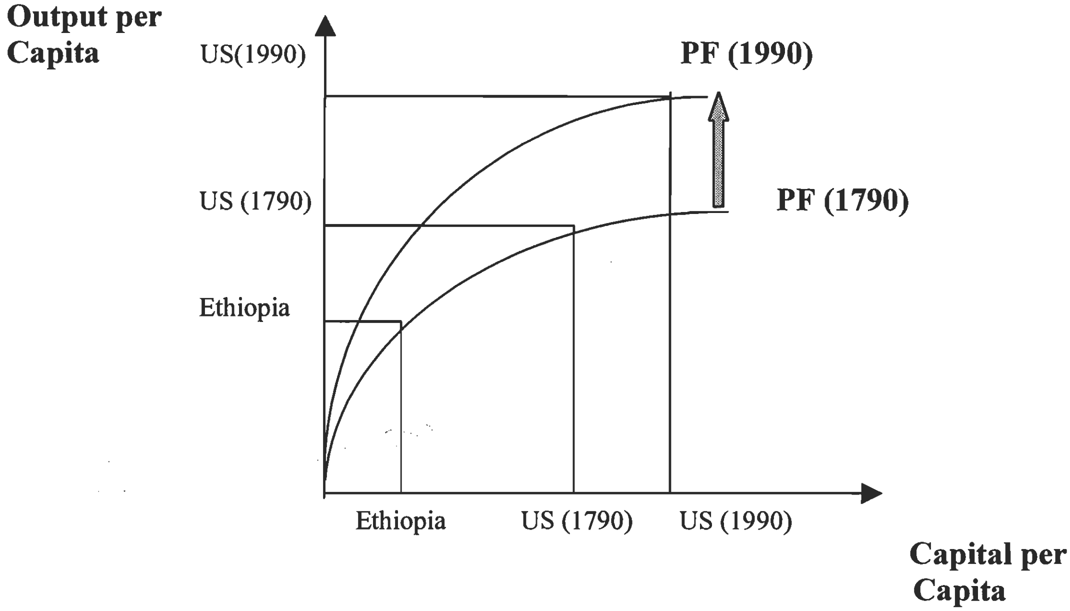


FIGURE 5.12 – THE EFFECT OF OUTPUT PER CAPITA WHEN TECHNOLOGICAL CHANGE IS INTRODUCED BETWEEN 1790 AND 1990

Technological change consists of two strategies: *invention* and *innovation*. The former is the discovery of a new technique while the latter is the application of the new technique. It is the pace of innovation that influences the growth rate of productivity. Government structures and policy have an extraordinary impact on the innovation time and process. Many intellectual observers believe capital costs - usually induced by national fiscal and monetary policies – are also critical. Higher capital costs force companies to shorten the time in investment decisions, placing pressure and in turn restrictions, on innovations. Although high capital costs mean a reduced return on investment time, low capital expenditures provide the *option and ability* for enterprises to invest in projects that would *not* have otherwise been rational in a high capital cost environment. Different industries in the economy are affected by different magnitudes by capital cost. Industries, which have products of short life cycles (like financial services, retailing, entertainment, software, computers in the US) are less affected by average capital costs due to their short time horizons.

Another important factor is the late adoption of available technology by top managers in industry. The major responsibility for developing and maintaining company time horizons rests with the corporate managers themselves. Corporate managers can create a more efficient and effective company through the use of the latest technology available in the market. This would also provide them access to the latest forms of communication and profit from the available knowledge.

One reason why technology has not yet been fully realised is due to economic systems that do not take technology into account [5.12]. One of the better economic systems that depict the influence of technology on the economy was developed by Robert Solow of MIT, winner of the 1987 Nobel Prize [5.12]. His research has shown how the value of a person can far exceed his/her living cost, allowing accumulation of wealth, leading to growth. This was first seen in the industrial revolution prior to which there was virtually no growth in the standard of living. Technology has allowed man to develop the land to its full potential, increase the value of output per person-hour (and hence the worker's real wage), produce economic contributions in capital investment, and improve productivity through education and training [5.12]. Real wealth increased, and through reinvestment, led to future growth. With this understood, the management of intellect and services effectively will set aside countries/enterprises from each other due to the unique development of their intellectual, innovation, or service capability. Underlying this management skill is software; a powerful tool to decrease innovation time, costs, and risks, and increase the value added on goods. *Therefore the two most critical skills of the next decade will be the effective management of innovation and of software* [5.12]. For most nations the key for growth today is the development of intellect, innovation, technology and services rather than the management of physical resources. For enterprises, the key is a management shift from a focus on managing ROA (Return On Assets (physical)) to managing ROI (Return On Intellect). *This means that nations/enterprises should focus on recruiting, developing, challenging, capturing, and measuring intellect need, rather than buying, maintaining, improving, or exploiting physical assets or products* [5.12]. Nationally it means the development of meaningful, accessible and challenging educational opportunities, plus the strengthening of knowledge, skill base and information infrastructures of the society. On the policy level this means emphasis on creating incentives, new technological and work opportunities, market driven demand systems and public support infrastructures that encourage people to learn, to apply their skills, and to excel in useful activities.

The established paradigm of efficiency in resources will have to be changed in favour of *effectiveness in value creation.* This simply means 'how to create maximum useful learning and distribution of knowledge which will in turn *generate* intellect and *connect* it to present and future market demands. With today's electronic capabilities, we have access to a more or less infinite resource of worldwide intellect, and all that must be done is its application to work on future versus current consumption projects. Software is the key to virtually all sophisticated innovation and management activities. Today, advanced industries first develop their products and constructions through the use of software and sometimes even produced using a combination of software/hardware mediums; CAE (Computer Assisted Engineering), CAD (Computer Assisted Design), and CAM (Computer Assisted Manufacturing) as examples. The advantages gained are very hard to be assessed; speed, time saving, flexibility, foresight, and capability. Software allows the interaction and combination of different areas usually with the prediction of needs through system models and online customer databases. *The critical factor in the national/corporate growth strategy is the support of new innovation and organisational capabilities through improved management of software, and it's utilisation* [5.12].

Consequently, globalisation is very important as it allows flexibility, opportunity, and a greater ability to satisfy the needs of an innovator. Even though Cyprus may be considered to be a 'remote location' in some respects, for the business market this no longer is the case. Due to the large distribution chains, the Internet, and global outsourcing, innovations can be sent and retrieved, and concepts can be linked and leveraged to international needs. Gigantic benefits are, and have been seen, in goods when they are turned globally rather than being kept domestically orientated. By focusing on intellect and the service trade, the enterprise gains the ability to leverage the value of its resources internationally, which is one of the demands of technology. Worldwide technology diffusion generates far greater economic benefits than the original innovation, and national/enterprise policies that do not focus on such diffusion leverages lose the most promising rewards reaped form knowledge and innovation [5.12].

Due to the lack of financial support of individual institutions, government support and participation is usually required for the most pressing issues in science and technology. Unfortunately, government action is usually delayed due to internal affairs, a difference in viewpoints, and the lack of understanding between the government and the scientific community [5.12]. As the policymakers try to make informed decisions as to what the 'scientific facts really are', many controversies occur due to the different sources of information. It is hard for the government to understand the science and technology issues as their validity will depend on the opinions of respected authors, views of individual scientists, experts in the field, and even the influence of the press. These usually lead to confusion, poor policy, and distrust toward science and technology. Technological advances and innovations are by nature disorderly, discontinuous, and 'unknown' to the policymaker. Scientific knowledge is highly complex and can rarely be defined (even more so in the usually allotted time frame). Kuhn argued that knowledge progresses through the establishment of new paradigms in areas of scientific revolution [5.12]. Another view is that knowledge tends to emerge as a series of partial truths that are useful for a period and a purpose. The history of science and technology suggest that there are at least seven activities (occurring at times simultaneously) which create knowledge [5.12]:

1) Observation, Exploration, and Description (creating a database)
2) Cataloguing and Classification (placing things in their natural relationships)
3) Search for Generalised Patterns (understanding subsystem relationships)
4) Proposal of Hypothesis (suggesting mechanisms)
5) Tests of Hypothesis (experimenting and testing)
6) Synthesis (merging theories for new paradigms)
7) Manipulation for a Purpose (technological development and diffusion)

All stages of knowledge building are important at both corporate and national levels. Its effective development through the distribution of science and technology, provides a broad understanding of the principles of scientific applications and generally leads to a much higher payoff than in earlier stages of knowledge generation [5.12]. Examples of modes of diffusion of science and technology knowledge are software, networks, popular books, videotapes, television programs (on nature, technology developments etc.), and other skilled explanations of useful science. Note that a strong scientific-technological, knowledge-generating system at the academic, industrial or national level does not necessarily mean more research and development. Rather it implies conscious and systematic support of all stages of knowledge development. Policymakers initially in the United States, then in Japan (in the 1960's) and Israel (in the 1970's), first recognised that technology (not science alone) was the driving force behind wealth creation. Only in the early 1990's did services, information, and intellectual development emerge as crucial dimensions in the growth of advanced countries [5.12].

With developed infrastructures (information, communication, and transportation), the most effective methods for maximising wealth production and technology development in democratic economies are market mechanisms. They link any resource group to relevant resources of intellect (technology and innovation), and allow the greatest freedom of choice for customers to optimise personal value and self-expression, and allow innovators, producers, and users to search for novelty and problem solutions [5.12]. Markets allow effective generation and use of technology required by effective technology strategies. The use of technology is far more important than scientific research alone and is the wealth-producing factor. The discovery/invention of new products (automobiles, semi-conductors, synthetic fibres, computers etc.) when diffused into the masses created improved growth (new production, support industries) by people who neither discovered them, built them, or even understood their science in detail.

Government incentives greatly influence the decisions made by investors entrepreneurs and innovators. Government incentives can open up monopolies, encourage development, tip the scales of project investment (by venture capitalists, etc.) from one sector to another, generate funds, and shift consumption toward investment [5.12]. Successful incentives do not necessarily need to be financial or tax based. Educational incentives in the US (for example, the National Defence Education Act after World War II encouraged veterans to complete college education [5.12]) help build up the intellectual infrastructure for the rapid growth of high technology industries. Generally, free-trade policies, though painful to individual enterprises/industries, benefit consumers who use global markets while protected policies had consumers pay much higher prices for the same goods [5.12].

Misallocation of incentives is also a problem that is faced by governments. The worst misallocation occurs when programs begin to support small but powerful interest groups, some of which are major sources of election funding, or in some way connected to the allocation makers. Often the results are wasteful to say the least. Misallocation can also occur through subsidies, such as holding down electricity or petrol prices and not enforcing pollution standards on the industry, thus harming the people in the area/nation [5.12].

In most national policy areas, *positive net incentives* (not direct expenditures) allow the highest leverage for government intervention [5.12]. Policies are successful if the incentives are able to change management or consumer behaviour in the private sector. On the other hand, private behaviour usually depends on 'what's in it for me' (potential capital benefits minus the personal costs). Therefore incentives are the most crucial elements for guidance, and the more market-orientated they are the more advantageous and productive the results will be.

Governments may also intervene in the breakdown of institutional barriers to progress. Breaking down restrictions on exchanges between companies and individuals for information concerning processes, products, patents, experimental data, and general knowledge, as well as the encouragement of joint research all help to enhance full co-operation within the industry. These types of government interventions can rapidly create whole new industry structures and release entrepreneurial energies with great economic impacts.

Although private markets may be successful in certain aspects, they often poorly allocate the economic and science and technology resources [5.12]. This can actually decrease innovation, and needs to be modulated by government actions. This can be seen in a number of situations [5.12]:

a) When individual buyers and sellers do not internalise all their transaction costs – when companies do not account for the full costs of their products' use and disposal, leading to overproduction in their product, and the placement of more costs on services and indirectly consumers, therefore decreasing incentives for innovation by both producers and users.
b) When individual buyers cannot aggregate demands effectively – at times, the government is needed to interfere by placing demands either on the general public (a highway trust fund for example) or on sections of the industry (meeting quality and safety standards on food, drugs, construction etc.). This adds marginally more cost to the product but increases safety and quality for the consumer.
c) When established institutions have the power to constrain innovation – opening up patent pools held by monopolies (in telecommunications, transportation, electric power etc.), allows innovators to progress and create totally new markets.
d) When the government itself in a monopsony buyer – when the government is the only potential buyer (war weapons, mass education etc.), policy mechanisms ought to be placed to ensure the highest value for the public rather than for the power holders in the government. This can be achieved by using review panels, cost benefit analysis etc.
e) When the costs to exploiters do not increase as resources are depleted – when private individuals continue to benefit by exploiting a public resource at a very low cost to themselves, until that resource becomes unavailable to anyone without prohibitive costs. A good example of this is the exploitation of water reserves for private swimming pools or the irrigation of heavy subsidised farms that deplete water reserves below replaceable levels.
f) When fairness is more important than immediate costs – When the goals and values other than economic cost-benefits dominate many transactions. For instance, a construction company's making of ¼% on its return on investment does not create social gain if the houses it builds quickly deteriorate into slums or death-traps.
g) In important areas of life quality – the greatest market inefficiencies occur in those aspects of life that are most important to the individuals quality of life; health, legal, personal safety, education, information access, water, air, catastrophe prevention, economic stability, safe housing, transportation, personal freedom and

recreational needs. A government should play a role in these realms as the individuals efforts alone cannot generate a difference.

Aside from misallocation being an economic reason for economic interaction, there is the creation of public markets, Real output values occur whenever the public purchases (for example CYP 10,000. - jointly invested by the public district on the districts hospital diagnostic equipment) are of higher relative value to the public than the private items (for example CYP 5,000. - spent on a third car) they could acquire for the same sum [5.12].

For public markets to create real growth there are two conditions that are to be met [5.12]. Firstly, there must be the will for the people to work and develop, and secondly, the demand must be valid. Given comparable reinforcement for both public and private demands, people must want or need publicly generated life quality, safety, or environmental improvements more than other goods and services they would buy as individuals with those same resources [5.12]. Note that environmental improvement does not mean sewage collection and treatment facilities or freshwater supplies, as these are not considered alternative 'costs' to a sailboat or second home. Creating this public demand will also create new jobs to satisfy the demand.

Unfortunately, when talking about health care, environmental improvement, or occupational safety, there is usually associated the negative 'cost' involvement. This is a faulty paradigm that is largely due to the recorded expenditures of the project that are visible, against the benefits that are never explicitly fed back into the national accounts [5.12]. *In fact, without these expenditures, the United States, as with a great deal of countries, pay very many real life-quality and environmental costs without receiving any of the market benefits afforded by solving these problems* [5.12]. The *Annual Environmental Quality Report to the President* (of the United States) has repeatedly demonstrated that the benefits of environmental improvement, for example, are measurably greater than their costs [5.12]. The most thorough recent report on this topic suggests a positive payoff of about *sixteen to one* on environmental investments, not including other feedback and multiplier benefits. While national markets stop with the collection of the 'costs' of public markets without indicating any of their benefits, they set forth the value added to the automobile, chemical, energy, and agriculture fields (for example) without subtracting many of the very high real costs of injury, hospitalisation, waste disposal, and environmental degradation these industries cause.

For example, the clean up of shorelines and beaches requires sewage treatment plants, heat transfer units, improved sewage systems, sophisticated monitoring equipment and so on. Thus water de-pollution creates huge markets for steel and metal products, construction equipment, pumps and treatment equipment, meters, switches, wire, electronic controls, construction materials, glass, ceramics, bricks, mortar, plastics and chemicals. Companies providing these materials and services obviously employ people and generate profits from these markets. They pay taxes and increase demands for local consumer goods, and their component and supply requirements diffuse further to benefit suppliers in other industries (See Appendix IV - P+R Techconsult Ltd. and

Morfomihaniki Ltd. case studies). It is hard to imagine technological solutions to environmental, health, or safety problems that do not call for high technologies, metals, cement, chemicals, glass and other products of myriad supplier industries.

We now understand that public markets can have positive benefits on the economy, but now we must question how to optimise those benefit in social and economic terms. Economists use two starting points in establishing the demand potential of a public market [5.12]. One is direct; asking people questions (how much would you be willing to pay to have a clean beach) The other is indirect; they try to create a real-world market in which interested parties buy or sell real or surrogate assets or solutions. Interestingly enough the first method concludes that people in the United States would usually per to accept a loss of current quality-of-life level than be willing to pay to achieve or improve it [5.12]. The second method analyses how people perform in an actual market-like situation – how much they actually do pay on average to vacation in an environmental park or to fish in a clean wilderness area rather than to picnic or to fish locally. Similar calculations show that there is more profit in protecting an environmental park than there is in using it for agricultural use.

The effects of government regulation should apply to all industry (not only bias toward a particular industry) and should be balanced. Government regulation should be as limited as possible to foster greater innovation while at the same time providing a breeding ground for industries that may not be able to operate without the regulations in place. Ultimately, regulations should be in place for the betterment of the community. Such policies that focus on community improvement have a parallel and positive effect on the productivity and industry. The application of these standards only to new installations defeats the purpose of obtaining the results. For example, pollution restrictions (applied to companies built after a certain year for example), cause the newer products to be higher priced and therefore the older and more damaging products stay longer on the market. The main benefits of market-like mechanisms are that they encourage innovation and reward those who act responsibly. They positively affect the masses and entrepreneurs rather than just punish a few bad actors (old car owners or old polluting plants for example).

Among the most important policies affecting innovation and economic growth in advanced economies today are those enabling people to learn, save, consume, and invest as *groups* [5.12]. Private enterprise systems have proved marvellously adept at producing virtually anything individual customers are prepared to buy. What are missing are effectively structured markets to fulfil these demands [5.12].

The two most important changes needed in technology-economic strategy are:

1) a better understanding of the true costs and benefits that public markets create, and
2) an establishment of more market-like mechanisms to channel demands, aggregate resources, and allocate costs in these 'public market' or 'aggregate demand' situations.

Two problems are thus encountered [5.12]: Firstly, how to handle nuances of demand within a single market category (e.g. what is the optimum trade off between particulate, gaseous, and noise outputs of an engine). Secondly, how to determine relative preferences among completely different public markets (such as health care, environmental improvement, transportation, national defence, public safety, energy independence, or public education). A crucial element in making these allocations more effectively is the recognition by all parties that most preferences are values, and not simply cost optimising. Unless perceptions are changed, nations will not be able to deal rationally and well with many of the important technological and growth challenges of the future [5.12].

Because of the inherent frictions, uncertainties, and political risks ever present in government and the market economy, national technology strategists have tended to focus on incremental changes in shaping their future domain [5.12]. The drivers of technology – demand, trained minds, individual component technologies' capabilities, and the interactiveness between technologies- are all growing exponentially and is going to continue to grow. Mainstream developmental economists still primarily focus on what a nation has in 'objects' like factories, roads, power generation, and relate these to policy through statistic equilibrium models concentrating on measurable physical assets [5.12]. A new conceptual school of economists now focuses more on 'idea gaps' – needs for intellectual, technological, and system infrastructures – and uses more dynamic, though less formal, models. Balanced policy needs both approaches [5.12]. Increasingly, national intellectual, technology, and economic strategies must be integrated more specifically to support the rapidly developing services, software, and intellect-based economy of the future. Many elements of policy can be best exercised through private markets, generic interventions, and better-structured public markets. There is an overwhelming need for government to reinvigorate the nation's intellect generating apparatus – its advanced research, public education, incentive, and national database infrastructures – in many areas. Further delays in these areas could rapidly diminish the nation's economic, military, and life-quality standards [5.12].

Most of the new jobs in the United States were in services, and all estimates show future job demands will be primarily in high-education intellectually based service situations. A large and totally unpredictable element in this economy will be a huge new virtual marketplace of on-line activities. The Internet and Web services and capabilities have come to as a shock to many in the investment and management fields. The Net is now a whole self-sustaining virtual economy, growing colossally out of proportion; small energy and investment inputs, amplified through further innovative modifications, result in a huge positive feedback of value gains. Many of these values are hard to express in economic terms.

Even though only 18% of the employment in the United States is in manufacturing, around 70% of these jobs are in service activities (like research, development, product design, process design, marketing, sales, distribution, accounting and MIS) [5.12]. *Intellectually based service activities*, not manufacturing, are the United States growth vector for the future [5.12]. They create the highest-value and highest-paying jobs

(Doctors, lawyers, consultants, software designers, scientists and engineers head the list) in the United States. Considering manufacturing activities as significantly more important – or having higher value in job or output terms – than those in the service industries is a major conceptual error. Unfortunately this misconception still dominates much of the United States' domestic and international policy thinking. The effects can be disastrous.

If a company is not best-in-the-world in an activity (including both value produced and transaction costs), and it produces that activity in-house, it sacrifices competitive edge; it can gain more by outsourcing the activity. Industries having realised this, are following this practice, and in doing so, they are making traditional strategies for economic and national technology development obsolete.

A company or nation wanting to participate in some industry's trade growth no longer has to have its own production plants in that industry. It can develop some specialised intellectual capabilities (such as research, design, software, finance, or logistics) to best-in-the-world levels, and sell these to other companies in the industry. Those other companies in turn will integrate them into value packages appealing to specific customer classes (like Nike and Reebok in shoes, Apple and Dell in computers, and Chrysler and BMW in automobiles). But national strategies need some major adjustments to accommodate developing changes.

International outsourcing changes the ways nations can best influence their economic growth and social development. The three most common ways of stimulating a national economy have been in the increase of government purchases, the lowering of interest rates, and making direct infrastructure investments [5.12]. But the more outsourcing abroad there is, the more jobs also go abroad. Lowering domestic interest rates also means that foreign competitors can also borrow at these rates. Therefore the government would stimulate the national economy if it were to invest directly into the country's infrastructure, especially in technology enhancement.

Among the most important impacts of the services and software age is the ability to reduce development times and costs extensively through international innovation and production of products and services [5.12]. Through software, innovators everywhere can be placed into any world marketplace or competitive situation. Once a product is introduced and encounters real customer responses, constant detailed electronic feedback form the marketplace lets innovators change their products to the most recent market perceptions. Since worldwide instant communications and competition interlink all economies in ways that make them totally interdependent, *national strategies must be international in concept.*

In an electronically interconnected world, private capital will move to whatever competencies exist, *provided* private markets have built the infrastructures necessary to exploit and nurture these competencies. Development becomes primarily a question of building competencies and incentives throughout the society so that people can understand and tap into the capabilities available to them [5.12]. Similar concepts can assist domestic technology-growth strategies. *The first imperative for these strategies in a* *paradigm shift from traditional centrist command-control concepts to a more decentralised, knowledge building, network interactive, high-diffusion, market orientated strategies*. This applies to both business and government. The keys to progress become advanced research, education, people development, open access, incentives, knowledge diffusion, and empowerment [5.12]:

Advanced Research: Most authorities agree that government expenditures on advanced research performed through universities are relatively inexpensive and offer extremely high intellectual leverages if *properly connected to the user communities.*

Open Access and Diffusion Systems: Well indexed government publications, public library systems, and open databases all help leverage available knowledge at a low cost through diffusion. These resources allow independent researchers to proceed more rapidly, avoid unnecessary duplication of effort, and exploit relationships both among the disciplines themselves and with the problems that researchers might otherwise not even discern.

Auto-Catalytic Growth Through Sharing and Feedback: A unique feature of a modern intellectual service economy is that once the substantial investment to develop a concept up to its first use has been made, the marginal costs of its reproduction often drops to essentially zero, and the economic concept of decreasing marginal returns from these industries becomes obsolete. The potential leverages of very small intellect-based investments can be very high as others amplify their value by further modification, innovation use, and posting their results onto the network for others to use and modify.

Three Levels of Policy Support: Under these circumstances, the widest possible distribution of knowledge, analytical techniques, and system access will maximise benefits, provided there are proper incentives to carry the new concepts to the market. Creating the knowledge skills to appreciate new concepts and opening network access for exchanges about them are likely to generate the greatest number of potential options for knowledge advancement at a low cost. Providing incentives to use these results in their secondary potentials through technological multipliers and worldwide diffusion can multiply benefits to extraordinary dimensions. Three levels of support exist; government support and control of public goods, competition for rival goods, and voluntary industry support for non-rival or generic goods. For public goods, recommended is allocation and development as public markets. For non-rival goods, if the industry group agrees, government could levy a uniform tax on its products.

Encouraging Private Software Innovation and Public Diffusion: Rapid innovation depends on innovators being *rewarded* for their efforts, and the society benefits most as the general parameters of their innovations become known and others amplify and innovate specific features in their own self interest.

New Threats and New Policy Needs: Hand in hand with diffusion come some gigantic new social threats such as fraud, massive system disruptions, creation of dangerous chemicals, potential disease agents, or weapons of mass destruction. With an infinite number of potential alternative sources open to all participants, the best form of monitoring and control will be providing incentives for the many decentralised players on networks to detect and warn bizarre behaviours, actively anticipate potential problems, and spread information about destructive behaviours through some co-ordinating clearinghouse. Government investments in this area are clearly warranted to ensure equity and to lower total societal costs.

In advanced countries, perhaps the most critical area for public concern is *education* for flexible employment and personal growth. *Education is clearly an essential source in an intellectually driven economy, and it is the best safety net in a changing employment situation* [5.12]. It is also the critical element in improving productivity and life quality in less developed countries. In the past, free public schools and libraries were the critical elements in the education infrastructure. New policy emphasis should add greater availability and utilisation of electronically based information throughout the system [5.12]. In order to develop a country's infrastructure for technology enhancement, technology itself should also be integrated into the high school education system, in order to educate the students to the meaning of 'technology' and its flexibility and prospects. With the combination of technology and utilisation of electronically based information, the students will be well prepared to further their studies (both locally and internationally) in any field. In quality terms, electronics changes both the mode and content of communications, making it easier to create more memorable images. Graphic display capabilities of modern computers make it possible to show visual simulations of phenomena that are not directly observable, like a light wave diffracting around an edge, or surface phenomena at an atomic level. Computer graphics make these concepts easier to understand and allow more students to participate directly in experiments changing various constants. This means probable shifts in the ratio between written and aural-visual learning, with corresponding efficiency improvements. Since individuals learn best by different means – by experience, from observation, from print, by hearing, or from repetition – electronic literacy enhances the ability to match the medium in both the information offered and to its target audience [5.12]. The capacity to modify the communication at the reception point can make education much more efficient, effective, and enjoyable. These elements should support a higher quality, more available, and less costly education system as digital infrastructures come into place. In developing countries most electronic education programs have been blocked by the high initial costs of electricity and telecommunication infrastructures. However, recognising the potentials of large markets and a massive possible substitution of capital for labour in all education systems, private companies in the United States are beginning to provide the necessary infrastructures (software and hardware) as commercial ventures [5.12].

One method by which a country can participate for commercial profitability and with the lowest cost nationally is to facilitate transfer of information *among* those nations were such privately supported installations do work well. Such co-operative arrangements are most productive when the developmental stage of the two countries is similar.

Countries that support education, intellectual, and economic development in the new mode are likely to be winners. Those that follow the past practices or allow bureaucracies to rule development of their most important assets will pay a high price.

6.2 CYPRUS – LOOKING INTO THE FUTURE

Today, Cyprus is in a good position to make a decision and change in almost any direction due to its strong economy. When governments have high general deficit, high monetary cost strategies, the tragic impact is reflected on programs with long delayed results (like environmental, educational, and infrastructure building programs) [5.12]. These impacts are enhanced in less developed countries where inflation, risks, and interest rates are higher, placing further importance on consuming now rather than saving for the future. This is the reverse of what economic studies state for the encouragement of investment, innovation, economic growth, and wealth generation. In both developed and developing countries, macroeconomic stability, low inflation, and savings-inducing policies go along-side increased innovation, economic growth, and environmental protection [5.12].

Cyprus is at a very special development stage. The stage of evolution; changing and adapting for a better future. Cyprus is very fortunate to be in a very rare position of having the ability to freely choose which direction it would like to head, with the choices and probable outcomes already depicted in other countries. The effects that different sectors can have on the economy of a country is clear, and of those sectors, the inexhaustible high technology sector is one of the only sectors that can provide a better and more stable future for Cyprus. The vision for Cyprus should be to build a world class science and technology base in fields that match Cyprus' competitive strengths and that will spur the growth of new high value-added industries (again, high value added means *the value requested be highly competitive and enhances productivity and cost efficiency to the purchaser*). Israel has shown how good Cyprus' position is by having interests in developing some of its technologies in Cyprus. Israel can act as a catalyst to Cyprus' technological development. This is very fortunate for Cyprus and Cyprus should take advantage of the situation using the useful input being offered. Cyprus should aim to develop a hold which would keep Israeli interests in Cyprus, and also avoid putting 'all the eggs in one basket' as one would say, by not becoming reliant on the Israelis. The achievement of this goal will enable Cyprus to maintain its economic dynamism as it develops into an advanced economy during the 21st century.

As a great number of countries have already embarked on the high technology industry adventure in the past, and it would be wise to both learn from their experience as well as differ in some way from what they have done. Through the use of their experience, Cyprus can avoid the mistakes made in the past by other countries, and better meet challenges that come from the new implementation of the high technology industry. Setting Cyprus aside from the rest provides the Cypriot industry with an opportunity to develop a niche in the world of high technology and to become a *'follower'* rather than a *'leader'* in the field of high technology. The implementation of such an industry should have an underlying paradigm that should be followed not only by the high technology industry but also by all other industries (the manufacturing industry, service industry, tourist industry etc.) that can be interconnected to the high technology industry. This underlying paradigm will help interconnect the industries and provide greater possibilities of projects that would otherwise go untapped, and will help promote Cyprus internationally as being specialised in this discipline. *The underlying paradigm that is to be incorporated is to be an 'environmentally efficient country'.*

Since the early 1980's there has been a push toward environmentally friendly products, sources of energy, stricter pollution standards etc., this has been given greater emphasis as the years have passed. The effects of man's developments on the environment have never been so evident as they are today. Conversely, the push for solutions to environmental problems, and environmentally friendly processes and products is continuously growing and is not liable to stop any time in the near future. With an *'environmentally efficient country'* as the underlying paradigm, many positive changes can be made in Cyprus involving the whole Cypriot community. It is not hard to imagine how one would feel if one lived in an environment that one knows is best for the natural environment, and *to be approached internationally by different communities for advice* on such a field.

As with everything in life, the field of interest must first be understood before being applied and improved. There is no doubt that this can be applied to the high technology industry in many ways and forms, and the search for such existing technology is readily available (See Appendix VI - Sources of Environmentally Friendly Information). In regards to the tourism industry, hotels can be built in an energy efficient structure/design, resembling nature (See Appendix III - Grove Construction), incorporating environmentally efficient ways of producing/retrieving energy (using solar energy for example), efficient living quarters, air-conditioning units etc. etc.. In addition, this paradigm can be applied to the desalination plants such as the plant in Japan (Appendix VIII – Environmental Projects). This plant uses solar energy to power a maintenance free seawater desalination plant by membrane distillation. There is not an industry that is not in some way affected by an *'environmentally efficient'* paradigm.

The Cypriot culture, as with most Mediterranean cultures, is a culture with a strong willed character, which enjoys freedom and independence. This type of character has led to a local industry comprising of few large firms, and many small, usually family owned businesses. This can easily be seen by the number of kiosks, bookshops, garages, taverns, kebab houses and pizzerias found virtually on every corner, some even being run from the home. The nature of a family-owned business is important to the Cypriot character, and is well worth protecting. As Cyprus prepares itself for the global market, entry to the EU, and the possible influx of the high technology industry, the Cypriot community will have to find a way to keep up with the high demand from these new parameters. This demand will take a large toll on the family-owned businesses, as they are not in a position to compete globally. Cyprus must prepare its industry as it bases more of its economy on the international economy. As it stands, from the experience of other countries, without the preparation in place, opening into highly competitive markets usually causes companies either to sell their products locally (and compete with the imported goods) or to close down (due to the inability to compete internationally). This has been seen to eventually lead to large impersonalised firms of hundreds of employees, as we have seen throughout the developed world.

One way to avoid this possible turn of events is to find a solution before the change is implemented. A solution where a fast moving industry, the high technology industry for example, may be able to survive in an environment such that the Cyprus industry has to offer. The setting up of a network that interconnects all the companies in that industry was the solution that Germany came up with when faced with the same challenge many years ago. *Mittelstand* of Germany is a network of about 3 million small to medium sized companies, mainly in manufacturing, which account for about half the country's industrial turnover, about two thirds of its jobs, and four out of five of its apprenticeships. The majority of the companies are family owned, secretive by nature, and usually employ less than 100 people. It is due to the innovative, high quality products, superior follow up service and punctual delivery and repair services that these companies have provided a real driving force behind Germany's exports, economic growth, and jobs. And although the companies are small by nature, many of the Mittelstand companies have a market share in their chosen sector of between 70 per cent and 90 per cent - a figure which many bigger companies can only dream of obtaining.

Today though, Mittelstand is facing two challenges; firstly, the weak state of the German economy, Germany's high costs, severe taxes, tight regulations and bureaucracy has led many companies to push toward international expansion, but in many cases without sufficient resources. With international expansion comes the need to sharply differentiate products in different countries in order to sell the products at varying prices and in separate markets. A second potential threat Mittelstand is experiencing is the European and monetary union. With the introduction of the single currency just released in 1999, there is the possibility that Mittelstand will be outpaced by the bigger companies who are in a better position (multinationals for example) to grasp the opportunity of the single currency in Europe. The single firm strives to increase its exports in order to expand business and increase profits. The importance of increasing the country's exports lies in the desire to achieve economic independence or viability – a situation in which foreign currency received for exports is sufficient to pay for all the goods and services that are imported. The greater the capital of the economy, the more and better the equipment they will be able to obtain, and the greater their product will be. In many countries, the government offers many incentives to companies that export a certain amount of total goods (typically 80% of the total), as it is to be to the country's benefit

According to Mr. Brun-Hagen Hennerkes, a professor at the University of Stuttgart, as Mittelstand is going through all these changes, new companies will be joining; many of which will be in the fast-growing high-technology sector. He also states that the most important reason for the success of the Mittelstand has been their *family owned managerial structure*. This form of organisation, he believes, led to a strong relationship between owners and workers and a flat hierarchical structure which, in turn, encouraged *greater worker motivation* and led to *a high degree of flexibility and innovation.*

The first steps toward the change of high technology would be to establish a network that would interconnect both the industries in Cyprus, as well as connect Cyprus to the rest of the world. In establishing a well-connected and organised network in Cyprus, Cyprus will be able to support the coming changes in a more up-to-date, organised, and prepared manner. With an interconnected network of small and medium sized enterprises (SME's), family businesses will be given the opportunity to specialise into individual sectors of the industrial market. This will open the opportunities for their businesses to become 'the best' in their specialisation, and allow the import of a wide variety of specialised engineering, that would be required for supporting a high technology industry. Initially, the development innovation/adaptation and acquisition of near term technologies should be introduced. The industry is expected to spearhead developments in this by making innovative improvements to the present generation of products and services, as well as to develop the next generation of products and services. Over the next five to ten years, Cyprus should focus most of its R&D efforts in these technologies. Such a focus will rapidly raise the level of technological competence in Cypriot industries. Companies like Tactics (http://www.tactics.com/) can aid in location of markets and in the planning of new products. In order to design and develop a high technology park or hospital, external help should be called upon, that would provide the experience necessary for such developments. Companies like the Industrial Development Corporation (http://idc.ch2m.com/default.htm), or the SRM Group (http://www.srmec.com/right.htm) have the experience and ability to ensure good results.

In order to create a supporting network that interconnects the companies and the industries with an information infrastructure, the Cyprus Multimedia Super Network (CyMSN) is to be set up. The CyMSN can enhance communication within the country, and to aid in the transfer of technology and knowledge (both locally and internationally) to the community. The CyMSN should be a high bandwidth data network designed to enhance the effective management of innovation and software skills and to decrease innovation time, costs and risks. With the CyMSN in place, multifunction kiosks can be set up for the public to access the CyMSN, and allow government transactions to take place, which would in turn ease the pressure on government officials, and create a more effective and efficient system. These kiosks can also act as information search houses for the public, allowing anyone the access to the information they need. Several web sites should be developed to become a one-stop source of information for the Cypriot industry. The web sites should be of good quality (easy to use and quick to download), and should contain the Cypriot's government policies, incentives, and available facilities. Included on the web site should be an active job recruitment site to inform both the Cypriots in Cyprus, and living abroad of the types of job offerings available in Cyprus.

To ease and promote the transition from general to specialised skills, opportunities must be made available to the industry in the form of meaningful, accessible, and challenging seminars, courses, and workshops for educational purposes. On the policy level, this transition would mean an emphasis on creating incentives, new technological and work opportunities, and market driven demand systems. The United Nations Industrial Development Organisation (UNIDO) (http://www.unido.org/themes/one/one3.htmls) has the knowledge and experience to advise support, and implement policies in transitional economies in addition to providing seminars and training and could be vital to policy development of Cyprus. Other companies like ZOI World Corporation (http://www.zoi.com) can help in industry development by providing sound technological solutions for corporate and individual users who want interactive products for SOHO (Small Office Home Office) environments.

Communication between the Cyprus Government, the Institute of Technology, the Higher Technical Institute, the University of Cyprus, and other technologically involved establishments must be strengthened both as a group, and in regards to the community. The community must become aware of what is available, and which body to contact for its needs. This awareness can be transmitted via the CyMSN, television, distribution of flyers to companies, and even the setting up of a monthly newsletter for distribution throughout the industry. It is of utmost importance that the community knows what possibilities are available, and what developments are being made. Another form of communication that can be enhanced is the science and technology knowledge in the form of television programs (on nature, documentaries, technology programs etc.), software, computer programs and any other form of skilled explanations of useful science. This will help educate the community by providing a better understanding of science and technology, and lay a solid foundation of knowledge. The importance of this is that naturally, as human beings, we build up resistance to change and the unknown. This type of communication/education will help dissolve that barrier.

In addition to informing and preparing the Cypriot community of the coming changes, the word must also be sent overseas. An effort must be made to contact as many international organisations as possible to send its message internationally of the ongoing changes in Cyprus. This will help in finding new contact and channel of information / technology transfers and will open dialogue between the key players in the private, public sectors, and academia. Some examples of organisations that can be contacted are:

- United Nations Commission for Science and Technology for Development (CSTD)
- United Nations Economic Commission for Europe's Senior Advisors in Science and Technology (SAST)
- United Nations Development Programme: Transfer of Knowledge Through Expatriate Nationals (TOKEN)
- UNIDO International Centre for Science and Technology (Trieste)
- UNESCO Man and Biosphere Programme
- International Oceanographic Commission
- Euro-Mediterranean Monitoring Committee for Scientific Research and Co-operation
- International Commission for the Exploration of the Mediterranean (ICESM)
- Commonwealth Science Council (CSC)
- Commonwealth Partnership for Technology Management (CPTM)
- EUREKA

In addition, global organisations that have information or incentives for environmental projects can be contacted like:

- UNDP
- UNEP
- UNEF
- MISTRA
- WORLD BANK
- UNIDO
- INTIB

In order to ensure an effective implementation of the *'environmentally efficient'* goal that Cyprus has undertaken, a masterplan is to be created. As in the Vision 2020 masterplan of Malaysia (Page 30), the masterplan, Cyprus 2010 (for the purpose of this project), should incorporate various different plans, each separated into the different industries, and each with its own goals and deadlines. A body of three or four policymakers from different educational backgrounds (for example management, economics and public policy, marketing, and engineering) can be set up to create each individual plan, each policymaker providing a different viewpoint to the plan. The group should be expected to perform an in-depth study into their individual fields before starting on the plan, this way, they will include the latest changes in their fields, and avoid the mistakes of those who have previously gone through this stage. The group can analyse different existing foreign industrial plans (for example, Singapore's IMP2), subscribe to various industrial/high technology newsletters from around the world (for example Israel's Hi-Tech newsletter (http://www.IsHiTech.co.il)) and similarly, subscriptions to environmental and energy newsletters such as the Renewable Energy Newsletter from the CADDET organisation. All this information can be used to better help our goals for Cyprus. Furthermore, the policymakers can be assisted by appointed persons (involved in academic/research institutions) in the international community, who will be responsible for researching and communicating with the local institutions and associations of that country. For instance, the appointed person in the USA could be a member of the National Business Incubation Association, and through attending the conferences and meetings of this association, can provide invaluable feedback to the policymakers in Cyprus. The masterplan will ensure that the plans are being handled and completed by the due dates, and it displays to an international organisation the *collaboration, security, and a willingness to progress* of the country.

As the plan is to be created by government officials, government officials *must* be sent abroad to partake in the latest training, courses and seminars to become better aware of the latest developments in the world, the latest strategies, and to generate contacts with other officials from other countries. In doing so, an efficient and effective plan can be set up, and the external interaction will also help spread the news of the changes Cyprus is going through. Policymakers should, among other things [5.21]:

- Ensure complimentarily between technology policy and reforms in product financial and labour markets, as well as in education and training,
- Co-ordinate technology policy and macroeconomic policy, because innovation and investment need a sound economic environment to thrive,

- Build on the globalisation process through openness to international flow of goods, people and ideas, because virtuous circles in technology, growth and employment can be set off by openness to foreign direct investment, as in Ireland,
- Improve the management of the science base via increased flexibility in research structures and incentives for university-industry collaboration,
- Ensure that basic, exploratory research is kept at a sufficiently high level,
- Raise the efficiency of financial support for industrial R&D, while better weighing its merits relative to other instruments for financing innovation,
- Strengthen technology diffusion mechanisms by fostering competition in product markets and through better design and delivery of programmes,
- Help overcome mismatches between demand and supply for skills, for example by encouraging companies to make complementary investments in organisational change and up-skilling,
- Facilitate the creation and growth of new technology-based firms,
- Promote new growth areas such as Internet-based services and environmental goods and services through regulatory reform.
- *The government should deregulate the Cyprus pound and allow funds to be repatriated.*

In order to keep the exchange rate of the Cyprus pound in good standing when it is deregulated, there has to be a demand placed upon it by foreigners. This means that there must be strong exports of goods and services, and a demand on assets like financial assets (stocks and bonds), and real assets (factories and machinery). These exports help keep the Cypriot pound strong. On the other hand, if the locals on the island spend more on goods produced in Cyprus, and less on imported goods, this will also help keep the exchange rate of the Cyprus pound strong. As the economy of Cyprus booms, so do the island's imports. However, if some of the demand on the imports can be transformed into local purchasing, then the Cyprus pound can appreciate against foreign currencies. High technology industries can and will help this happen. In the short run, countries that offer investors high rates of return are able to attract more capital and will lead to appreciation of the currency.

Incorporated in each plan should be an individual fund to aid in the implementation of the plan. For example the 'Technology Acquisition Fund' can be set up to facilitate the acquisition of strategic and relevant technology by the Cypriot industrial sector. This fund can be divided into several sectors including:

- The purchase of high technology equipment and machinery to enhance the current production processes.
- Technology acquisition to enhance the design and production of new and existing products and processes
- Transfer of technology to local companies
- Placement of Cypriots in foreign high technology companies and foreign technology institutes
- Information dissemination seminars/workshops
- To assist the local companies to bring in foreign technical experts and consultants for the upgrading of their products and processes

- To assist the chamber of Commerce and industry based associations to bring in foreign expert advice in upgrading the current technological capabilities.

First and foremost, the masterplan Cyprus 2010 should cover the educational system of Cyprus, before the industry. The educational system of Cyprus should be the first of the plans that is to be developed. In order to run the science and technology fields in Cyprus, there must first be an educational foundation in the same fields. The education system in Cyprus is of a high standard but it lacks the option of a science and technology emphasis. Development in this area is not only meant to prepare up coming future Cypriot scientists for the high technology industry, but also to expose the students to another option in life; exposing them to what the future can hold for them. In addition to this, Cyprus is going to be competing with other nations that have already implemented this type of education, and therefore Cypriot students are at a disadvantage if this type of education were it not to be implemented. An idea of what can be developed in regards to the types of courses offered, technology rooms set-up and equipment, and most other information pertaining to technology education in secondary school is contained in an outline for Florida's Technology Education for the Year 2000 design handbook (Appendix V). In addition to the school science and technology education, the students and the general public can be exposed to science and technology can be achieved through science museums that contain the history of science, present science, plus what is to come in science. An emphasis on interactive exhibits would be most educative and spark most interest in those that came to visit. Competitions and prizes can be set up to involve the community and raise the awareness of science and technology, and form interests in research and development as an attractive career option.

Supporting and continuing technology education from secondary school, is technology education at university level. This is where the Cypriot students develop into scientists and engineers, and is a key factor that is needed for the technology infrastructure in Cyprus. A separate engineering college / university / polytechnic can be set up to support such a venture, or the institution can be combined as part of the high technology park having equipment / resources / projects readily available to both businesses and the institution. Education is important due to the common trend in the responsibilities of the individual.

Establishing exchange programs between educational institutions abroad, and internships with companies abroad is important to develop this international experience. In addition, this form of exchange will educate the students in the rapidly changing fields of science and technology. It would be very hard for universities to have implemented curricula in the fields of the latest changes in industry, as industry is continuously evolving. Students in this type of exchange will not only be exposed to the latest developments of the country, but will also gain experience working in teams with professionals and have access to equipment that would be too costly for a university budget. Internships also invite students of different backgrounds to interact with each other. With proper facilities made available, the University of Cyprus and other educational institutions will be able to attract Cypriot professors and researchers from abroad to return to Cyprus and enhance the education of their homeland.

In a special report in Mechanical Engineering Magazine [5.22], it was stated that the education of tomorrow's engineers can no longer be focused purely on engineering. Due to the downsizing of companies and streamlining of processes, competency in areas such as accounting and economics are now challenging the engineers. Distinguished academicians and managers have identifies several key areas for engineering educators to focus on. These include the newer technologies (such as metatronics (a mixture of mechanical and electrical engineering) and composites), management skills, team leadership, financial planning, management of information, total quality management, international business communication, and the ability to compete in global economies. It is important to note that a similar environment of what the professors are used to must be reproduced on the island in order to attract these professionals. Professors abroad are not just educators who advise and prepare graduate students, but experts in their field, conducting research for major firms and government agencies, publishing papers, holding seminars to people in similar fields, and have major research facilities at hand. They are able to obtain major funding from either government sponsorship or private industry support, and are continuously surrounded by others in their field. This type of an environment is hard to duplicate but is essential for the educational system.

Cyprus is at a stage that has virtually no high technology industry, technology, and experience. The Cypriot community can not be expected to attract major firms to Cyprus unless they are serious in their goal, and have the ability to support them. And in order to convince the outside world of their seriousness, they have to show an immediate, proactive, willing, progression toward their goal of high technology. This means making Cyprus attractive for the high technology industry by establishing high technology centres, introducing high technology incentives, investment incentives (some examples of incentives are listed in Appendix VII), and offering a promising future to Cypriots or foreigners with a knowledge of high technology who are living abroad presently. Cyprus must advertise to the high technology community its intentions, and one effective way to do this is by starting seminars that are locally sponsored in order to bring into Cyprus experts in the high technology field. These seminars will introduce the Cypriot industry to high technology, and vice versa, introduce the experts to what Cyprus is willing to offer high technology investment. These celebrities will leave Cyprus with an opinion that will be spread to other celebrities in their field of expertise. In order to find the type of technology Cyprus would want to attract to Cyprus, it may be a good idea to find out what Cypriots have studied and in what type of discipline. This includes Cypriots who have studied abroad and who are presently living abroad.

Both financial and technology transfer support can come from foreign investment. Possible reasons why a company may want to invest abroad are usually due to:

- *demand* (a manufacturing base could be established to satisfy the overseas demand for the company's products, Carlsberg beer in Cyprus for example),
- *financial reasons* (an NVP analysis might indicate a positive net value for such an investment, increasing the wealth of the parent company),
- *production efficiency* (raw materials or labour might be cheaper in the overseas market than at home), and

- *tariff avoidance* (having tariff barriers established by an overseas country to frustrate imports into that market, may be avoided by establishing a base within the country that will not be subject to the tariffs).

It would be false to say that Cyprus is strong on any of these points. On the other hand, the reasons found that companies would avoid investing in other countries are:

- *classification of political risk* (possibility of invasion by powerful neighbours),
- *commercial political risk* (protectionist authorities can starve foreign establishments of orders, give commercial or financial advantages to locally owned competitors, restrict import licenses for imported materials or products, or use work permits to expatriate staff),
- *financial political risk* (restricted access to local borrowings, restrictions on repatriating capital, dividends or other remittances, or financial penalties on imports from the rest of the group),
- *currency risk*, and *group vs. subsidiary risk.*

Most of these points are applicable to Cyprus in one form or another. It would be best to try and dissolve these problems as they act as a deterrent to the international investor/company.

If Cyprus were to decide to attract foreign investors and high technology, it would be a good idea to offer them something different to what is already available. A theme, based on the underlying paradigm, can be created that is of interest to high technology companies. For example, Cyprus could claim to have the *most environmentally friendly high tech park in the world*; something international businesses would like to claim when selling their own product (being produced within this park) on the market. Another idea/point of interest would be to focus on a certain type of high technology, and to build the best worldwide facilities for this type of technology. Naturally, the advantages Cyprus has to offer, the better the chances are of attracting the 'right' type of high technology industry and technology. What is meant by the 'right' type of high technology companies are companies who value these points the high technology park has to offer, and know their value. These companies can be known international companies, seeking new places to invest. One way to contact foreign companies would be to use the BRE (Bureau De Rapprochement Des Enterprises) correspondent in Cyprus who could help Cypriot SME's locate European partners, opportunities and participation in related activities. Another way would be to spread the word to the Cypriot scientists abroad who are in contact with industries worldwide.

Multinational companies that ate active on several continents are looking for locations around the globe to set up offices that can communicate worldwide. Cyprus, as well as the rest of Europe, are in the ideal time zones for global communication. In the morning, a business can communicate with Asia, while in the late afternoon they can communicate with the USA. Multinational IT (information technology) companies represent a section of industry that is extremely flexible and which allows business ventures away from their headquarters. CIO Enterprise section magazine (http://enterprise.cio.com) (Feb 15 1999) states that there is a demand on emerging IT companies looking for niche locations:

> "Some (governments) offer tax incentives, grants and other financial sweeteners. Most tout their workforces and, increasingly, universities that will work with companies to develop customised IT curriculum"

Netscape Communications Corp. for example, have opened a centre in Dublin to get closer to its customers (from Europe, the Middle East, and Africa). They, among other multinationals, have picked Ireland due to its cost effectiveness (including government grants) and facilities. In addition to these advantages, Ireland has a very mature infrastructure *geared toward subsidiaries*.

With a good science and technology infrastructure (educational system) in place, Cyprus can concentrate its efforts in the high technology field. Cyprus should concentrate on the development of products rather than scientific research. Cyprus is not in a position to discover something new in the scientific realm, but rather use entrepreneurship, innovation and what has been developed so far to produce something that has not existed before. The discovery of new formulae or the like in science can only come after that of what is existing has been understood, and the most efficient way to understand what has been discovered is to use and develop it. In order to have access to what is available, a medium has to be created, and one of the most efficient, extensive, and cost effective mediums is the Internet. But first, an interest has to be created in the Cypriot community to develop and enhance entrepreneurship in Cyprus. It is common knowledge that the more people involved in a common goal there are, the more efficient and effective (and the least time consuming) will be the road toward this goal. Take the construction of a building for example. Without the collaboration between the owners, architect, construction management, construction workers, steel/cement companies etc. etc, the building would take longer, and be of poorer quality that if it had been built with full collaboration between all parties involved.

The setting up of a technology centre in Cyprus is a must if high technology is to be introduced and developed. The next section (Section 5.3) outlines what could be entailed in a technology centre. The centre could offer excellent world class incubator facilities for certain types of high technology, for the promotion of emerging technologies. This would provide a short-term stay (2 to 3 years) for foreign/local high technology firms that will be developing the latest emerging innovations. Once established, it can eventually incorporate multiple multinational firms in one dense location each working on the latest in their field. The facilities needed for such an industrial complex are small and compact, taking up minimal land space, and a short construction time. This technology centre would act as a catalyst to the high technology industry.

> According to Dr. Simon Johnson (See Appendix II - Background Information on People) from the Massachusetts Institute of Technology, to introduce high technology, a country must (1) get the macro/regulatory environment right, (2) find human capital (especially trained abroad) and (3) establish the right relationships with big international firms.

In order to attract new scientists, be them locals abroad or foreigners, a medium in which they can be introduced to the prospects has first to be established. This is best done by using the Internet, and a simple example of this is Jobnet (http://jobnet.co.il), a job search Internet site run by the Association of Americans and Canadians in Israel. Jobnet had some 100,000 visitors in the first nine months of operation, offering a total of 1,500 job offers. A similar web site should be established for Cyprus in order to inform the world of the opportunities available in Cyprus. Included on the web site can be the different policies, incentives and facilities available. It is important that the web page be of good quality as it reflects the country's seriousness, and therefore foreign scientists are more likely to take an interest in Cyprus. Detailed WebPages take long periods of time to open up and therefore may act as a deterrent. Although this WebPages is a minor point, it is also the first contact / impression the scientists experience, and therefore very important.

> According to Paschos Mandravelis (See Appendix II - Background Information on People), (1) researchers in Cyprus need more the opportunities to do their job than economic compensation. By opportunities he means labs and universities. Researchers need their name printed in as many citations as possible to become recognised and receive credit for their work. (2) In terms of investment, information technology is the cheapest. The cultural climate is a key factor in which smooth flowing ideas will attract scientists from abroad. (3) Telecommunications are crucial for a scientist's environment at it allows them to know what is going on in their field of expertise, and allows them to share thoughts with their colleagues.
>
> As short term measures, he proposes seminars and conventions which will attract scientists (not only Cypriots), showing them how good life is there. That there are work opportunities, that there is cultural tradition that will fertilise their thinking and show them that people respect scientists, and that they will be prominent members for the society.
>
> He believes that the state should finance beginnings of companies (as done in Israel), but researchers who establish such companies, should not feel that whatever happens the state will be there to help them out. He believes that Cypriots will do better in this area because they have a more business-orientated mentality than the Greeks.

It is important that scientists are given challenging opportunities, as they are the brains of the high technology industry. Already Cyprus has places were scientists can work and develop, but more needs must be created in order to bring in further know-how from around the world. This imported know-how will provide different views, opinions, methods of problem solving, thought processes and ideas to the technology base needed for high technology development. In the case of Israel for example, there is a strong correlation between the increase in ex-Soviet immigrants, and Israel's economic growth. To enhance the exchange of technology, technology conferences (for example, Singapore's Techmonth '97) can be set up to bring in foreign technology, create interaction, and display the local industry. External visitors specialised in a particular field of interest may be invited to join the event and provide up-to-date information on the current events and achievements. These events should target not only business and industry, but include students – the researchers of tomorrow – and the general public. Tours can also be prepared at these events to take researchers out into the science and technology facilities, local companies and relevant research centres and institutes and tertiary institutions. Students can be treated to demonstrations, talks and tours of the facilities giving them a better understanding of the researcher's role.

Supporting the high technology industry will be the service industry. The development of service industry was one of the goals of ex-president Vassiliou though unfortunately it was never seriously undertaken.

According to Yiannos Aletraris who deals mainly with the service industry, "Cyprus has all the potential to play a vital role in high technology services for our wider geographical area. Cyprus' future is in services. Cyprus has a considerably high proportion of educated workforce, and its geographical position is ideal for providing services to the Middle East, as well as playing a gateway role for the Eastern block countries."

He added "We have seen recently an explosion of high technology assembly lines (erring to computers) opening up in Cyprus. Due to the high availability of PC components, and the cheap Asian manufacturers, Cypriot companies now build up complete PC's from basic components, customised to the user's requirements. The problem here is the issue of quality. Quality control seems to elude most of our assemblers, and they fail to understand this vital point. A few companies have realised this and have proceeded with full ISO 9002 certification, so there is hope. As we have seen in the past one or two years, Cypriot firms can compete in the high technology arena, but so far only in using ready made parts and producing final products. I am not aware of any attempts into high technology manufacturing, at least not in the Computing Area."

Talking about the effect on the economy, Mr. Aletraris adds, "Our firms are exploiting fully the Eastern European markets, where the quality of our PCs is seen as satisfactory. But, money made from this sector is still low. Labour in Cyprus, as you know, is relatively expensive, and it is difficult to compete with our Asian counterparts. Since our firms are really in a mass production competition, rather than a specialised market, then there is no apparent difference between a Cyprus assembled PC and a Korean one. - So when there is an option Cyprus loses due to high labour costs."

As Mr. Aletraris has indicated, specialisation is a key factor in the service industry (as in high technology industry). The service industry is easier to develop, expand and update than the high technology industry, as the infrastructure required in not as extent as that required by the high technology industry. A combination of the two would be most beneficial to Cyprus as the service industry is essential for supporting the high technology industry. Research centres or the CyHTP can be used to make innovative improvements in the present generation of products and services, as well as provide better QC (quality control) standards. In addition, government officials can pay surprise visits/inspections of different facilities in Cyprus to ensure the conditions and quality are up to standard, and that the company is keeping to the health/pollution standards of the country.

Having met with Ms. Nazli Choucri, Ph.D., a professor of political science and associate director of MIT's Technology and Development Program, she proposes that Cyprus should concentrate on becoming a hub for Europe, the Middle East and Africa for the following two areas:

1) for the service industry,
2) for becoming a conference and exhibition centre.

Dr. Choucri believes that concentrating on these two areas would be best due to the location and present situation of Cyprus. Both of these concentrations can be well supported by the high technology industry. Dr. Choucri also suggests that India would be a good example to follow since it has effectively developed these two areas.

Concerning the latter point for instance, Cyprus can hold all types of conferences including, for example, an annual Techmonth or Techweek to display, introduce, and form connections between technology companies. These exhibitions will bring together the latest know-how of the different fields. Conferences of a specific field will pool key figures in those fields who will interact with other international and local figures, exchanging up-to-date information on current developments and achievements. The organisational committee for these conferences should include research institutes, universities, and government bodies. The conferences provide ideal environments to award deserved recognition to scientists and engineers.

One of the key factors in becoming a conference centre is *communication.* Not only does *communication* refer to the physical telecommunication infrastructure of the island, but also the type of services it supplies. Language proficiency is very important in the communication industry. For example, Holiday Inn chose Amsterdam as the head reservations office of Bas Hotel's & Resorts (an Atlanta (USA) based company). This office processes reservations from 18 countries in the region, plus Hungary and Israel, and half the staff speaks four languages or more. Bass Hotel's & Resorts are now moving from a purely reservations office to a service centre.

To conclude, the ideal time to secure a good future for Cyprus is now. Today, Cyprus has the resources and opportunity to enhance the infrastructure of Cyprus toward the development of the high-value high technology industry. Cyprus has to upgrade its infrastructure by creating the Cyprus Multimedia Super Network to enhance communication and interaction within the community, and establish educational institutions, to support the industry. Starting with the educational system, science and technology must be introduced into the community to prepare the community for the upcoming changes. These changes will push the innovation and development in the service industry, with the high technology sector acting as a catalyst. A *positive consistent push* has to be made by both the community and the government of Cyprus, and carried through, in order to allow the high technology industry to breathe its first breath of life. As Dr. Lee, director of the United Technologies Research Center once quoted 'Even though we may be on the right track, if we stand still, we can still get run over'.

6.3 CYPRUS HIGH TECHNOLOGY PARK

Technology innovation is only the seed of the technological market. Just as a seed needs a nutrient rich soil to develop and bloom into a beautiful flower, so does technology innovation. Technology parks are one, if not the most, 'nutritious' environments for technology innovation. They provide maximum efficiency for the entrepreneurial innovators to develop their ideas/products by having a single body that provides the services needed for the business aspect of the idea/product development.

THE PARK'S PURPOSE IS TO:
(1) offer premises tailored to the business needs, through management support, marketing support, infrastructure support, technical support, and financial support,
(2) provide services that improve the efficiency of the business,
(3) develop programs that make the businesses more competitive,
(4) provide facilities that contribute to the availability of labour and stimulate business, and
(5) reduce the operating cost of setting up initial years of a business to a minimum

In order for the Cyprus High Technology Park (CyHTP) to be effective, it must work efficiently and effectively. Therefore an excellent infrastructure is of utmost importance.
After an extensive exploration into high technology parks, and feedback from entrepreneurial innovators, a skeleton of the set up and process of the Technology Park has been established. Note that the government can request international organisations to formulate its concept just as the UNIDO had done for the Kulim High Tech Park in Malaysia.

ASSIGNING A NAME TO THE HIGH TECHNOLOGY PARK.
The assigning of different names to different parks (if there are to be more than one) enhances the public image of the products being sold at that particular park, and helps to keep a concentration in a particular field. For instance the 'Mediopolis Park' would contain the medical technology and biotechnology, while 'Technopolis Park' would contain technology based firms. These names could also be different areas of the same park. For project purposes, the park will be erred to as The Cyprus High Technology Park (CyHTP).

PARK ORGANISATIONAL STRUCTURE.
The Cyprus High Technology Park Authority (CyHTPA) will be established to carry out all the needs of running the park. It will be the dominant body, and will be in charge of permitting projects to be established within the park itself. As this establishment will be the backbone of the park, and has the power to make the park succeed or fail. Therefore, the administrators <u>*must*</u> be chosen by their credentials; background education, and

experience (completed projects/papers/research) <u>*rather*</u> <u>*than*</u> the well known 'μεσον' method of selection. This point can not be stressed strongly enough.

THE PARK'S SUPPORT ORGANISATIONS.

The CyHTPA will communicate with established institutions like the Institute of Technology, the Higher Technical Institute, the University of Cyprus, and others, for constant feedback in their specialities (See Figure 5.31, page 63). This constant feedback helps avoid the waste of the utilisation of resources by its division between an excessively large number of fields. The feedback will also give the CyHTPA a clear understanding for the formation of clear industrial policies, and an understanding of the sectors in which Cypriot companies possess special expertise. CyHTP will work closely with the Cyprus Government to act as a one-stop business approval centre for investors in providing businesses license application and approval, documentation, custom clearances and so forth.

GOALS.

The goals of the CyHTP are to:

1) Support and promote the '*environmentally friendly*' paradigm,
2) Enhance the development of the high technology and service industry in Cyprus,
3) Act as a catalyst for new emerging companies by the reduction of red tape, and reduce the start-up time through the incubation programme.
4) Become a test centre for Cypriot products.

THE CYHTP SUPPORT PROGRAMS.

In order to meet the objectives set for the CyHTP, three major programs are to be developed:

1) Technology Based Incubation Programme
2) Technology Transfer Programme
3) R&D Support and Services Programme

The businesses being incubated today are at the forefront of developing new and innovative technologies -- creating products and services that improve the quality of our lives -- on a small scale today, and on a much grander scale tomorrow.

The CyHTPA will develop a training project that will help the companies/innovators with business survival by offering courses/seminars in the use of time and rationalisation, profitability in global markets, international communications and communication strategies, cultural differences and practical presentation and negotiation skills. Agreements can be set up between various educational institutions on the island to provide further education in a specified field, or intensive courses in software usage (AutoCAD, ProEngineer, etc). All these non-administrative service elements can become a source of income for the park by being available to the public at a modest price. The type of business conducted at the park should be concentrated on the generation of small and medium Cypriot businesses (that can benefit from Cypriot intellectual property), and should target the boosting of the Cyprus economy by generating jobs and exports. To a lesser extent, and not in the category of start-ups is the attraction of multinational companies. The CyHTP can impose criteria toward the companies in the CyHTP like, for example, that the local R&D expenditure to gross sales should be at least 2% (for non incubator companies) on an annual basis, or that the percentage of engineers against total workforce should be at least 7%.

LOCATION

The location is very important to the success of the CyHTP. It must be located near research, academic, and industrial institutions, an international airport (Larnaca), a highway, as well as hotels or available apartments/houses[1]. The location should be in an open area so that the CyHTP would be able to expand its premises in the future if the need arises.

The premises of the CyHTP should reflect the necessity of the high technology industry. Under the underlying paradigm for the promotion of Cyprus toward international investment/business/tourism, the construction of the premises should be environmentally friendly and energy/resource efficient. The construction of the premises should not be brick and concrete internally, but rather high technology construction that would permit working surfaces to be easily expanded or reduced to accommodate the flexibility of the type of industries that enter. The Oulu Technopolis for example can range its rented business premises from $15m^2$ to $15{,}000m^2$ (its total industrial working/office space is almost $60{,}000m^2$ comprising of over 100 companies and employing around 2800 persons). The park should promote the environmental aspect by having a greenland coverage of, say >35% as in the case of the Shanghai High Technology Park.

PHYSICAL DESIGN OF THE CyHTP

The key to success of the CyHTP lies in its excellent operating conditions and environment.

"It is of course true that business premises should be first rate, but the most important thing of all is that companies should be surrounded by a lively network of business activities and contacts", says Pertti Huuskonen, CEO of Oulu Technopolis Ltd.

A central concrete building should house the CyHTPA, welcome/information desk, the *Administration Service Centre* (ASC), *exhibition halls, conference and videoconferencing rooms, QC Test Centre, Accountants Office, Patents Office, Customs Office, Hotel Accommodation Service, Post Office, a travel agent, catering facilities, a gym, a library, children's Day Nursery, and some restaurants.*

The Administration Service Centre (ASC), a high standard of business service, provides secretarial services, financial management, personnel, recruitment, purchasing, making photocopies, and contains photocopiers, fax, telephone exchange service, etc. etc., and equipment used should be provided on the basis of a share system at cost. The ASC can assist in selecting consulting services, and identifying and establishing contact with strategic partners and investors (both local and abroad). The library will contain access to high-speed computers, the Internet and databases, books, software, microfiches, periodicals, subscription magazines etc..

The library is connected via computer to all libraries in Cyprus providing quick search times for information and an exchange service will allow quick retrieval of material. Centrally located within the building is a glass covered atrium surrounded by columns, containing grove construction (refer to Appendix III) comprising of a waterfall, pond, rock formations incorporating trees and plants, paths, and benches on which business can be discussed. The idea is to provide a serene atmosphere by providing a naturalistic look, and providing a therapeutic effect through lighting and the sound of running water. This also emphasises the environmental aspect of the CyHTP.

"It is of course true that business premises should be first rate, but the most important thing of all is that companies should be surrounded by a lively network of business activities and contacts", says Pertti Huuskonen, CEO of Oulu Technopolis Ltd.

Surrounding the central building are to be various Smarthouses each containing a central cafeteria, surrounded by the incubators and enterprises. Each Smarthouse contains companies of the same field and therefore promotes interaction and exchange of ideas. Each building contains most telecommunication and administration equipment like phone, fax, e-mail, Internet access, photocopiers, secretarial services and so fourth.

ELECTRICITY AND CLIMATE CONTROL

The electricity supply should be foreseen with modern electricity saving devices avoiding UPS but replacing it with the above. Lighting should be of modern high intensity, low power consumption with proper EMI insulation and lightning protection. *Solar and wind energy can be used to help produce electrical energy* (Appendices VI and VIII). A stand-by electric generator for minimum load should be provided. Provision should be made to supply 3-phase and 60 cycle frequency, to test instrument for shipments to countries where this frequency is mandatory. Central heating, air conditioning and dust proofing should all be considered at the planning stage. In appropriate areas, the atrium for instance, noise and thermal insulation should be considered.

TELECOMMUNICATION

Telecommunication services include Internet access, e-mail, voice box, fax, PDS, leased line, video-text, wireless paging, mobile communication, data communications among other services. Telecommunications should be as fast and efficient as possible including an optical fibre cable network. Videoconferencing is one of the fastest growing telecommunication sectors (expanding ~50% annually) and will benefit the SME's (small and Medium Size Enterprises), especially in global respects. The telecommunication services are to be available to the public at a reasonable cost, 24 hours a day to accommodate for time zone differences. The ASC staff will be responsible for demonstrating the use of all equipment, and for the testing of the connection to the external source (before the meeting between the two companies is to be held).

Transport cost includes special rates with Cyprus Airways in due course, as well as with other airlines and the post office. The same applies to telephone and fax costs, as this will make part of the cost of development, production and marketing. It is there suggested that only those within a high technology industrial zone would qualify and a proper planned control for such services and this should be done at the initial stage.

All this indicates that a massive Government involvement must be considered for a successful realisation of this new and important high technology industry. Financing for the park can be/ and has been in the past by the city of location, EU (questionable), individual enterprises and the government.

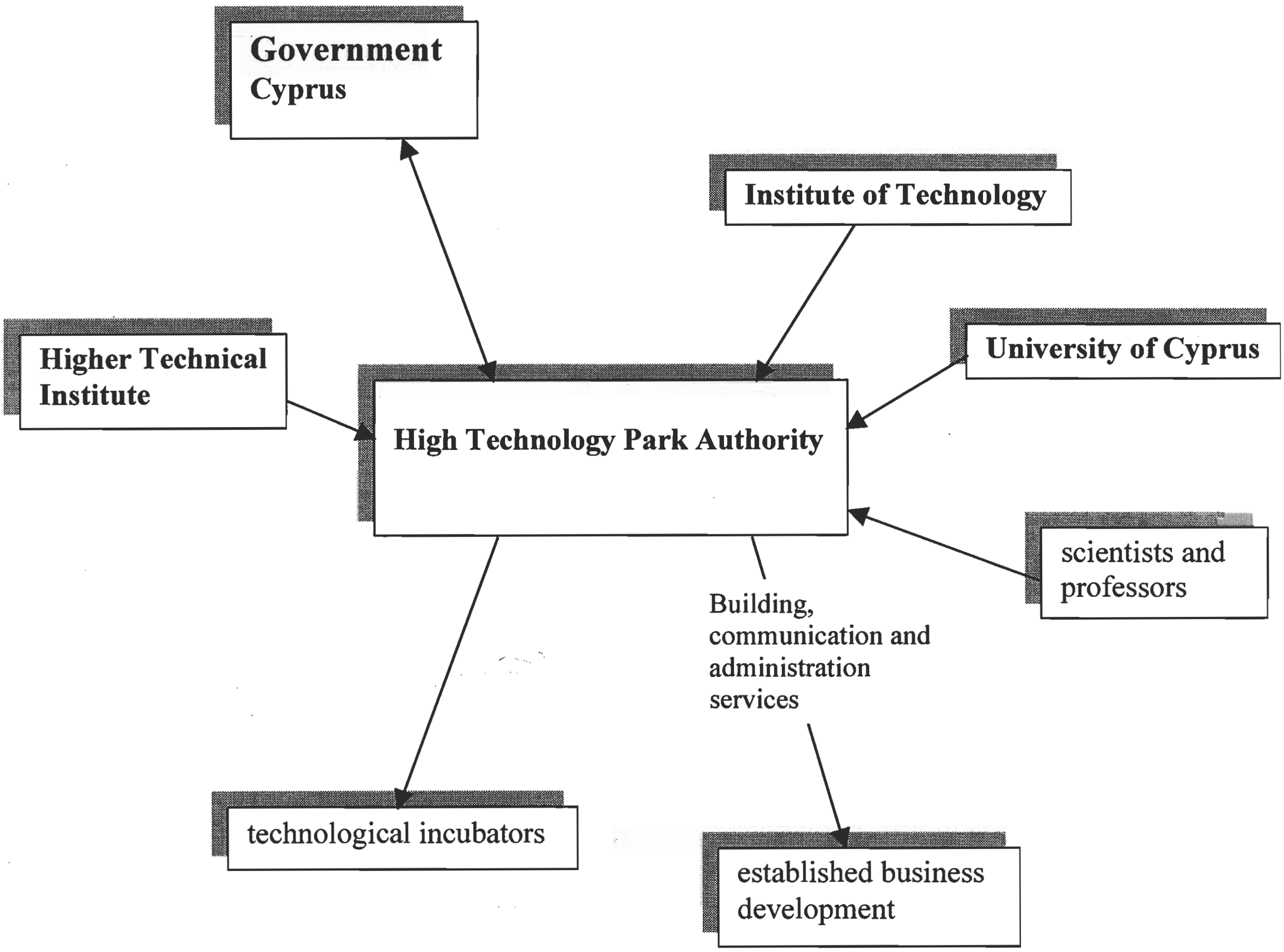


FIGURE 6.31 - CYPRUS HIGH TECHNOLOGY PARK NETWORK.

7 CONCLUSIONS

The aim for Cyprus to reduce the dependence on the less stable tourism sector and to establish a more secure economy by enhancing the industrial/technology sector is to be reached as soon as possible. To develop the industrial sector a new masterplan, Cyprus 2010, is to be developed to encompass and guide this implementation with the underlying paradigm of Cyprus to become an environmentally efficient country (page 53). The Cyprus 2010 masterplan (page 57) will contain a multiple of plans that are each focused on a specific field (the development of the educational or tourism sectors, for example). The field of education is of utmost importance (pages 41, and 59), and is closely followed by the development of the Cyprus Multimedia Super Network (CyMSN). Intellectual capital requires the greatest investment for a country but is the driving force behind sustained technological development. This asset fosters a country's flexibility, the innovation, creativity, and productivity of the community and promotes a country's insertion as a competitive player in a global market.

The Cyprus Multimedia Super Network (CyMSN) (page 54) is to be set up to interconnect the industries, educational institutions, and government together, and will lie as the backbone to the future development of Cyprus' highly efficient and effective infrastructure (page 43). With the establishment of such a network, specialisation in certain fields (pages 54 and 63) will become possible. The CyMSN will in turn promote the two most critical skills of the next decade (page 41); effective management of innovation and software. The CyMSN will host web sites that allow government transactions to take place, government policy, industry information, and an active job recruitment site (page 55, and 62). The CyMSN will also promote Cyprus to overseas interests.

Promoting the technology development in Cyprus will be the high technology sector. Acting as a catalyst to the development of this sector will be the establishment of the Cyprus High Technology Park (CyHTP) (Section 5.3), which will promote opportunities for the needed R&D for Cypriot professors of the local educational institutions which play an important role (page 59). Supporting these changes will be the development of the service industry in Cyprus (page 63).

To initiate the exchange of ideas and development in Cyprus, Cyprus should promote as many international conferences/seminars as possible (page 59, and 63). To support theses international conferences and enhancement of the telecommunications of the island with respect to the available services and language proficiency (page 64).

Government incentives (page 44, Appendix VII) are to be introduced to promote high technology and technology investment on the island (page 43). The news of the changes in Cyprus should be spread overseas and as many contacts made (page 55). Government policy should be developed (page 56) and supported by a variety of information from international sources. This would entail government officials travelling abroad for furthering their knowledge with the latest developments (page 56). Exports should be promoted and the Cyprus Pound should be deregulated (page 57). To promote technology exchange, a fund should be set up to acquire relevant technology (page 57).

The change of technology improvement and development in Cyprus is inevitable. The greater the involvement on the island, the better and more efficient a change will happen.

8 APPENDICES

APPENDIX I - STATISTICS ON CYPRUS

The information below has been taken directly from the Industrial Statistics 1995, Series II, Report No. 32.

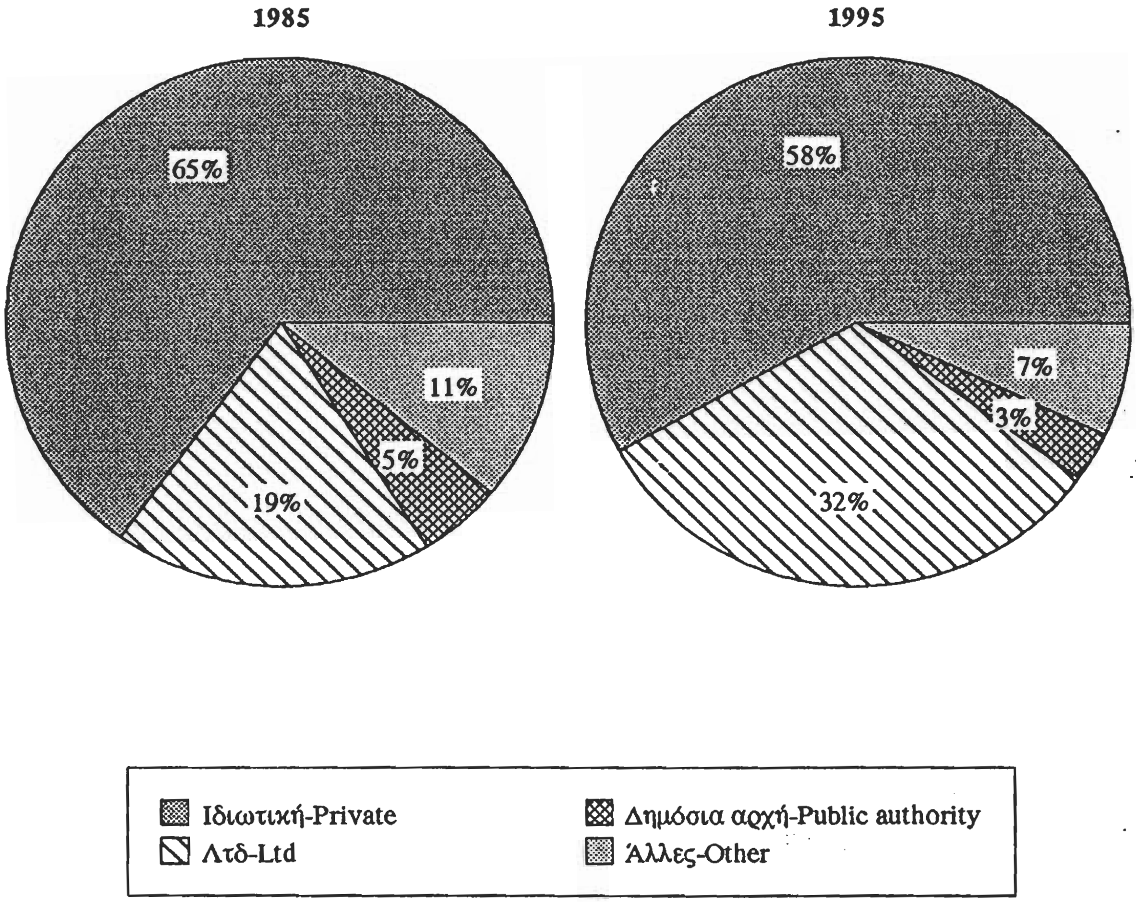
Definition of Terms Used

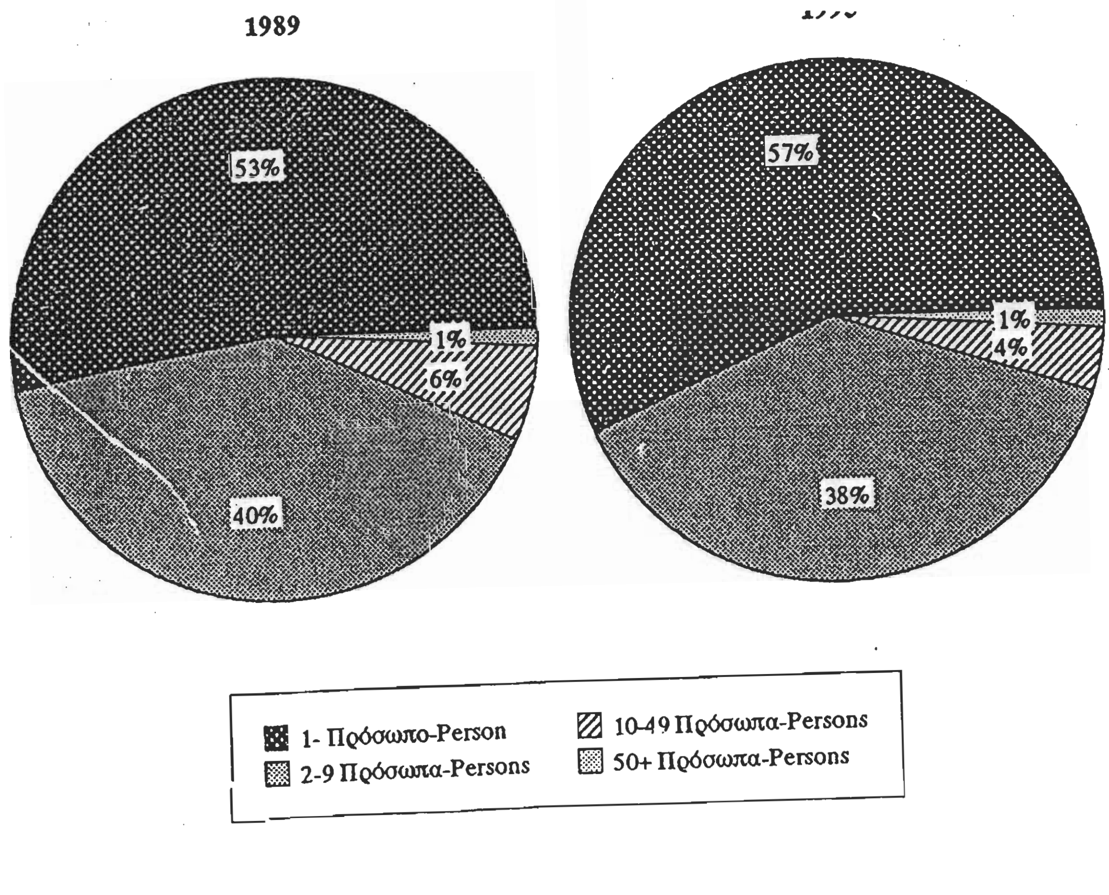
Establishment: It is an economic unit (a firm or self employed person), which is engaged in one or more than one kind of activity but which operates in one building under a single ownership.

Enterprise: It consists of either one independent establishment or two or more establishments which belong to the same company. For example, a bank with 100 branch-establishments in Cyprus is one enterprise.

Economic Activity: It refers to the main activity of the establishment and not to any other activity of the proprietor.

Διάγραμμα II: ΚΑΤΑΝΟΜΗ ΥΠΟΣΤΑΤΙΚΩΝ ΚΑΤΑ ΝΟΜΙΚΗ ΜΟΡΦΗ
Figure II: DISTRIBUTION OF ESTABLISHMENTS BY LEGAL ENTITY





ΠΙΝΑΚΑΣ 6 (συν.). ΕΓΧΩΡΙΕΣ ΕΞΑΓΩΓΕΣ ΜΕΤΑΠΟΙΗΤΙΚΩΝ ΠΡΟΙΟΝΤΩΝ ΚΑΤΑ ΚΛΑΔΟ ΒΙΟΜΗΧΑΝΙΑΣ, 1963-1995

TABLE 6 (cont'd). DOMESTIC EXPORTS OF MANUFACTURING GOODS BY MAJOR GROUP, 1963-1995

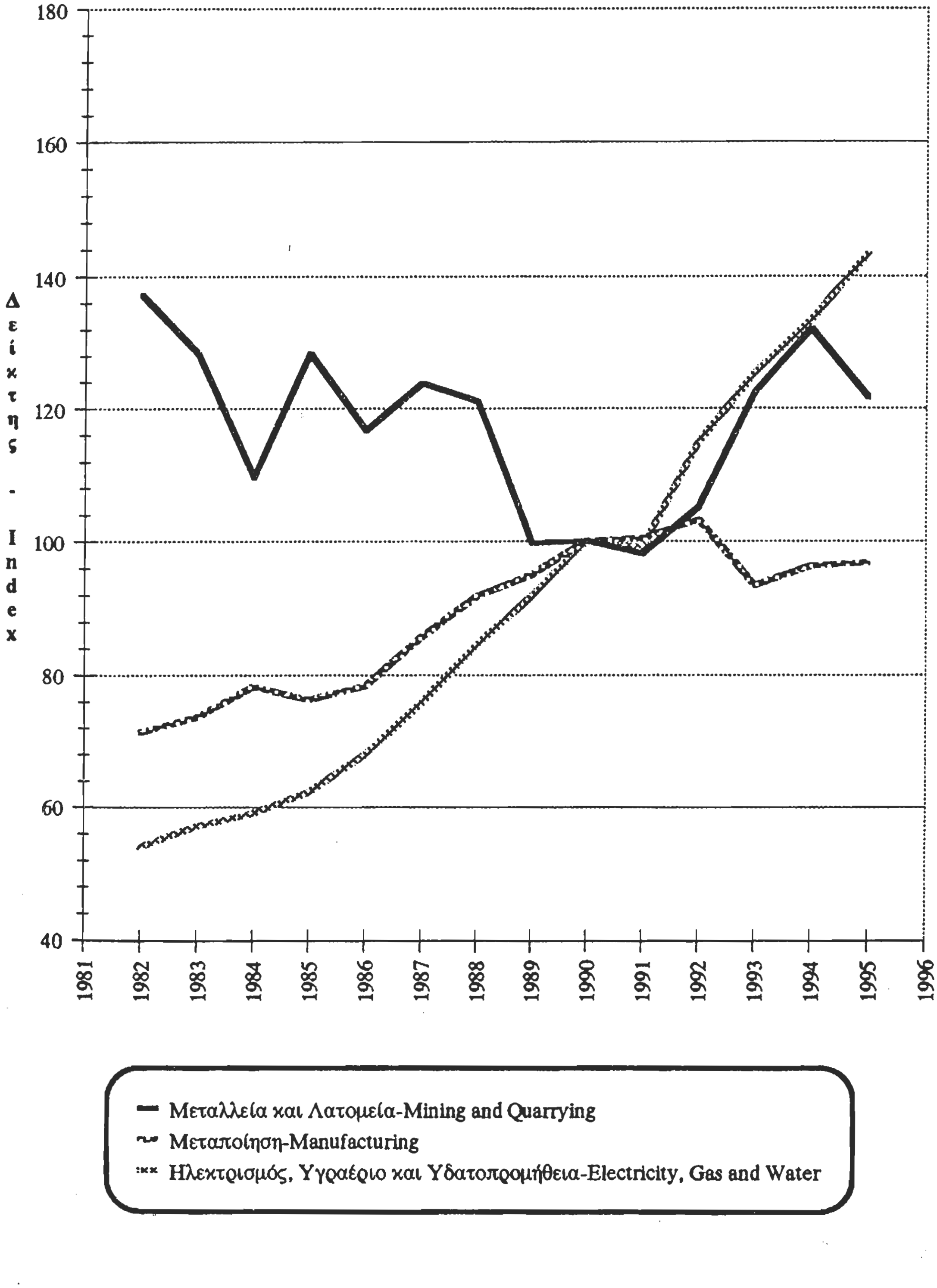
(F.O.B. Κ£000's) (F.O.B. C£000's)

Έτος / Year	Σύνολο / Total	ΚΛΑΔΟΣ ΒΙΟΜΗΧΑΝΙΑΣ - INDUSTRY CODE (ISIC 1968)							
		(31)	(32)	(33)	(34)	(35)	(36)	(38)	(39)
		Είδη Διατροφής, Ποτών και Καπνού / Food, Beverages and Tobacco	Υφαντικές Βιομηχανίες και Βιομηχανίες Ειδών Ένδυσης, Υπόδησης και Επεξεργασίας Δερμάτων / Textile, Wearing Apparel and Leather	Βιομηχανίες Ξυλείας και Προϊόντων Ξύλου Περιλαμβανομένων Επίπλων / Wood and Wood Products, Including Furniture	Χαρτοβιομηχανίες, Εκτυπώσεις και Εκδόσεις / Paper and Paper Products; Printing and Publishing	Χημικές Βιομηχανίες και Βιομηχανίες Παραγώγων Πετρελαίου, Ελαστικού και Πλαστικών / Chemicals and Chemical, Petroleum, Rubber and Plastic Products	Προϊόντα από Μη Μεταλλικά Ορυκτά / Non-Metallic Mineral Products	Είδη από Μέταλλο, Μηχανές και Μεταφορικά Μέσα / Metal Products, Machinery and Equipment	Άλλες Βιομηχανίες (Περιλαμβανομένης της Οικοτεχνίας) / Other Manufacturing Industries (Including Cottage Industry)
1980	**107.508**	25.709	44.291	440	7.006	6.031	14.400	9.442	189
1981	**143.214**	32.398	61.490	496	10.052	8.261	15.017	15.103	397
1982	**140.551**	37.951	52.384	365	9.557	9.279	15.474	15.149	392
1983	**135.352**	33.185	58.440	716	6.483	11.399	11.539	13.197	393
1984	**171.512**	38.361	85.581	852	8.638	13.164	9.177	15.292	447
1985	**149.808**	31.851	73.206	1.466	9.048	12.581	3.652	17.371	633
1986	**125.911**	31.582	60.692	784	4.862	10.916	5.510	10.958	607
1987	**168.130**	36.366	91.144	1.205	5.831	11.237	7.144	14.426	777
1988	**187.165**	32.468	98.386	2.051	5.272	22.113	8.064	18.105	706
1989	**189.117**	40.795	94.127	1.850	5.960	20.227	8.373	16.764	1.021
1990	**190.129**	43.957	93.914	2.053	6.816	18.137	9.791	14.089	1.372
1991	**183.063**	41.085	89.419	1.950	6.656	19.418	7.551	14.735	2.249
1992	**175.738**	38.205	82.974	2.429	4.980	21.616	8.068	14.893	2.573
1993	**157.170**	35.128	66.330	2.595	4.528	23.151	7.421	15.552	2.465
1994	**165.893**	38.735	56.678	3.045	5.938	27.666	13.564	18.132	2.135
1995	**163.807**	38.848	52.966	3.774	6.819	30.570	10.560	18.602	1.668

Διάγραμμα 1. Δείκτης Βιομηχανικής Παραγωγής, 1982-1995

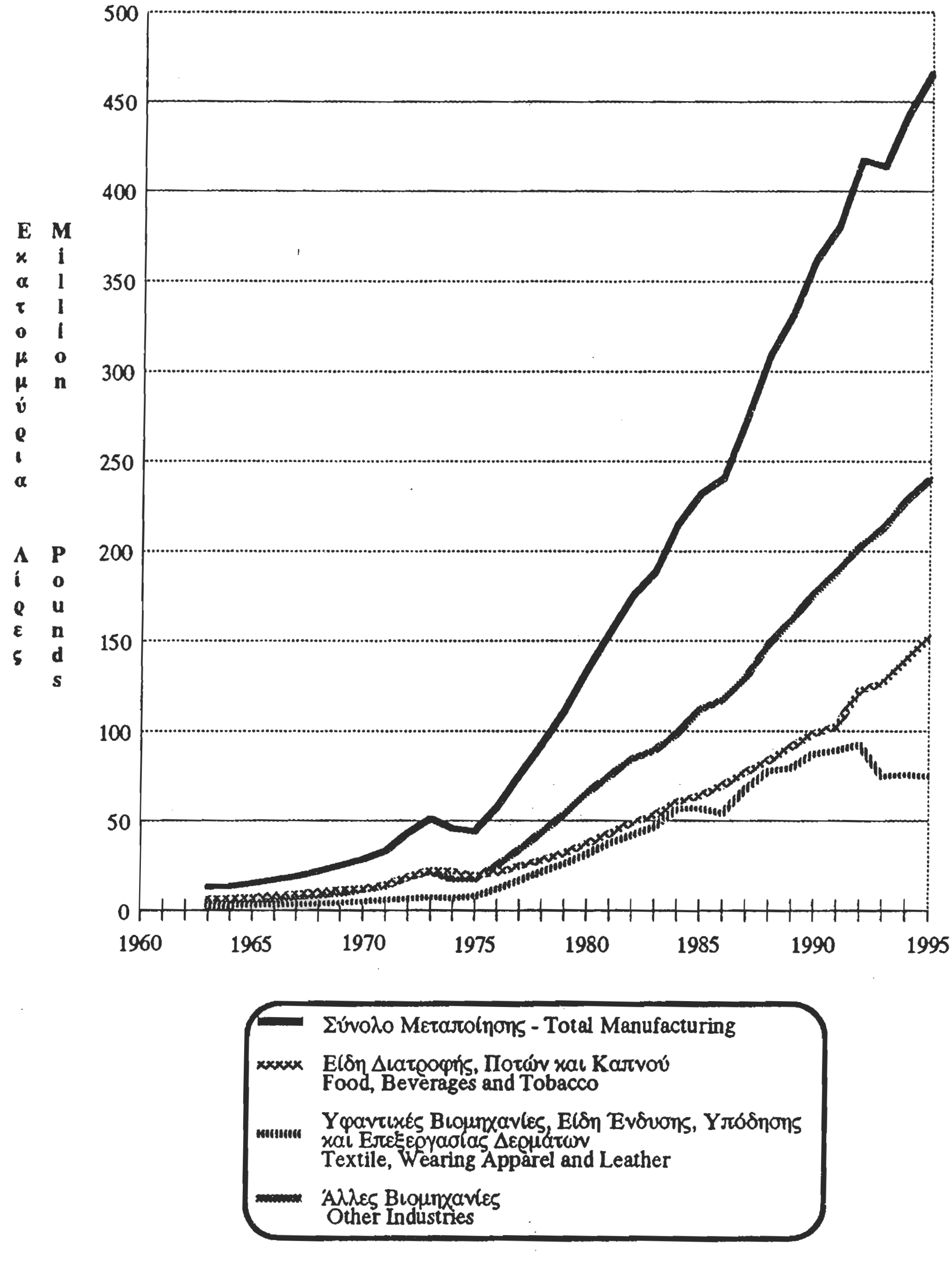
Figure 1. Index of Industrial Production, 1982-1995

(Βάση: 1990=100)
(Base: 1990=100)

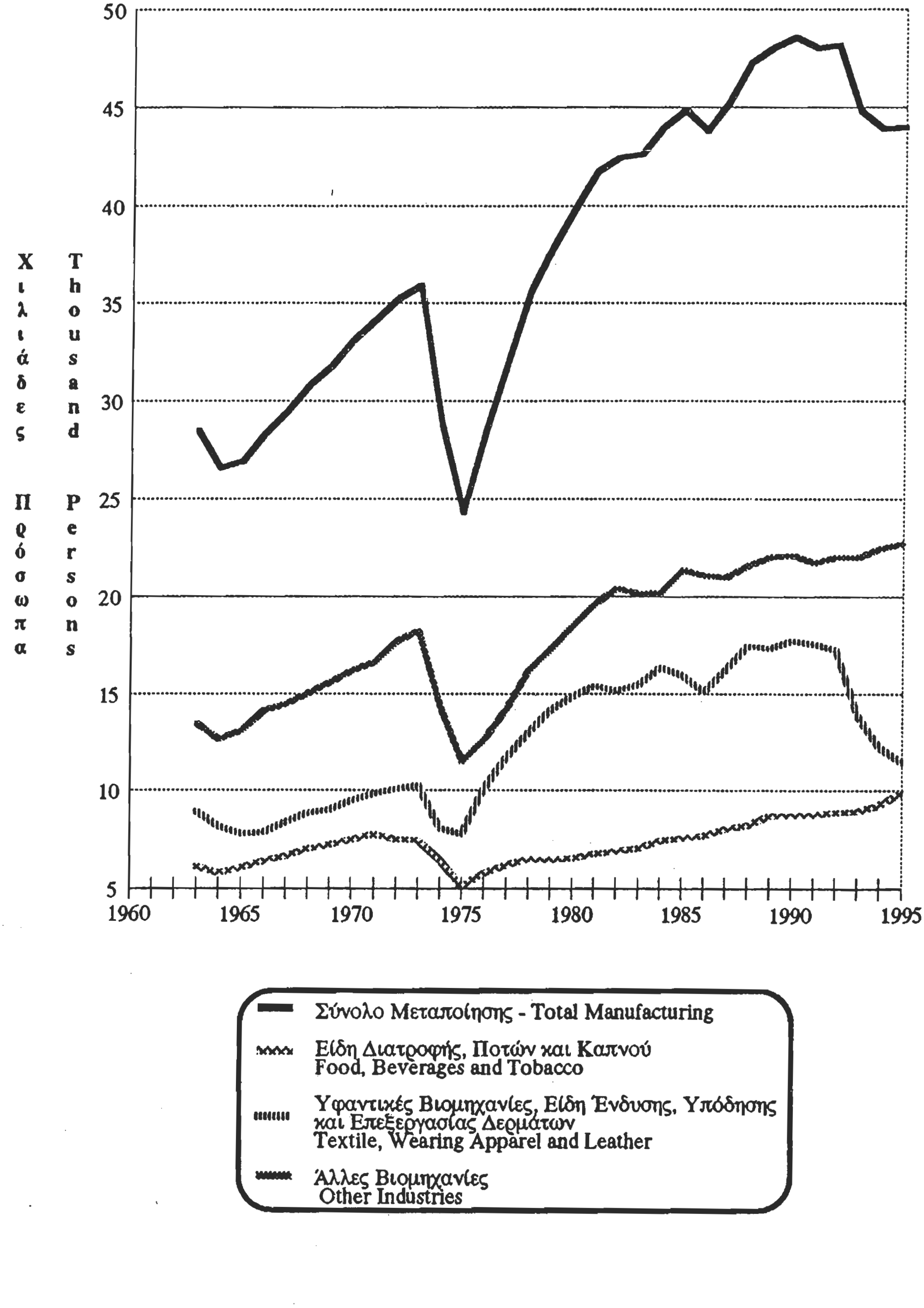


Διάγραμμα 3. Προστιθέμενη Αξία κατά Κλάδο Βιομηχανίας, 1963-1995

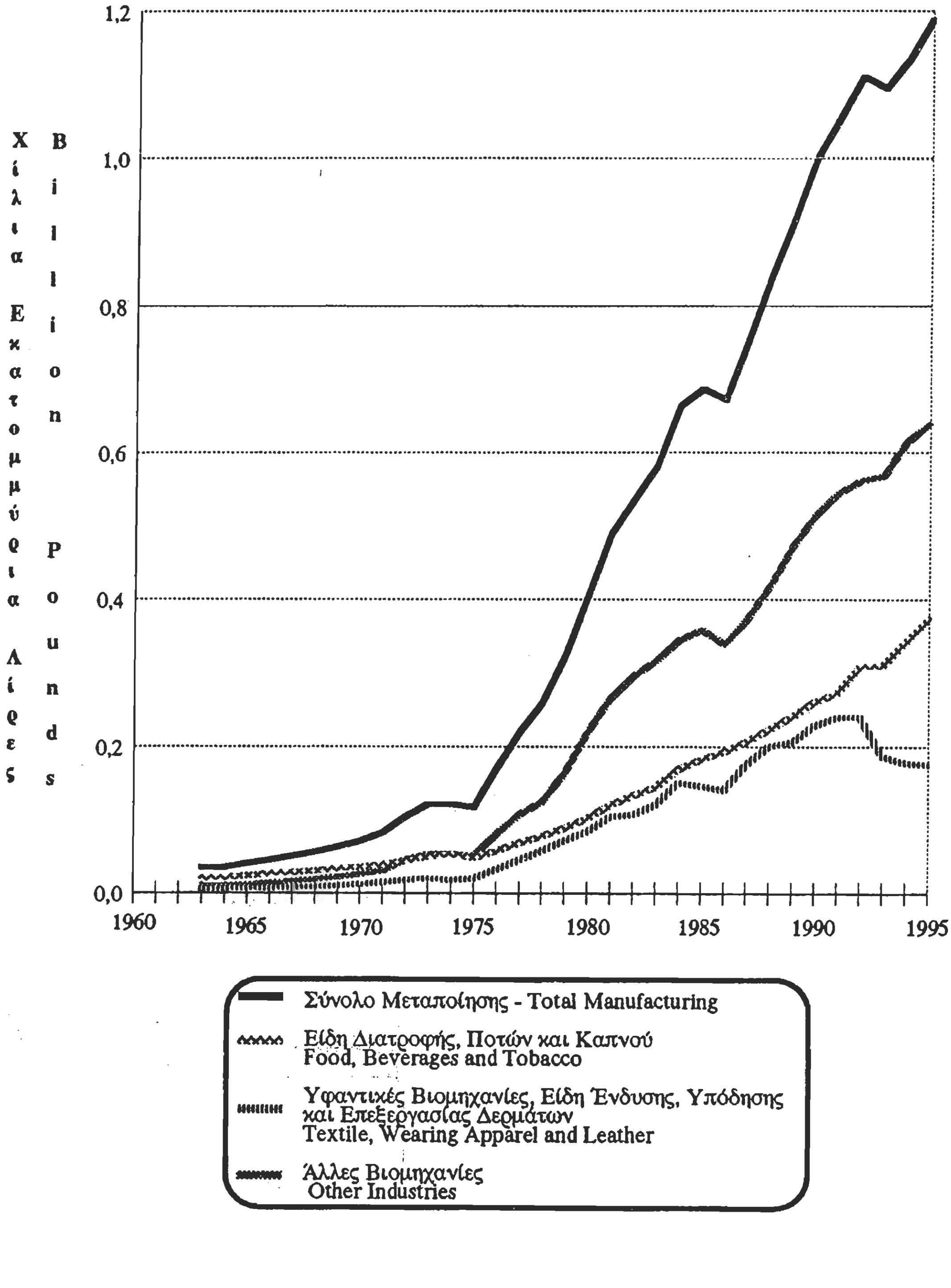
Figure 3. Value Added by Industry, 1963-1995



Διάγραμμα 1. Απασχόληση κατά Κλάδο Βιομηχανίας, 1963-1995
Figure 1. Employment by Industry, 1963-1995



Διάγραμμα 2. Ακαθάριστη Αξία Παραγωγής κατά Κλάδο Βιομηχανίας, 1963-1995
Figure 2. Gross Output by Industry, 1963-1995



ΠΙΝΑΚΑΣ 1. ΑΠΑΣΧΟΛΗΣΗ, ΠΑΡΑΓΩΓΗ ΚΑΙ ΕΞΑΓΩΓΕΣ, 1963-1995

TABLE 1. EMPLOYMENT, OUTPUT AND EXPORTS, 1963-1995

Έτος Year	Απασχόληση Persons Engaged	Ακαθάριστη Αξία Παραγωγής (Κ£000'ς) Gross Output (C£000's)	Προστιθέμενη Αξία (Κ£000'ς) Value Added (C£000's)	Δείκτης Βιομηχανικής Παραγωγής (1990=100) Index of Industrial Production (1990=100)	Εξαγωγές Μεταποιητικών Προϊόντων (F.O.B. Κ£000'ς) Exports of Manufactured Goods (F.O.B. C£000's)
1963	28.464	34.085	13.148	18,4	3.519
1964	26.528	34.571	13.399	18,1	3.097
1965	26.879	39.784	14.961	20,4	3.541
1966	28.330	44.689	16.828	22,9	4.678
1967	29.446	50.315	18.972	26,3	5.346
1968	30.810	55.547	21.823	28,6	7.060
1969	31.748	62.696	24.820	31,5	7.800
1970	33.102	70.338	28.537	34,7	7.955
1971	34.182	81.815	32.981	38,9	10.567
1972	35.249	103.953	43.160	46,1	12.300
1973	35.909	121.061	51.058	49,0	14.867
1974	28.822	121.687	45.622	39,4	18.257
1975	24.293	117.476	43.970	36,3	24.031
1976	28.341	169.725	57.635	42,1	47.723
1977	32.075	218.653	75.158	49,4	65.162
1978	35.672	257.663	92.641	55,1	69.857
1979	37.897	322.118	110.823	60,1	86.327
1980	39.884	404.681	133.443	64,9	107.508
1981	41.733	489.003	154.175	69,7	143.214
1982	42.455	535.574	174.474	71,4	140.551
1983	42.625	580.822	187.892	73,6	135.352
1984	43.982	662.954	215.191	78,2	171.512
1985	44.839	685.923	231.867	76,2	149.808
1986	43.805	670.863	240.509	78,3	125.911
1987	45.244	752.338	273.710	85,7	168.130
1988	47.254	839.055	308.639	91,8	187.165
1989	48.037	915.922	331.652	95,0	189.117
1990	48.546	1.000.787	361.773	100,0	190.129
1991	48.000	1.054.105	379.833	100,5	183.063
1992	48.147	1.108.774	416.865	103,2	175.738
1993	44.783	1.062.975	413.318	93,4	157.170
1994	43.902	1.132.519	442.559	96,3	165.893
1995*	43.972	1.186.768	465.634	96,8	163.807

Σημ.: 1. Τα στοιχεία για τα έτη 1963 μέχρι το μέσο του 1974 αναφέρονται τόσο στα Ελληνοκυπριακά όσο και στα Τουρκοκυπριακά υποστατικά. Τα στοιχεία από το μέσο του 1974 και μετά αναφέρονται μόνο στη βιομηχανική δραστηριότητα στην ελεγχόμενη από το κράτος περιοχή.
2. Στα στοιχεία περιλαμβάνεται και η οικοτεχνία.

Notes: 1. Data for the years 1963 until mid-1974 refer to both Greek and Turkish establishments. Data as from mid-1974 onwards refer only to the industrial activity in the Government controlled area.
2. Data include cottage industry.

APPENDIX II - BACKGROUND INFORMATION ON PEOPLE

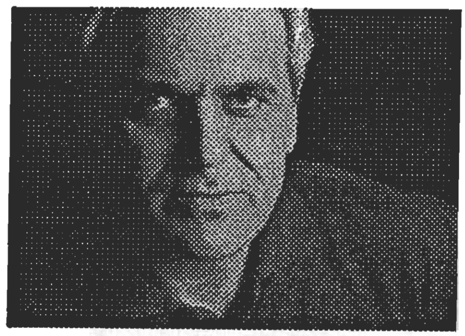
1) Paschos Mandravelis – see adjoining papers

2) Dr. Simon Johnson
   University of Oxford, BA'84, Economics and Politics
   University of Manchester, MA'86, Economics
   MIT PhD'89

   The World Bank, and the European Bank has sponsored his work for the Reconstruction and Development, and the US Government, studies entrepreneurship in emerging markets. He is especially interested in the development of high technology businesses outside the United States.
   His book; Starting Over in Eastern Europe: Entrepreneurship and Economic Renewal (Harvard Business School Press, 1995) examines how businesses have arisen in the wake of communism.
   Expertise: Applied Economics, Asia Pacific, Czech Republic, Europe (including Eastern), entrepreneurship/new ventures.

άρθρα για το αύριο

ΠΕΡΙ ΤΟΥ INTERNET
Ο ΚΟΣΜΟΣ ΤΟΥ USENET
SITE...SEEING
INTERNET ΚΑΙ ΛΟΓΟΚΡΙΣΙΑ
ΕΛΛΑΔΑ ΚΑΙ ΠΛΗΡΟΦΟΡΙΚΗ
ΚΟΙΝΩΝΙΑ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑ
ΚΡΥΠΤΟΓΡΑΦΙΑ
ΗΛΕΚΤΡΟΝΙΚΟ ΕΓΚΛΗΜΑ
ΠΝΕΥΜΑΤΙΚΗ ΙΔΙΟΚΤΗΣΙΑ
Μ.Μ.Ε.
ΥΠΟΛΟΓΙΣΤΕΣ - ΤΕΧΝΟΛΟΓΙΑ
ΠΡΟΣΩΠΑ ΣΤΗ ΛΕΩΦΟΡΟ
ΕΠΙ...ΠΑΝΤΟΣ ΕΠΙΣΤΗΤΟΥ


Φωτογραφία: Κωνσταντίνος Ζάγκας

Ο Πάσχος Μανδραβέλης γεννήθηκε το 1963 στην Κοζάνη. Σπούδασε οικονομικά στο Πανεπιστήμιο Αθηνών και έκανε μεταπτυχιακές σπουδές στο πανεπιστήμιο της Νέας Υόρκης "New School for Social Research". Τα τελευταία δεκαπέντε χρόνια εργάζεται σε αθηναϊκές εφημερίδες και περιοδικά. Τελευταία ήταν αρχισυντάκτης στο περιοδικό "TEMPO/Newsweek" και σήμερα είναι σύμβουλος έκδοσης στο περιοδικό "Media View".

Είναι μέλος της "□Ενωσης Συντακτών Ημερησίων Εφημερίδων Αθηνών" (ΕΣΗΕΑ), του Οικονομικού Επιμελητηρίου Ελλάδος, της Ελληνικής Εταιρείας Οικονομολόγων, του Electronic Frontier Foundation (EFF), και της "American Association for the Advancement of Science".

□Εχει γράψει τρία βιβλία για την πληροφορική:

- **Ο πρώτος μου υπολογιστής**(□κδόσεις Καστανιώτη)
- **Η ιστορία των υπολογιστών** (Εκδόσεις Καστανιώτη)
- **Βουτιά στα δίκτυα** (υπο έκδοση: Καστανκώτης)

Είναι παντρεμένος με την Σοφία Τολιοπούλου.

pmandrav@compulink.gr

APPENDIX III - GROVE CONSTRUCTION

M.V. Artificial Rock Decorations Ltd.

Established in 1997, M.V. Artificial Rock Decorations Ltd is a Nicosia based Construction Company specialised in the art of grove construction. This art allows the designer/architect to use his/her imagination when applying a naturalistic look to an area. The designs can range from artificial rocks of any size and shape, to complete waterfalls, with ecological ponds containing fish and incorporating living plants. The construction is made of steel and wire and coated with multiple layers of concrete to assure a strong durable structure that can be easily walked upon. Durable dyes and/or special paint are incorporated to give the structure a natural look. All construction is waterproof and can be placed in swimming pools and ecological ponds. Stonefacing is the art of making a wall look like it were built out of stone (or limestone), although it is actually a cement/brick wall. It can be incorporated during the building of the wall, or applied to an existing wall. The company also work with moulds that range from small plant pots to large statues and cover a variety of shapes from columns to wall carvings. The work is warranted for 6 months on structural work, and for machines i.e. pumps, lights etc. the warrantee is to the manufacturer's specifications. Past projects have varied in scale, covering the imagination of landlords or of architect(s) working on a new wing of a hotel. Some of the larger projects performed can be seen at the following locations:

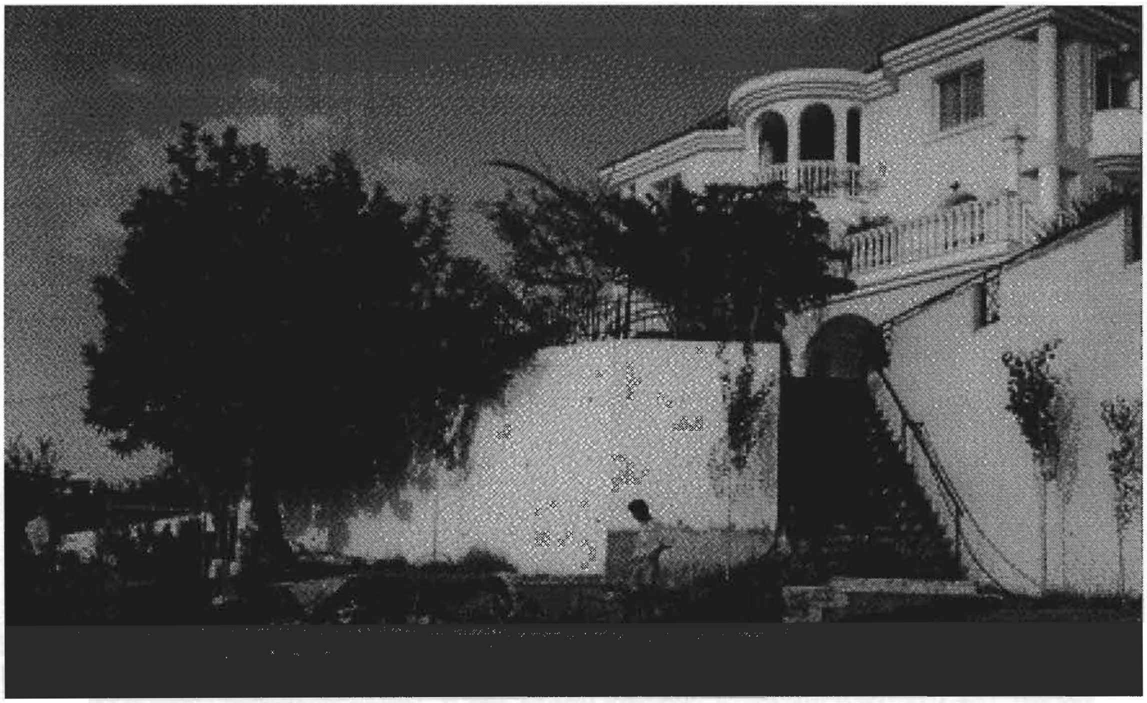
Ajax Hotel, Limassol
Four Seasons Hotel, Limassol
Atlantica Bay, Limassol
Treasure Island - water park Limassol

M.V. Artificial Rock Decorations Ltd has at present 10 employees, and benefits a total of 25 suppliers.

Please see the adjoining pages for detailed for examples of work performed, and detailed information on the construction.

For additional information please contact:

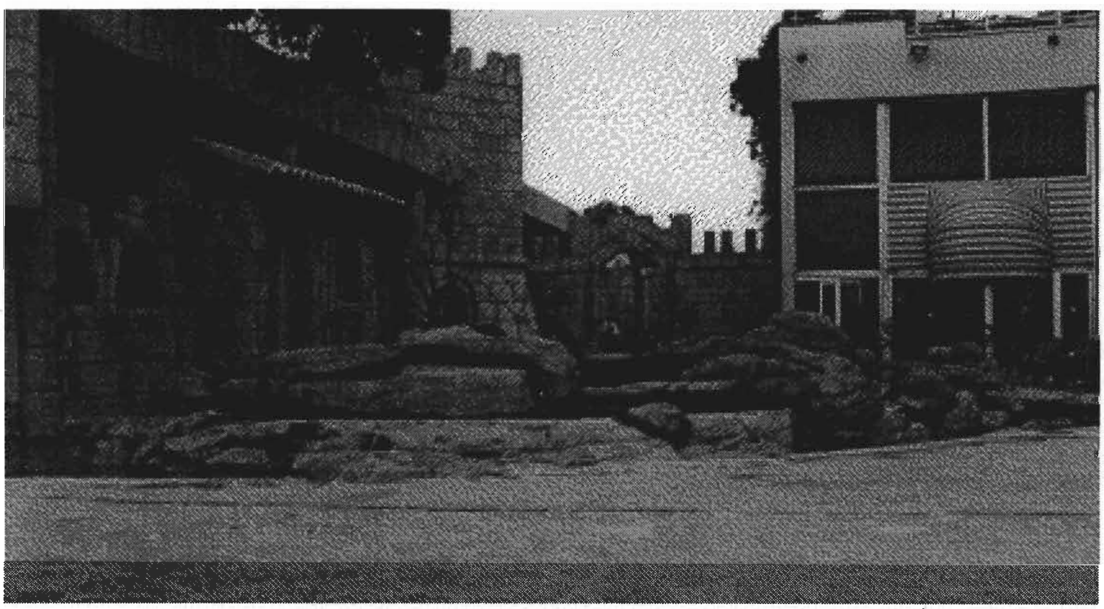
Marinos Azas, Manager
M.V. Artificial Rock Decorations Ltd.
P.O. Box Number 25139,
Nicosia, 1307,
02 - 375092



Private Residence - Before Construction

Private Residence - During the Final Stages of Construction

Private Residence - Waterfall View



Public Area with Grove Construction

2.2. POSITIVE ROCKWORK

2.2.1 Where stonefacing is required the existing surface will be prepared and, if required, a layer of chicken mesh will be shot fastened to same. A scratch coat of cement mortar with 6mm average thickness will then be applied to the surface followed by a 50mm average thickness cement mortar final coat. Skilled artisans will then carve the final coat with hand tools, templates, etc. to resemble natural rock which will then, after drying, be finished with a paint mixture to the approval of the client. Depending on the scope of work, mortar pumps and spray guns will be used in order to speed up the process.

2.2.2 Where positive rockwork is required, the following procedure will apply. Depending on the scope of work, the structural steel process might not be required.

2.2.3 The engineer employed by the client will assist in the design and shop detail drawing of the structural steelwork.

2.2.4 Angle-, I-beam, or channel sections with protective coating touched up after erection will be anchored to the existing structure, welded and bolted where necessary.

2.2.5 Y10 or other suitable diameter reinforcing rods will be bent to shape and fixed to the existing structure or structural steel work with binding wire or welded. The centers of rods will be determined by the skilled artisan.

2.2.6 This grid will then be covered with one layer of hessian (burlap) and one of more layers of chicken mesh as required by the skilled artisan.

2.2.7 A cement mortar scratch coat to average 6mm thickness will then be applied to the total exposed visible area.

2.2.8 A cement mortar final coat to average 75mm thickness will then be applied to the total exposed visible area to be carved, treated and finished to resemble natural rock by the skilled artisan. Lime or additives such as retarders or accelerators will be added to the mortar, and oxides to tint the final product if required might be added, all at the discretion of the skilled artisan.

2.2.9 At the discretion of the skilled artisan, latex prints to be taken from natural rock in the vicinity to be used as a " blanket" over the final coat for either positive – or stoneface work in order to provide the correct texture.

2.2.10 After drying, the final coat will be painted and finished in accordance with 2.2.1 above, thus completing the work.

NOTE: GFRC PANELS or other type reinforced pre-cast concrete panels are not acceptable.

2.3 WATERFALLS

2.4.1 The process is similar to that of positive rockwork, with the following additions:

2.4.2 Should the location require waterfalls to be waterproof, the process above is carried out to stage 2.2.7 with a layer of waterproofing placed onto the scratch coat, taking care not puncture same.

2.4.3 A further layer of chicken mesh or mesh reinforcement (if required by the engineer) is then placed over the membrane.

2.4.4 A further scratch coat is then applied to same, followed by stage 2.2.8 above.

2.4.5 Water pumps, piping and sundry hydraulics designed by the engineer employed by the client can be installed.

2.4.6 Care is taken to install required sleeves in order to avoid cutting after completion.

2.3. GFRC PANELS

2.3.1 Glass reinforced concrete panels can only be made if suitable machinery and infrastructure is available on location.

2.3.2 Latex prints will be taken from natural rock in the vicinity to be reinforced in-situ with a layer of glass fiber using available glass fiber blankets and resins.

2.3.3 After drying the rough mould will be taken to a suitable factory to be reinforced by further layers of glass fiber.

2.3.4 In the factory a releasing agent will be applied inside the mould.

2.3.5 Suitable mechanical spray guns with attached fiber cutters are then used to spray cement mortar mixed with a suitable alkali resistant fiber into the mould. The thickness will be an average of 50mm with a mass of 35kg/m2. The panels should not be too large in order to erect later.

2.3.6 Suitable anchors are cast into the panel for erection.

2.3.7 After drying, the panel is lifted out of the mould that will be re-used for a period decided by the skilled artisan.

2.3.8 Panels will then be transported to site and erected by hand, or, if too high, lifted by crane and fixed in position to structural steel (if required) or anchors precast into the existing structure.

2.3.9 Panels may be cut to form a random appearance.

2.3.10 Joints in panels will then be embossed by using techniques similar to positive rockwork.

2.3.11 The panels will then be painted and finished in accordance with 2.2.1 above, thus completing the work.

APPENDIX IV – CASE STUDIES

A high technology company case study -P+R Techconsult Ltd., Nicosia, Cyprus.

P & R TECHCONSULT LTD is a precision engineering company supported by a highly motivated, technically oriented team of scientists and engineers and managed by an experienced marketing & sales director with over 25 years work in the field of high technology. The company has been operating in Europe, the U.S.A., and the Middle and Far East.

GENERAL

Expecting that the world-wide recession would deepen and eager to capitalise on the valuable experience gained in the field of laboratory technology, the management of ATS and P+R decided to invest in the research and development of specific new products for niche markets, but of global interest. The research concentrated mainly on an opto-electronic product for a well-established method of analysis, though water purification units have also been researched and initiated. The economic sectors targeted were those involved in energy savings, water purification, as well as specific quality controls for the environment, pharmaceutics, agriculture and clinical fields. Efforts were focused on a product line that would offer the end-user a simplified work process, better and faster analytical results, and reduced costs of operation. Furthermore, with the ever more pressing demands for regulatory controls by organisations, such as ISO, US FDA, WHO, and others, a product was to be offered that had a PC Computer Data Acquisition System, and would enable the end-user to set-up his own method for the validation of results. From 1990 to 1993 pre-production prototypes were built and underwent lengthy and rigorous testing. Since the first commercially produced units left the factory 3 years ago, over a hundred units were sold throughout many parts of the world.

The company has now the leading edge in a technology that has been known internationally for a long time and to which it has given a unique new product line. The company's aim was to develop instrumentation in a science that has world-wide acceptance and yet is so specialised that its products can be aimed at specific market niches and will have little competition. Flame Photometry as an analytical method has been used for nearly a hundred years and is even today the only method of analysis for specific applications. The company has developed a new technology that has *modernised* flame photometry. The company's advanced *high performance flame photometers* (HPFP) are designed to allow common components to be easily assembled, and variations of the basic instrument to be manufactured without changing all the components; the aim is to optimise instruments for specific fields of application at economic production costs.

The products have applications in many important fields that have priority for financing by governments and international organisations such as the World Bank, UNIDO, WHO, FAO, UNEP, and others. The applications include the survey and monitoring of water, waste waters, the control of environmental, pollution, agriculture, food & feeds, pharmaceuticals, health, petroleum and petrochemicals, to mention some, as well as many industries that need to control and check their products and their local industrial wastes. It follows that with the right sales strategy a wide market potential can be exploited. A further market segment with worldwide possibilities would be the replacement of many of the older instruments which are complex to use and expensive to run.

HISTORY

P + R Techconsult Ltd. was initially established in Oct. 1981 as a technical support unit to ADVANCED TECHNICAL SERVICES GmbH of Switzerland (ATS), to perform installations, after sales service and training for the sophisticated instrumentation ATS was supplying to the Middle-East. In 1986 ATS had established a research program for P + R Techconsult Ltd. for water purification, energy saving devices and opto-electronic instruments; there were then about 12 Cypriot employees working for P + R Techconsult Ltd. The company's aim was to develop its own products for *export to global markets.*

BENEFITS

The company works with over 35 local suppliers out of which 8 manufacture components/parts to their specifications. Each one of these 8 suppliers secures material or services from an average of 2 to 5 sub-suppliers; taking an average of 3 each this would give 24 companies. Adding the 35 to this figure means that a total of 59 companies co-operate and benefit from our company alone; service companies are not included in this figure. *A good turnover of our products in global sales would yield a high return for all other Cypriot enterprises we co-operate with as well.*

P + R Techconsult Ltd. is a local company with 51% local Cyprus share holding participation and 49% foreign (ATS and B. Sciffo).

COMMENTS

Cyprus is a small country with a strong entrepreneurial spirit where it is very important to stimulate small and medium size enterprises. With its family and friends oriented social structure, there can be a fruitful interaction and a networking co-operation between companies. The high technology industry in Cyprus will generate jobs for university and HTI graduates as well as others. An important asset is that such jobs will also offer good remuneration and thus the greater the number of such industries, the less the brain drain from Cyprus. By increasing the number of export oriented hi-tech industries in Cyprus, those than generate good value added [at least 30%], and that these plan to use local purchased material or manufactured parts, many jobs will be created across the economy and foreign exchange imports will be boosted dramatically. *Each* such company is a motivator and can be compared to a train engine: the high technology industry with its own know-how/technology is the train engine that pulls dozens of cars using its own power - its technology. With increasing speed it travels over wider areas in shorter time and benefits each station it serves. Some estimates are given on the next page.

CONTACT PERSON:

Mr. Bruno Sciffo – Managing Director,
Tel (02) 426269, Fax: (02) 426458.

COMPARISON OF THE VALUE ADDED OF A HIGH TECH INDUSTRY WITH TRADITIONAL INDUSTRIES

A food or clothing industry that exports yearly CyP 2,000,000.00 and generates a value added of 30% would yield to the country's economy the following benefits:

Jobs about 30 to 50
Cash value added @ 30%=CyP 600,000.00
Import foreign exchange earnings to equivalent CYP 2 MIO @ USD2 = USD 4 MIO

High Technology Industry
The start up of small high technology industrial units, each working with only 2-3 people, and having a value added on their products of 40% to over 60%, (it is possible to have over 100% value added) and with an initial export value of about CyP 100,000.00 p/year each, the return would be as follows:

A) **20 ENTERPRISES WOULD GENERATE**:
60 jobs, CyP 2 Mio turnover (foreign exchange) and a value added of between CyP 800,000.00to over 1.2 Mio (see calculations below);

B) **50 ENTERPRISES WOULD GENERATE**:
150 jobs, CyP 5 Mio foreign exchange and a value added of CyP 2 to 3 Mio.

The increase in sales volume over 3 - 5 years would increase the job possibilities and proportionally also the foreign exchange revenues and value added.

CALCULATIONS.

A) For 20 such small enterprises (this is a number already available in Cyprus)
A.1) 20 x 3 persons=60 jobs;
A.2) Sales per year 20xCyP 100,000.00= CyP2 Mio i.e. USD 4 Mio.
A.3) Total value added @ 40% = 40,000.00 x 20 = CyP800,000.00 generated gross profit, or @ 60% = 60,000.00 x 20 = CyP 1,200,000.00 " " "

B) With 50 such hi-tech companies the figures would be:
B.1) 50x3 =150 jobs
B.2) Sales per year 50xCyP 100,000.00=CyP 5 Mio or USD 10 Mio
B.3) Total value added @ 40% = 40,000.00 x 50 = CyP 2,000,000.00
Or @ 60% = 60,000.00 x 50 = CyP 3,000,000.00.

With increased exports within 3 - 5 years, the number of jobs will increase and so will the turnover of each unit. The scenario could then look like this:
New jobs generated: 20 X 6 = 120 jobs; or 50 X 6 = 300 jobs;

Foreign exchange generated:

for 20 companies: sales per year each CyP 500,000.00x20 =CyP 10 Mio. (Ca. USD 20 Mio)
Gross Profit @ 40%=CyP 200,000.00x20= CYP 4 million, or
Gross Profit @ 60%=CyP 300,000.00x20= CYP6 million, and

for 50 companies: sales total each 500,000.00x50= CYP 25 Mio. (Ca. USD 50 Mio)
Gross Profit @ 40%=CyP 200,000.00x50= CYP 10 million, or
Gross Profit @ 60%=CyP 300,000.00x50= CYP 18 million.

With no proper Cyprus government infrastructure, government initiative and generally similar help existing in other countries, the company has exported in the last few years CYP 288.000,00 and can secure immediate orders worth over USD 200.000,00. The following estimates orders and revenues lost to our Company i.e. to the Cyprus economy due to present shortcomings: 1) Total 3 - 6 jobs, 2) Foreign Exchange earnings: USD 800.000,00.

A High Technology Supporter Company Case Study - Morfomichaniki Ltd, Paralimni.

GENERAL
Morfomichaniki Ltd. is the leading company in Cyprus using CAD/CAM and CNC machines in the production of industrial moulds, prototypes and products. They produce moulds, designs for industrial products, software for CNC machines, consulting on subjects about products that need mould technology (Certified by the Institute of Technology).

HISTORY
The customers basically where in Cyprus for the three first years. In 1997 products from the company where sold in Greece by third parties. In 1998 their customer base expanded to Syria and Sweden for plastic moulds. Their customers come from the plastic industries in Cyprus, jewellery industries, casting industries, chocolate industries, brake pads industries, filters for cars industries, rubber industries and any factory that is based on moulds. Also architects buy plastic models for buildings.

BENEFITS
Companies that benefit from Morfomichaniki Ltd. are about 100.

COMMENTS
By Mr. Loizou, manager of Morfomichaniki Ltd.: I believe that the development of the high technology industry in Cyprus would benefit my company because these industries would have demand on quality, which Morfomichaniki Ltd. meets and exceeds.
When asked what difficulties were encountered, the response was that the economy during the first years of the company's establishment, as there was not enough development.
Today the Cyprus economy plays less of an effect, as good customers have been located in Europe. They will never be based on Cyprus market.

Morfomichaniki Ltd. is certified in "Design Management" by the Cyprus
Technology Foundation.

CONTACT PERSON:
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Tel 03-730566
Fax 03-823056

APPENDIX V - TECHNOLOGY EDUCATION - FLORIDA

Please see the adjoining papers.

TECHNOLOGY EDUCATION
FOR YEAR 2000

Technology Education is a comprehensive, action-based K-12 discipline designed to incorporate information technologies, physical technologies, and biotechnologies in promoting the integration of academic and career skills with an emphasis on problem solving and decision making that is essential in developing the human potential needed to compete in a technological society.

A Design Handbook For Technology Education Facilities And Other Related Programs

JANUARY 1997

Florida Department of Education
Division of Applied Technology, Adult & Community Education
Turlington Building, Tallahassee, Florida 32399-0400

FACILITIES GUIDELINES

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*Participants of this document may not necessarily imply endorsement of its contents in its entirety.

TECHNOLOGY EDUCATION FACILITIES GUIDELINES

TABLE OF CONTENTS

TECHNOLOGY EDUCATION

EDUCATION'S ROLE IN PREPARING A TECHNOLOGICALLY LITERATE CITIZENRY 1
A DEFINITION OF TECHNOLOGY 2
TECHNOLOGICAL LITERACY 2
TECHNOLOGY EDUCATION 3
ELEMENTARY SCHOOL TECHNOLOGY EDUCATION 5
MIDDLE/JUNIOR HIGH SCHOOL TECHNOLOGY EDUCATION 5
HIGH SCHOOL TECHNOLOGY EDUCATION 6

TECHNOLOGY EDUCATION FACILITIES GUIDELINES

FACILITY DESIGN CRITERIA

PHASE I - INITIAL PLANNING 7
PHASE II - DESIGN 7
PHASE III - CONSTRUCTION 8

HUMAN RESOURCE STRATEGY

AN ADVISORY GROUP FOR FACILITIES PLANNING 9

PROCEDURES FOR DEVELOPING A TECHNOLOGY LABORATORY

SECTION 1

THE PROGRAM FACILITIES LIST

THE EDUCATIONAL PLANT SURVEY 11
THE PURPOSE OF AN EDUCATIONAL PLANT SURVEY 12
THE LIMITATIONS OF AN EDUCATIONAL PLANT SURVEY 12
A TYPICAL DISTRICT FACILITIES LIST SECTION FOR MATH, SCIENCE AND TECHNOLOGY EDUCATION 13
TECHNOLOGY EDUCATION AND SCIENCE PROGRAM WORKSHEET AND MODULAR PROGRAM ACTIVITIES 14
STATE REQUIREMENTS FOR EDUCATIONAL FACILITIES TECHNOLOGY EDUCATION LABORATORY PROGRAM FACILITY SPACES 16

SECTION 2

EDUCATIONAL SPECIFICATIONS DESIGN DOCUMENT

TECHNOLOGY EDUCATION FACILITIES DESIGN 17
EDUCATIONAL SPECIFICATION 18
Letter of Transmittal 18
Fish Design Codes, Room Numbers as Found on Fish, and Educational Specifications for Proposed Spaces 19
Program Facilities List 19
Program Furniture and Equipment Request Form 19
Space Relationships 20
Special Considerations 20
Proposed Plans, Funds, and Design Drawing 21

ORIENTATION AND EXPLORATION 22
TECHNOLOGY EDUCATION LABORATORY 23
Small 23
Medium 24
Large 25
Technology and Science Laboratory 26
A SAMPLE FACILITIES INVENTORY 27

SECTION 3

ARCHITECTURAL PLANS
ARCHITECTURAL PLANNING 29
THE SCHEMATIC DESIGN PHASE 30
THE PRELIMINARY DESIGN PHASE: 30
THE FINAL DESIGN PHASE 31
Samples of Technology Education School Labs 32

SECTION 4

CONTRACTOR BIDS AND CONSTRUCTION
CONTRACTOR BIDS 35
THE CONTRACT DOCUMENTS 35
THE BIDDING PROCESS 35
THE CONSTRUCTION 36
Survey - Finance Relationships 37
Project Manual and Contract Documents 38

CONSTRUCTION
THE CONSTRUCTION PHASE 39
THE INSTALLATION OF FURNISHINGS AND EQUIPMENT 39

SECTION 5

OCCUPANCY AND POST-OCCUPANCY EVALUATIONS
WHAT IS A POST-OCCUPANCY EVALUATION? 41
WHEN SHOULD THE POST-OCCUPANCY EVALUATION BE CONDUCTED? 42
WHO SHOULD CONDUCT THE POST-OCCUPANCY EVALUATION? 42
THE METHODOLOGY AND FORMAT FOR A POST-OCCUPANCY EVALUATION? 42
WHAT SHOULD BE ANALYZED IN A POST-OCCUPANCY EVALUATION? 43
COLLECTIVE EVALUATION DATA 44
The First Visit 44
The Second Visit 45
DATA ANALYSIS, EVALUATION RESULTS AND CONCLUSION 45
First Stage 45
Second Stage 46
EVALUATION RESULTS AND CONCLUSION 46

GLOSSARY

DEFINITIONS OF TERMINOLOGY 47

TECHNOLOGY EDUCATION

EDUCATION'S ROLE IN PREPARING A TECHNOLOGICALLY LITERATE CITIZENRY

Within the four walls of a school we cannot prepare every student for a specialized occupation. However, we can and must help every student learn about the technology revolution that will dramatically shape their lives. By the time they finish high school, young adults should be fully aware that they will encounter technology on an ever changing basis throughout their lives. It is not enough that they accumulate knowledge along the way; they should also know what technology means, what it is, and how it can be applied. Ultimately, each student should participate at some level as a technologist, thriving in a highly technical world.

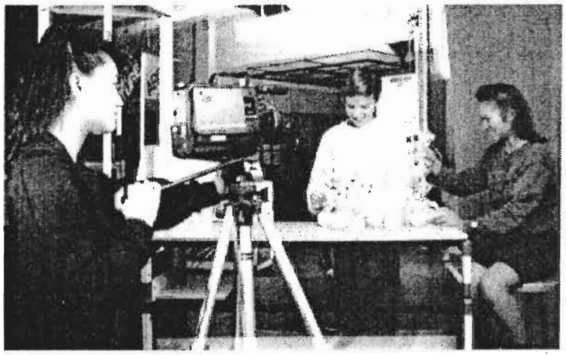
Although Technology Education is taught in programs designated as "Technology Education," it may also be taught more indirectly in other programs. A program of Technology Education is useful, however, as an organizing theme or integrator binding together applications of all technological studies.

Technology Education should not be confused with Educational Technology. Technology Education is a subject area centered on Technology and related aspects as its content base. Educational Technology deals with instructional technology devices to enhance teaching methodology.

Technology education should describe technology in a holistic way, showing it as part and parcel of our history, our everyday existence, and our future. It should provide opportunities to experience technology as well as learn it in the abstract. It should connect the technic with the ethics.

Because the American culture is distinctly characterized as technological, it is the function of schools to give every student an insight into and understanding of the technological nature of the culture. This is what the program of Technology Education strives to do. It acquaints all persons with their technological environment so they can make rational decisions about their own lives on a day-to-day basis and eagerly participate in controlling their own destiny. Overall, Technology Education is a liberating force which does not arbitrarily divide students - saying to some, "you're the workers" and to others, "you're the thinkers." Life for all of us is a blend of both.

A DEFINITION OF TECHNOLOGY



Technology is in part a social process. Technology is supported to serve the society that generates and controls it through society's private and public institutions; people need to understand the interactions of technology and its various fields with human social systems and the values that society may apply. The results and dynamics of these interactions are key to the ways in which technology affects people's lives.

Simply stated, technology can be defined as "man's handiwork" or "the way things work." It is the application of knowledge, tools, and skills to solve practical problems and extend human capabilities. Technology is best described as process, but it is more commonly known by its products and their effects on society. It is enhanced by the discoveries of science and shaped by the designs of engineering. It is conceived by inventors and planners, raised to fruition by the work of entrepreneurs and craftsmen, and implemented and used by society. Sometimes, though, it enters the social system imperceptibly and brings about many changes, often in unforeseen ways.

Technology is also a technical process. It should not be confused with science. Science is what the universe, macrocosm and microcosm, consists of galaxies, planets, stars, cells, atoms, and particles. Technology is tools, machines, power, instrumentation, processes, and techniques. Science is investigation, discovery, and the formulation of theories and laws. Technology's role is doing, making, and implementing things. The principles of science, whether discovered or not, underlie technology. The results and actions of technology are subject to the laws of nature, even though technology has often preceded the discovery of the science on which it is based.

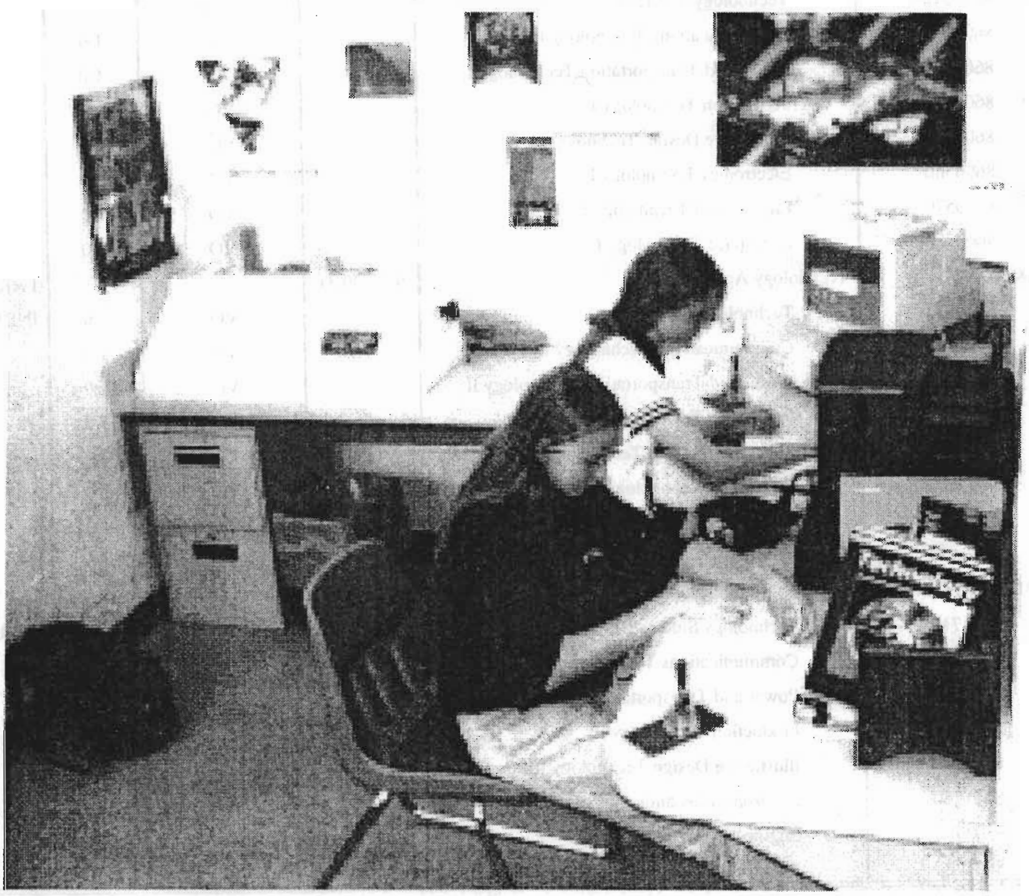
TECHNOLOGICAL LITERACY

Specialized occupational training in vocational job preparatory programs may make a person more technologically literate but it goes beyond general technological literacy. Technological literacy in our modern times is required of all citizens and is not just the province of specially trained or technologically elite groups. Otherwise, there is the risk that the flow of technological information will be stopped or that the populace will bind itself in a position of reacting to decisions without their participation or consent. Literacy by its very nature implies that a person must be able to do something. To be technologically literate, a student must have the opportunity to develop rudimentary skills regarding tools, materials, and processes as well as to understand and appreciate how technology affects our lives and careers. Technological literacy, then, means that a student must understand basic technological concepts; know societal needs and moral constraints; be cognizant of the application of scientific and mathematical principles to tools and materials; and, to a certain extent, be able to utilize these tools and materials.

TECHNOLOGY EDUCATION

Today, curricula design in Technology Education is responding to the realities of a new age. The concept is sound and achievable and we are currently moving toward full realization as we undertake a mode of responding to change.

Technology Education is defined as: A comprehensive, action-based educational program concerned with technical means, their evolution, utilization, and significance; with industry, its organization, personnel systems, techniques, resources, and products; and their social/cultural impact. Florida's program of Technology Education is organized around, but not limited to, the technological categories of communications, construction, manufacturing, production, energy, power, transportation, engineering, drafting, electronics, and other supporting content areas. Applied learning activities are conducted in a laboratory setting with a minimum of 75 percent hands-on experiences with technological tools, machines, instruments, materials, processes, and systems. Several courses are available for offering Technology Education beginning at the elementary school level and continuing through grade 12 at the high school level. A total program can be designed from these courses in an articulated sequence so that students gain maximum educational benefits from taking Technology Education. Detailed curriculum frameworks for the courses are listed and updated in the Vocational Education Program Courses Standards for Technology Education. The following chart outlines the Technology Education Program/Course Titles for grades K-12.



TECHNOLOGY EDUCATION PROGRAM AND COURSE CHANGES

Program/Course Number	Program/Course Title	Grade Levels	Graduation Requirements	Credit	Certification
8600000	Integrated Technology Studies	6-9			I ART-TEC 1 2
8600010	Introduction to Technology		VO	0.5	INDUS ARTS @4 @6
8600020	Exploring Technology		VO	0.5	
8600030	Exploration of Communications Technology		VO	0.5	
8600040	Exploration of Production Technology		VO	0.5	
8600050	Exploration of Aerospace Technology		VO	0.5	
8600400	Technology Systems	9-12,30,31			I ART-TEC 1 2
8600410	Communications Systems		VO	0.5	INDUS ARTS @4 @6
8600420	Power and Transportation Systems		VO	0.5	
8600430	Production Systems		VO	0.5	
8600440	Illustrative Design Systems		VO	0.5	
8600450	Electronics Systems		VO	0.5	
8600460	Engineering Systems		VO	0.5	
8600470	Applied Technology Systems		VO	0.5	
8600480	Home Technology Systems		VO	0.5	
8600500	Technology Applications I	9-12,30,31			I ART-TEC 1 2
8600510	Technology Studies I		VO	1.0	INDUS ARTS @4 @6
8600520	Communications Technology I		VO	1.0	
8600530	Power and Transportation Technology I		VO	1.0	
8600540	Production Technology I		VO	1.0	
8600550	Illustrative Design Technology I		VO	1.0	
8600560	Electronics Technology I		VO	1.0	
8600570	Engineering Technology I		VO	1.0	
8600580	Aerospace Technology I		VO	1.0	
8600600	Technology Applications II	9-12,30,31			I ART-TEC 1 2
8600610	Technology Studies II		VO	1.0	INDUS ARTS @4 @6
8600620	Communications Technology II		VO	1.0	
8600630	Power and Transportation Technology II		VO	1.0	
8600640	Production Technology II		VO	1.0	
8600650	Illustrative Design Technology II		VO	1.0	
8600660	Electronics Technology II		VO	1.0	
8600670	Engineering Technology II		VO	1.0	
8600680	Aerospace Technology II		VO	1.0	
8601700	Technology Applications III	9-12,30,31			I ART-TEC 1 2
8601710	Technology Studies III		VO	1.0	INDUS ARTS @4 @6
8601720	Communications Technology III		VO	1.0	
8601730	Power and Transportation Technology III		VO	1.0	
8601740	Production Technology III		VO	1.0	
8601750	Illustrative Design Technology III		VO	1.0	
8601760	Electronics Technology III		VO	1.0	
8601770	Engineering Technology III		VO	1.0	
8601780	Aerospace Technology IIII		VO	1.0	

ELEMENTARY SCHOOL TECHNOLOGY EDUCATION

Elementary School Technology Education experiences are designed to assist in the attainment of educational goals within a total elementary school program. These important learning experiences should orient students to Technology Education, provide assistance in the development of personal psychomotor skills, and re-define attitudes relating to the effect of Technology on society. The Technology Education program activities should be integrated into the total elementary school curriculum, and these activities should provide students with experiences that reinforce this curriculum.

MIDDLE/JUNIOR HIGH SCHOOL TECHNOLOGY EDUCATION

Technology Education programs at the middle or junior high school level are exploratory in nature. At this level, students investigate and examine broad content areas of Technology Education. It is recommended that all students take Technology Education at this level, whether they have future plans to enter college or to pursue a vocation after high school, and regardless of their career goals. Technology Education courses at the middle school or junior high school level should be designed to lead into a well-articulated series of courses at senior high school and postsecondary levels. As a result of taking Technology Education at the middle school or junior high school level, all students can begin to develop their innate talents, attitudes and skills to better live in our technological world. Problem solving, career orientation, and learning for tomorrow's adaptive environment are cornerstones of the Technology Eduction program at the middle school and junior high school level.

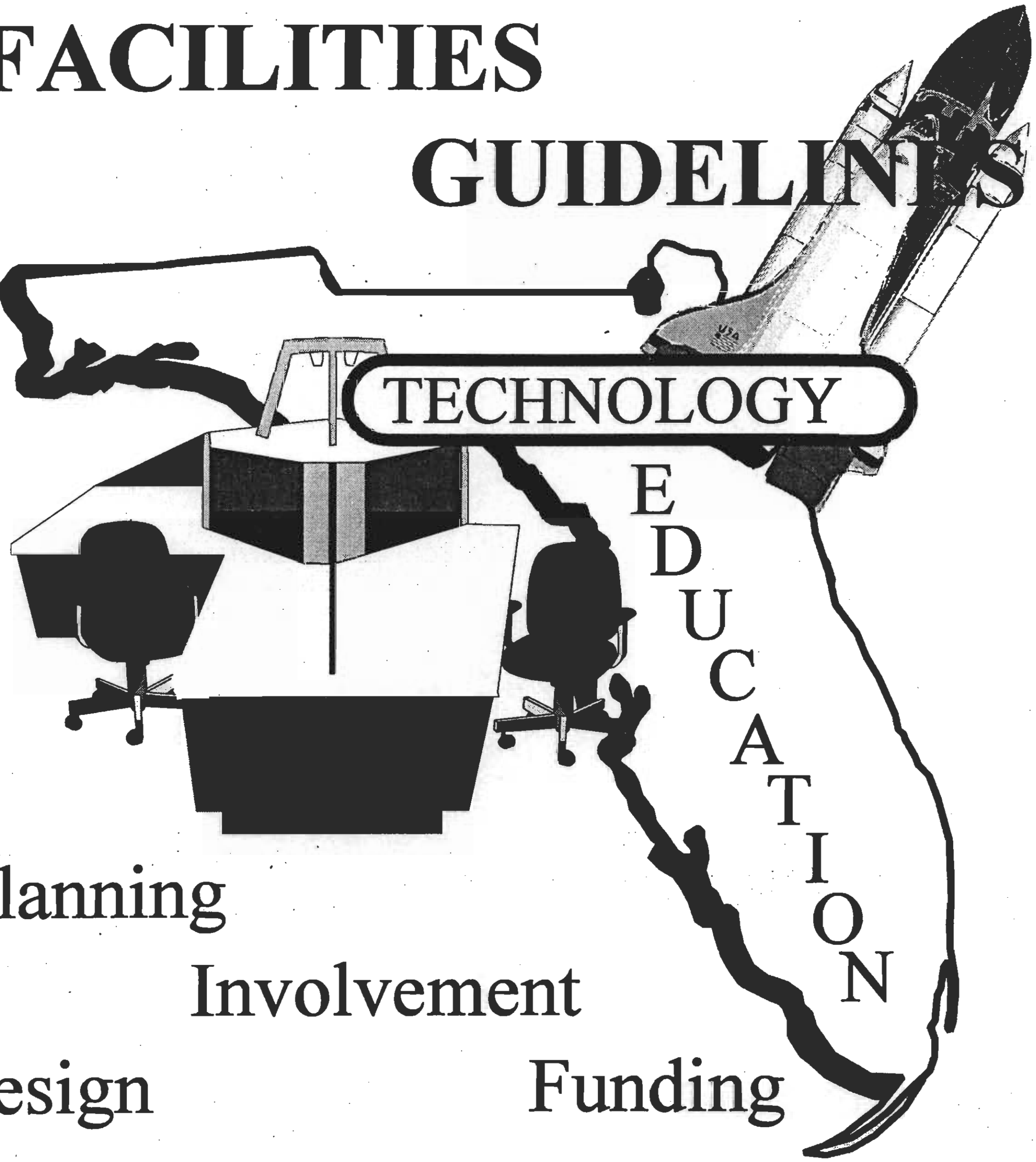
HIGH SCHOOL TECHNOLOGY EDUCATION

The Technology Education programs at the high school level are designed to provide an in-depth foundation for career preparation at the secondary or postsecondary levels. Students will gain an adaptability leading to consumer awareness and personal enrichment, as well as occupational readiness. Students pursuing engineering and scientific careers in colleges or universities will gain much from taking certain Technology Education courses. Also, students will develop transferable skills for life as well as for further education. The program complements the middle or junior high school curriculum and offers sequential courses that build on previously learned content without repetition.

Technology Education is a link in the educational process that treats academic and vocational skills in both theoretical and applied ways. It reduces barriers between academic programs and vocational training. Students are provided optimum experiences, both abstract and concrete, through the application of technological tools, materials, systems and processes. It is a type of learning that allows students to make sense out of their world and provides the correct balance of depth and breadth to enable them to deal with a world of rapid change and complexity.

Although specfic technologies may become obsolete in the future, the student, through Technology Education, will gain learning experiences that will provide a sense of worth and self-confidence that will enable him or her to compete in a changing world .

FACILITIES GUIDELINES



Planning

Involvement

Design

Funding

Process

Construction

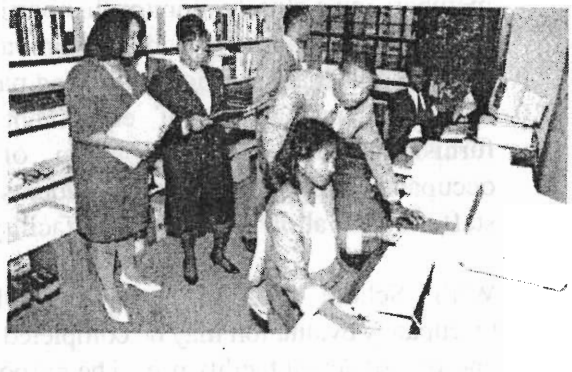
Evaluation

FACILITY DESIGN CRITERIA

PHASE I - INITIAL PLANNING

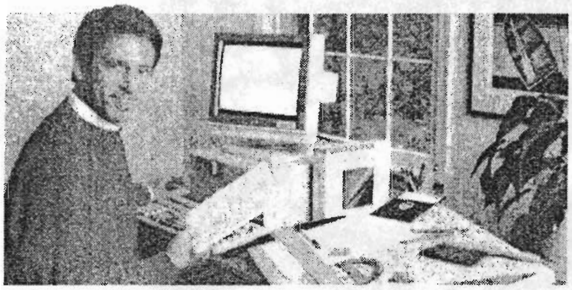
In the process of facility planning, educators translate their professional judgement and the most modern educational philosophy into a three dimensional space. To insure a properly designed facility, many points of view representing many areas of expertise are assembled as advisory groups consist of educational administrators, teachers, students, and other professionals. The purpose of this advisory group could be to plan a Technology Education laboratory or a complete school facility. Once assembled, this advisory group will be responsible for all phases of planning and construction from the reviewing of a Facility List to actual occupancy of the structure. Although the process may vary, the basic sequence is consistent for every project.

The Initial Phase of planning involves the **Facilities List**, and the **Educational Plant Survey**. These documents are prepared by the local school district, and are approved by the



Superintendent and School Board. Once a Survey recommendation is selected, it becomes the focus for developing Educational Specifications. Educational Specifications result from many discussions and decisions on district philosophy, content of programs, staffing, students, and house and space requirements. Survey recommendations and method of construction are both important factors when selecting an appropriate source of funding.

PHASE II - DESIGN



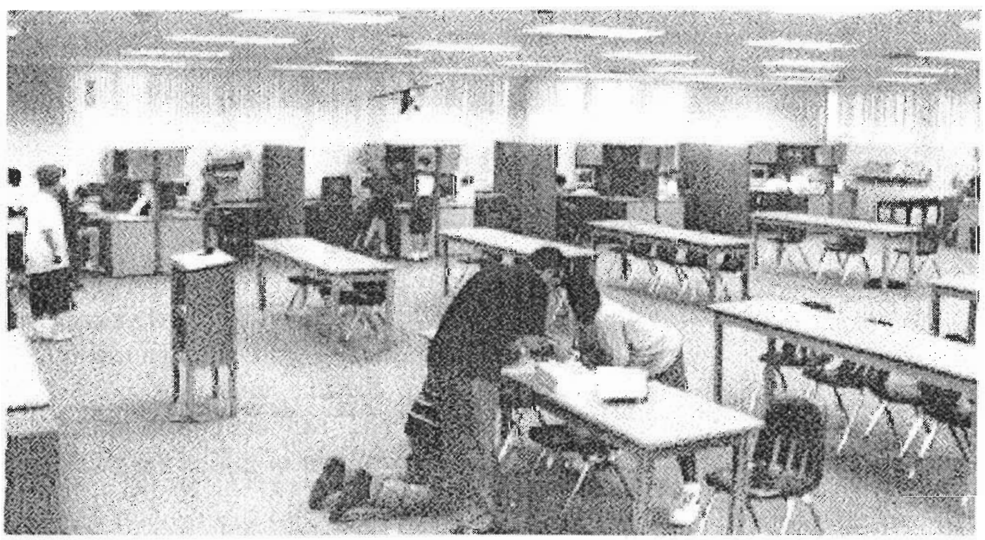
The Design Phase involves architectural planning which culminates in the development of **Schematics**, **Plan Design**, and **Final Documents**. Sources of funding for each project are critical because the bidding and awarding of contracts is contingent upon adequate financing. After contract approval by the School Board, an inventory update on the Florida Inventory of School Houses **("FISH")** should be submitted to the Florida Department of Education in Tallahassee.

The Public Education Capital Outlay **("PECO")** maintenance source of funding is based on the most recent **net square footage** of space in the **"FISH"** inventory.

PHASE III - CONSTRUCTION

In the Construction Phase, amendments are often added to the original agreement. These amendments could result in an additional project cost. Architects and advisory group members must closely monitor this portion of the process and provide approval of construction changes prior to funding payout. After the installation of equipment and furnishings and the completion of the occupancy inspection report, students and staff are then allowed to enter the facility.

With School Board approval, a Post-Occupancy evaluation may be completed after one year of actual facility use. The purpose of this Post-Occupancy report is to provide valuable information on what works and doesn't work as well as document user information for future construction planning.



HUMAN RESOURCE STRATEGY

AN ADVISORY GROUP FOR FACILITIES PLANNING

The Advisory Group includes individuals with diversity in educational endeavor and possession of academic, as well as business, acumen. These individuals are responsible, prudent citizens who can play a key role in the decision making process necessary for guiding the planning and design phases of facilities construction. Although a typical Advisory Group may vary in size and composition, a common bond of interest must exist in order to achieve optimum results and gain strong community support for facilities planning.

A typical facilities Advisory Group should include:

- School superintendent or designee
- Local school facilities planner
- District-wide administrative staff
- School based principals/coordinator
- Specific and regular teaching staff
- Student body representatives
- School support services staff
- Community/parents, interested citizens
- Joint use/government agencies
- Business/industry/corporate executives
- The project architect/designer

The District Administrative Staff have responsibility for developing educational programs, planning construction, budgeting and facilities standards. The School Board is the legal authority and has approval power over the total district operation from policy making to finance. The Facilities Planner is usually responsible for coordinating the process of planning new construction or remodeling and renovation of existing facilities.

Future users of the facility are the principal, teachers, support staff and students. Their participation in the advisory group insures that practical concerns and curriculum needs are properly incorporated into the development phase. It is especially important that Technology Education teachers become involved in the project from the beginning to provide for their infusion of knowledge and expertise. The Department of Education facilities specialist and curriculum specialist may also participate in an advisory role and provide resource information regarding annual statutory changes and other important new statewide recommendations.

The architect can provide valuable technical assistance either during or after completion of the Educational Specifications. However, the use of Educational Specifications is critical when architects join projects at the plan design phase.

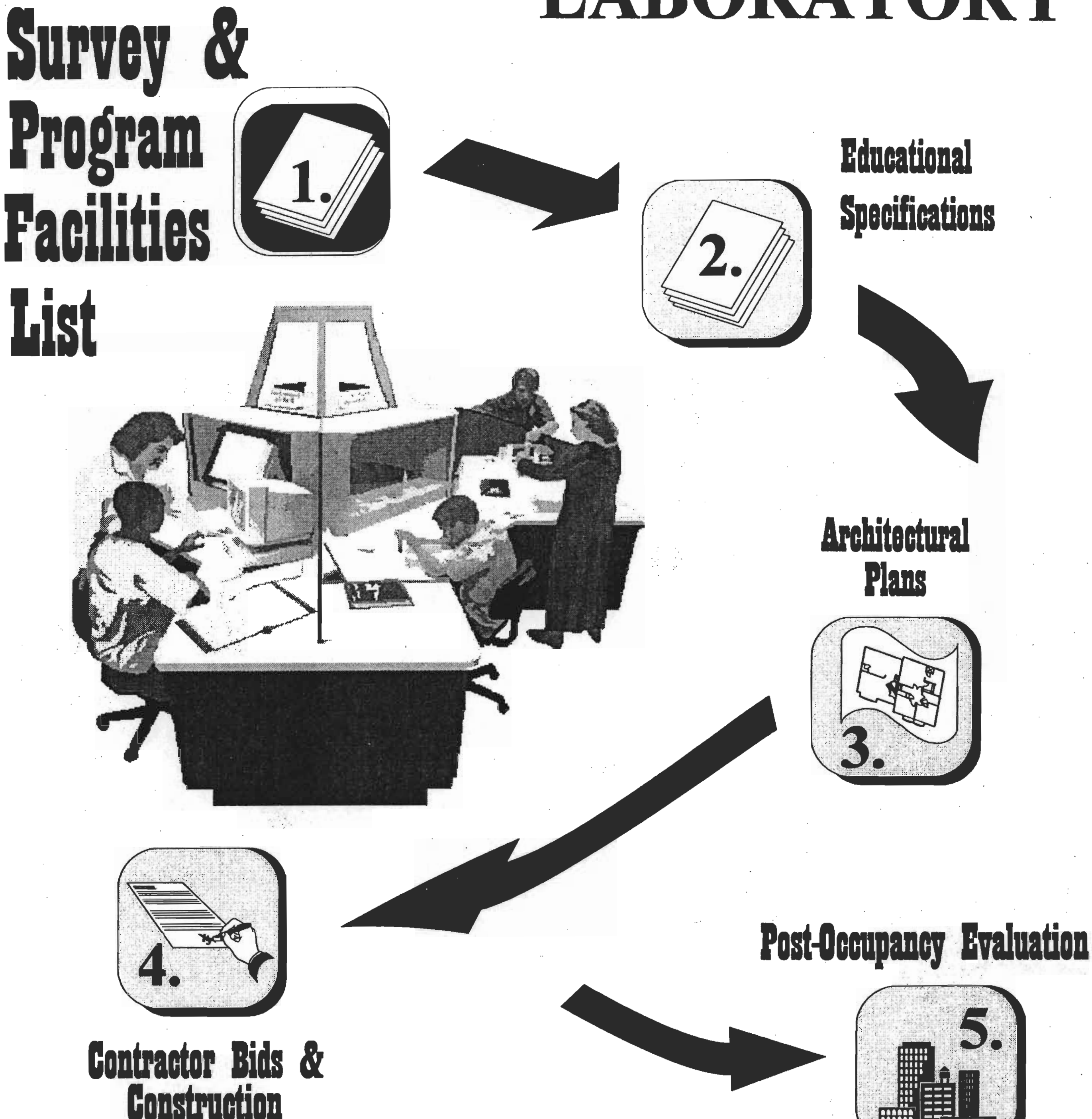
For large or complex facilities projects, additional advisory group members may be selected from business, industry and the community. On these large projects, the Advisory Group may be subdivided into small committees for different types of work or individual programs. An example would be Technology Education, Science and Mathematics; another example is for new construction to be treated separately from remodeling and renovation. In every instance, composition of these Advisory Group committees should consist of members who share philosophical beliefs.

These small committees should be knowledgeable about their project or program area in order to give direction to the larger Advisory Group. Even though these small committees may have completed the initial project assignment, their responsibility continues throughout the entire process of facilities planning, construction and post-occupancy evaluation.

An important aspect of facilities planning by each small committee is the monitoring of both design and construction phases to insure a proper integration of Technology Education with other programs. This committee should define in detail important facility design requirements to insure that all construction needs are met, and with members of the other committees, review each phase of construction at major milestones, and become involved in preparation of the final detailed list for both furniture and equipment.

The Advisory Group and smaller committees should participate in the preparation and interpretation of Educational Specifications for the architect; provide other important resource information for the architect during planning and design; monitor construction; and review each phase of the project to insure adequacy of design. This group should be cognizant of the importance of a post-occupancy evaluation, and inform other members of the community about the importance of their facilities Advisory Group experience, while building support for taxes to fund future capital outlay bond referenda.

PROCEDURES FOR DEVELOPING A TECHNOLOGY EDUCATION LABORATORY



SECTION 1

THE PROGRAM FACILITIES LIST AND SURVEY

THE PROGRAM FACILITIES LIST

According to recommended standards in "SREF," State Requirements for Educational Facilities (1994), a district generated school board approved list of educational programs, related spaces, and occupancy design criteria shall provide the necessary information for the development of Educational Specifications which also provides a framework for completing the Architectural Plans.

This document, referred to as the "Facilities List," reflects planning by district staff members and community participants, and after School Board approval, becomes the tool for future facilities planning activities.

It is important that this Facilities List have approval of both the local School Board and the Division of Applied Technology and Adult Education. This document should reflect the educational philosophy of the local School District and the State Commissioner of Education.

Once completed, the Facilities List becomes a basis for all construction outcomes, and becomes the design document for all future activities leading to facility construction and occupancy by staff and students.

THE EDUCATIONAL PLANT SURVEY

This document is a systematic study of existing educational and ancillary plants and an estimate of their future needs in terms of renovation, remodeling and/or additions. The survey is not primarily interested in educational programs. However, there is need to show a relationship between educational facilities and programs in order to provide judgmental decisions in terms of recommendations in the Educational Plant Survey.

THE PURPOSE OF AN EDUCATIONAL PLANT SURVEY

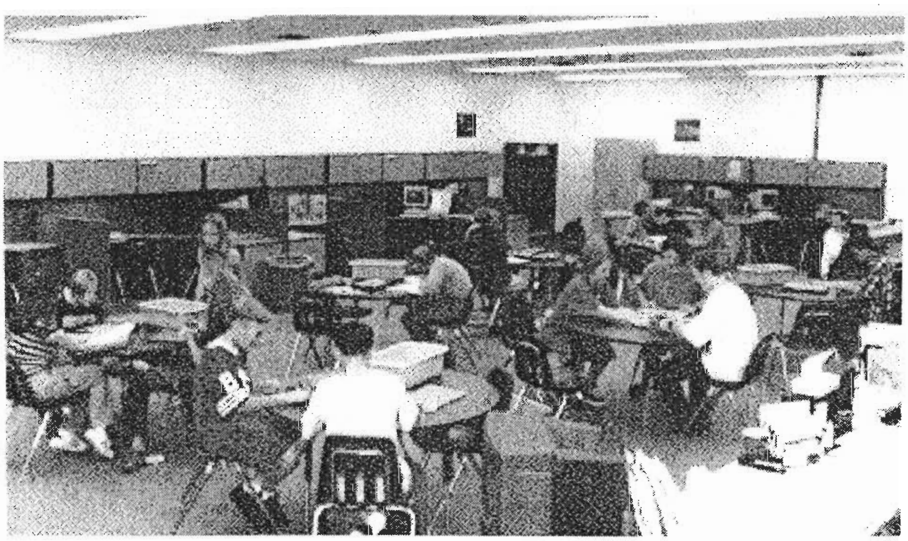
The purpose of an Educational Plant Survey is to encourage a thoughtful, organized process in order to provide for both educational and ancillary facilities to adequately house students, teaching staff, support staff, and administrators, as well as the activities of a local School District. This document shall aid the local School Board in formulating plans and planning capital outlay budgets for the next several years.

An Educational Plant Survey is conducted every five years, but circumstances may cause a Survey to be conducted within this five year period. It may be necessary to have a Survey up-date before a local capital outlay bond referendum or because of changes in educational philosophy (i.e., changing a facilities list to add or delete programs or a grade configuration from K-5, 6-8 to Pre-K-6, 7-9 etc.); or to make changes in the current Survey anytime within the five year cycle. These changes are called a Supplemental Survey which may involve only one school or several schools within the school district.

THE LIMITATIONS OF AN EDUCATIONAL PLANT SURVEY

The Educational Plant Survey is limited to an evaluation of the effective and adequate use of facilities, not of the educational program or of the staff. All recommendations reflect changes to existing facilities or the addition of new facilities to house students and programs.

According to Florida Statutes, all Applied Technology and Adult Education programs shall be approved through a program/facilities needs survey prior to the School Board adoption of the program Facilities List.



A TYPICAL DISTRICT FACILITIES LIST
SECTION FOR MATH, SCIENCE AND TECHNOLOGY EDUCATION

District Caldwell Total stations 1,600 Gross Sq. Ft.: 244,045
Level: High 9-12 Student Capacity 1,520 Utilization: 95%

FISH CODE	DESCRIPTION	NET SQUARE FEET	NET SQUARE FEET PER STUDENT	STUDENT STATIONS UTILIZED
	MATH			
035	Math, Classroom	756	4,536	28
808	Storage, Material			
	Subtotal	756	4,536	
	SCIENCE			
042	Science Demo Classroom	1,036	3,108	28
809	Storage, Material	155	465	
	Subtotal	1,191	3,573	
043	Science Lab	1,224	7,344	24
809	Storage, Material	155	930	
812	Storage, Project	150	900	
	Subtotal	1,529	9,174	
	TECHNOLOGY EDUCATION			
241	Electronics Technology	1,560		24
808	Storage, Material	90		
850	Storage, Tool	195		
852	Technology Resource Center	800		
	Subtotal	2,645		
242	Drafting & Design Technology	2,280		24
810	Storage, Material	395		
852	Technology Resource Center	800		
	Subtotal	3,475		
243	Communications Technology	3,240		24
808	Storage, Material	90		
810	Storage, Material	395		
852	Technology Resource Center	800		
849	Storage, Project	310		
851	Storage, Tool	310		
	Subtotal	4,525		
243	Technology Applications	3,240		24
808	Storage, Material	90		
810	Storage, Material	395		
852	Technology Resource Center	800		
849	Storage, Project	310		
851	Storage, Tool	310		
	Subtotal	4,525		

TECHNOLOGY EDUCATION AND SCIENCE PROGRAM WORKSHEET AND MODULAR PROGRAM ACTIVITIES

SUGGESTED TECHNOLOGY EDUCATION/SCIENCE LABORATORY SPACES						
FISH CODE	SPACES		ITEM	Per Item	NET SQUARE FEET	STUDENT STATIONS
027	Science Lab		1		1224	24
240	Technology Lab. -	Small	1		1560	24
241	Technology Lab. -	Small	1		1560	24
242	Technology Lab. -	Medium	1		2280	24
243	Technology Lab -	Large	1		3240	24
803	Darkroom -	Small	1		100	0
807	Equipment Storage-	Regular	1		315	0
808	Material Storage -	Small	2	90	180	0
809	Storage Material -	Medium	1		155	0
810	Storage Material -	Large	1		395	0
811	Storage -	Outside	1		50	0
812	Storage Material -	Small	1		90	0
813	Student Storage		1		40	0
814	Student Restroom-	M/F	2	35	70	0
849	Project Storage -	Large	1		310	0
850	Tool Storage -	Small	1		195	0
851	Tool Storage -	Large	1		310	0
852	Resource Center		1		800	0
854	Darkroom -	Large	1		225	0

OTHER TECHNOLOGY EDUCATION PROGRAM LABORATORIES						
PROGRAM & SPACES	PER	ITEMS	NSF	NSF	NSF	STU.
Aerospace Island						
Applied Physics						
Architectural Structures						
Astronomy						
Automotive Engineering						
Biology/Ecology						
Biotechnology						
Communications						
Computer Animation						
Computer Programming						
Desktop Publishing						
Digital Electronics						
Digital Graphics						
Drafting Technology						
Electricity/Electronics						
Energy/Power Mechanics						
Environment Island						
Experimentation Island						
Fabrication Island						
Flight/Aerodynamics						
Forecasting Island						
Graphics & Animation						
Hydraulics/Pneumatics						
Industrial Pneumatics						
Laser/Fiber Optics						
Manufacturing Design						
Manufacturing Physics						
Matter/Chemical Interaction						
Materials Processing						
Meteorology/Astronomy						
Modeling Island						
Modeling/Inventing						
Nuclear Physics						
Plastics & Composites						
Pneumatics Island						
Product Design Island						
Recycle Island						
Research & Design						
Robotics Island						
Satellite Communications						
Simulation Design						
Structural Design						
Technological Systems						
Telecommunications						
Testing & Analysis						
Transportation Island						
TV Directing/Editing						

STATE REQUIREMENTS FOR EDUCATIONAL FACILITIES
TECHNOLOGY EDUCATION LABORATORY
PROGRAM FACILITY SPACES

GRADE LEVEL	PROGRAM FACILITY SPACE	FISH DESIGN CODE	OCCUPANT DESIGN STATIONS	NET SQUARE FEET			RELATED SPACE IN NET SQ FT	PROGRAM SPACE
				MIN	NORM	MAX		
6-9	Orientation and Exploration	240	24	85	95	105	808, 810, 849, 851, 852, *854	Laboratory

Recommended Technology Education Courses/Programs

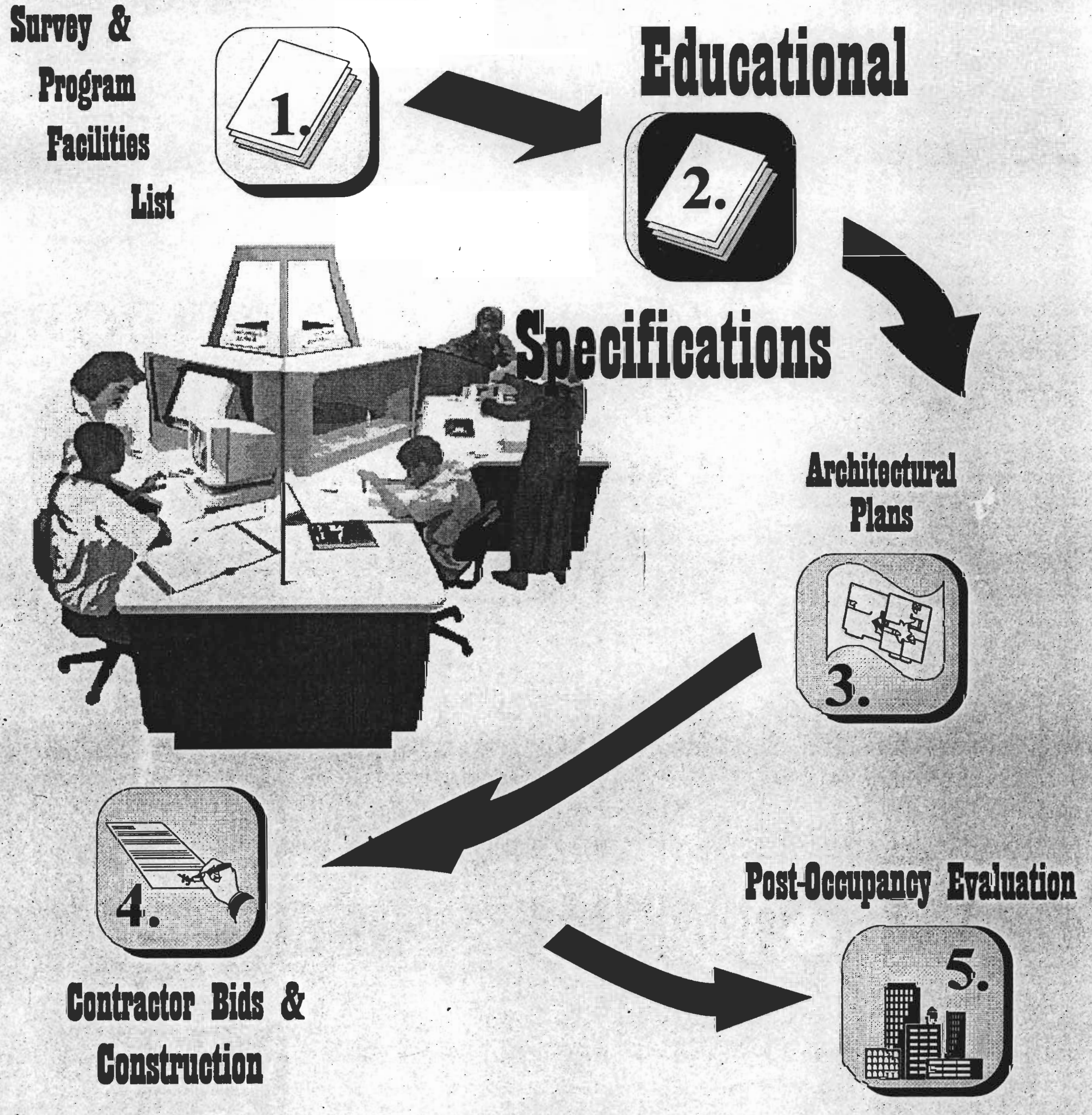
Integrated Technology Studies	8600000
Introduction to Technology	8600010
Exploring Technology	8600020
Exploration of Communications Technology	8600030
Exploration of Production Technology	8600040
Exploration of Aerospace Technology	8600050
Orientation to Technology	8600110
Exploration of Power and Transportation Technology	8600240
*Exploration of Graphic Communications Technology	8600220

GRADE LEVEL	PROGRAM FACILITY SPACE	FISH DESIGN CODE	OCCUPANT DESIGN STATIONS	NET SQUARE FEET			RELATED SPACE IN NET SQ FT	
				MIN	NORM	MAX		
9-12	Large Technology Education	243	24	120	135	150	803, 807, 808, 810, 811, 849, 851, 852, *854	Laboratory
9-12	Medium Technology Education	242	24	85	95	105	852, 803, 807, 810, *854	Laboratory
9-12	Small Technology Education	241	24	60	65	70	852, 807, 808, 850	Laboratory

Recommended Technology Education Courses/Programs

Construction Technology	8600700
*Communications Technology	8601000
Aerospace Technology	8601600
Power and Transportation Technology	8601200
Materials and Processes Technology	8601100
Engineering Technology	8601300
Production Technology	8601400
Technology Applications I	8600500
Technology Applications II	8600600
Technology Applications III	8601700
*Technology Studies	8601500
Graphics/Illustrative Design Technology	8600800
Electronics Technology	8600900

PROCEDURES FOR DEVELOPING A TECHNOLOGY EDUCATION LABORATORY



SECTION 2

EDUCATIONAL SPECIFICATIONS DESIGN DOCUMENT

Information for completing an educational specifications document is derived from the School Board **philosophy of education**, the **school improvement plan**, the school board approved **curriculum**, a program **facilities list**, a comprehensive list of equipment and furniture, and detailed construction guidelines unique to each individual program need.

Educational Specifications may include one program in the Facility List or the complete school depending on the scope of the project. It involves projects which consist of new construction, remodeling and renovation.

Architectural planning and design utilizes this document for several reasons:

1. The educator's point of view on program needs is incorporated into the design.
2. Project approval and guidance is provided according to the School Board philosophy.
3. It provides opportunity for variances on regular procedures or in space requirements.

This document guides the architect through both the project **design phase** and **construction phase**. It also provides a valuable instrument for project evaluation.

TECHNOLOGY EDUCATION FACILITIES DESIGN

The laboratory/classroom design area must accommodate teaching and learning strategies that produce optimum learner outcomes for Technology Education. It is recommended that the classroom be adjacent or near other program areas (mathematics, science, social studies, etc.) for enhancement of the concept of integrating Technology Education with other programs. This collaboration of programs and resources should provide a learning environment to support the interdisciplinary studies concept.

A Technology Education laboratory/ classroom should include:

1. Laboratory/classroom workspace and seating area.
2. Design, research, modular instructional activity area.
3. Production/fabrication dynamic testing/evaluation area.
4. Finishing, photography, material storage, and project area.
5. Resource, small group meeting and teacher planning area.

The arrangement and size of these areas will be dependent upon the educational program, the developmental grade levels, design enrollment, staffing and available space requirements. Individual space requirements for each area are included to facilitate future program planning.

An Educational Specifications document for each project regardless of the scope and sequence is imperative for architectural design. This document should be completed for all new construction and remodeling projects. Remodeling projects must include a current space "**FISH**" (Florida Inventory of School Houses) inventory report and utilize all the available net square feet of available existing space.

A Project Funding proposal should indicate the source and amount of dollar commitment by the School Board, and provide a system of audit control for all combinations of funding sources.

(Sample Format)

EDUCATIONAL SPECIFICATION
LETTER OF TRANSMITTAL

<u>INSTRUCTIONS</u>: Submit one copy of this form with educational, auxiliary, and ancillary with facilities specifications document being transmitted. **FILL IN ALL LINES AND CHECK ALL APPROPRIATE BOXES.**

1. ______________________________ ☐ School District
2. ______________________________ ☐ School Name
3. ______________________________ ☐ School Code Number
4. Description of Project: ☐ New Construction ☐ Remodeling ☐ Renovation

5. ☐ Attached are 2 copies of educational specifications which were **APPROVED BY THE SCHOOL BOARD** on __________, 19 __ for the above referenced facility.

6. District name of project: ____________ 7. State survey name of project: ________

8. SURVEY RECOMMENDED: ☐ Yes, Survey Document Date: _______ ☐ No ☐ N/A If not, then funding source does not require a survey recommendations.

9. SURVEY RECOMMENDATION NUMBER(s) or PAGE NUMBER(s): _______ and/or Date of Supplemental Survey: __________

10. Is project on Project Priority List (PPL)? ☐ Yes ☐ No If yes PPL number: _____

11. School Board Approval of the District Facility List - DATE: ____________

12. Edition of **<u>Florida Administrative Code</u>** Section SREF that was used in developing the educational specifications - Date: __________

13. FUNDING SOURCE anticipated for this project: (One or more sources may be checked)

☐ CO&DS ☐ PECO ☐ LOCAL MILLAGE ☐ LOCAL BOND ☐ LCIF (Local Capital Improvement Funds) ☐ OTHER (Specify) Please Be Specific

14. District Contact Person: ______________ Phone (Commercial) __________ (SunCom) __________

(Sample Format)

FISH DESIGN CODES, ROOM NUMBERS AS FOUND ON FISH, AND EDUCATIONAL SPECIFICATIONS FOR PROPOSED SPACES

1. ____
School District

2. ____
School Name

4. Description of Project: ☐ New Construction ☐ Remodeling ☐ Renovation

GRADE LEVEL: _______

PROGRAM FACILITIES LIST

Fish Code or 6A-2	*Areas or Bldg./ Rms.	Description of Area	No. of Staff Per Area	No. of Students Per Area	No. of Students Total	Net Sq. Ft. Per Unit	Net Sq. Ft. Total
						Subtotal Net Sq. Ft.	
						6% for Mechanical	
						**Total Net Sq. Ft.	
Circulation, Walls, Overhangs, etc.			Up to 32% for grades six through nine Up to 34% for grades nine through twelve				
						***Total Gross Sq. Ft.	

*Note: New construction shall have SREF space reference numbers. A combined Remodeling and Renovation projects should use FISH Building numbers/Room Numbers and design codes. Renovation projects need to submit a Scope of Work Outline and identify the "FISH" spaces.

** Net square feet shall be included for all three types of construction.

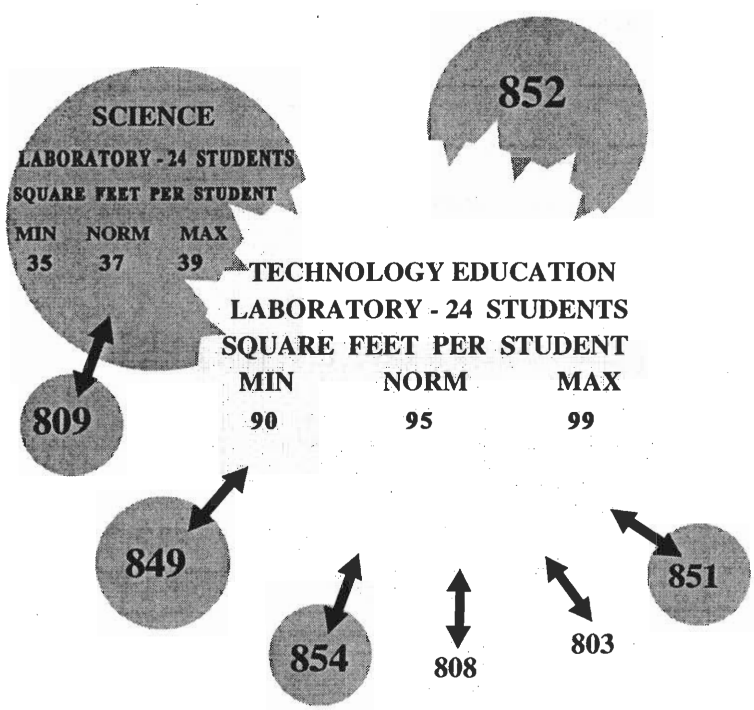
*** Net to Gross is required for new construction only.

PROGRAM FURNITURE AND EQUIPMENT REQUEST FORM

Space or Area	No. of Items	DESCRIPTION OF FURNITURE/EQUIPMENT NEEDED	UNIT COST	TOTAL COST
			TOTAL	

Note: Renovation does not include furniture and equipment.

SPACE RELATIONSHIPS
(See elementary school, middle school, or high school models as a reference.)



SPECIAL CONSIDERATIONS

List below any special consideration of HEATING, COOLING, VENTILATION, ACOUSTICAL, FLOOR, WALLS, CEILING, WINDOWS, DOORS, WATER, COMMUNICATIONS, ELECTRICAL, GAS AND AIR, SAFETY, FENCING, SERVICE DRIVES, PARKING that apply to this project.

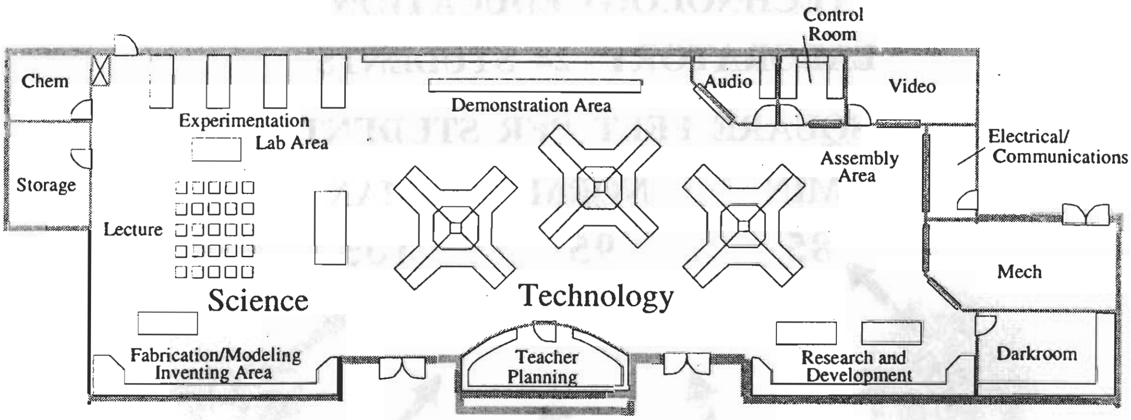
BUILT-INS:
A. Built-in work counter:
B. Built-in cabinets/shelving:
C. Built-in Instruction Aids:
D. Other Built-ins:

OTHER CONSIDERATIONS: Space configuration, Room Layouts, Site Considerations, etc.

PROPOSED PLANS, FUNDS, AND DESIGN DRAWING
FOR THE REMODELING, RENOVATION, OR NEW CONSTRUCTION OF A SCIENCE AND TECHNOLOGY EDUCATION LABORATORY

* FUNDS REQUESTED:
NEW CONSTRUCTION: ______________________
REMODELING: ______________________
RENOVATION: ______________________
TOTAL ______________________

* LABORATORY FLOOR PLAN (sample):



NOTE: Include copies of planning model and floor plan.

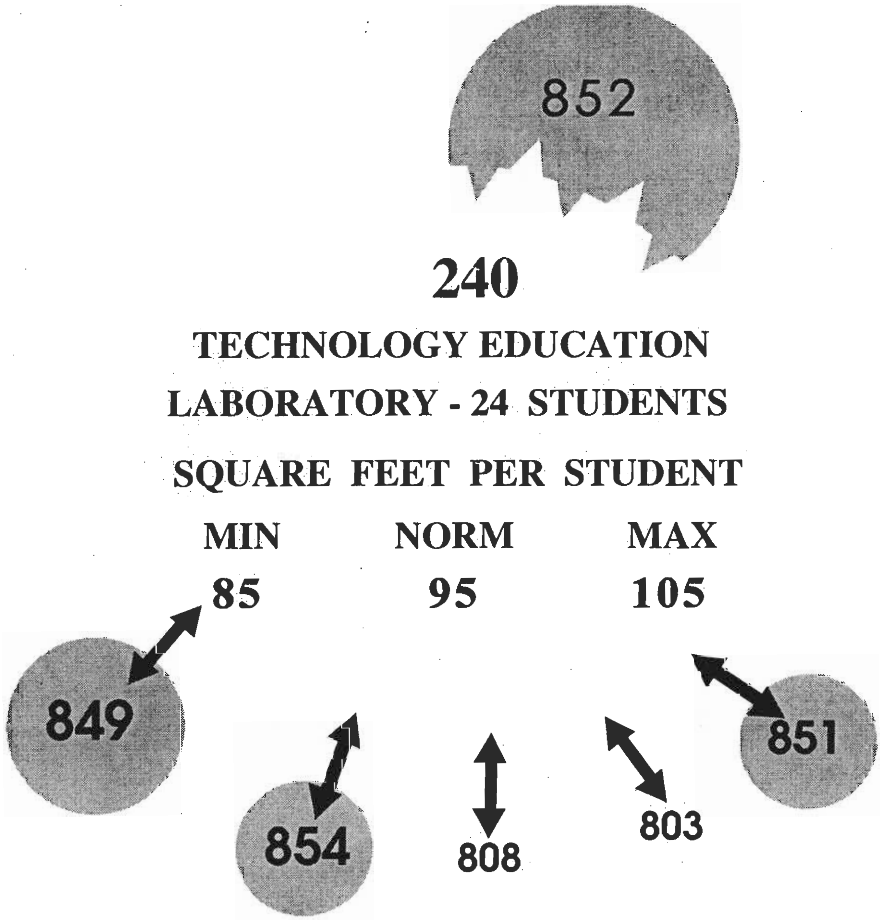
INSTRUCTIONS

New Construction should use the "Planned Model" for Technology & Science Laboratory.
Remodeling should closely resemble the "Planned Model" using existing spaces. (FISH attachment must accompany your work).
Remodeling may include renovation and may change the floor plan and/or may change the use of the existing space; renovation only upgrades the existing space.
Renovation need only show the net square feet and scope of work outline.
FISH (Florida Inventory of School Houses)
This document consists of a complete school inventory in terms of its Net Square Feet, Facility, Building and Room Numbers, plus other information (i.e., size, condition, etc.) of importance to school plant planning and maintenance.
CONSTRUCTION COSTS:*

New Construction is 100% X Gross Square Feet.
Remodeling is ½ of New Construction X Net Square Feet.
Renovation is 1/3 of New Construction X Net Square Feet.

*Refer to cost figures for your district on page 31.

ORIENTATION AND EXPLORATION

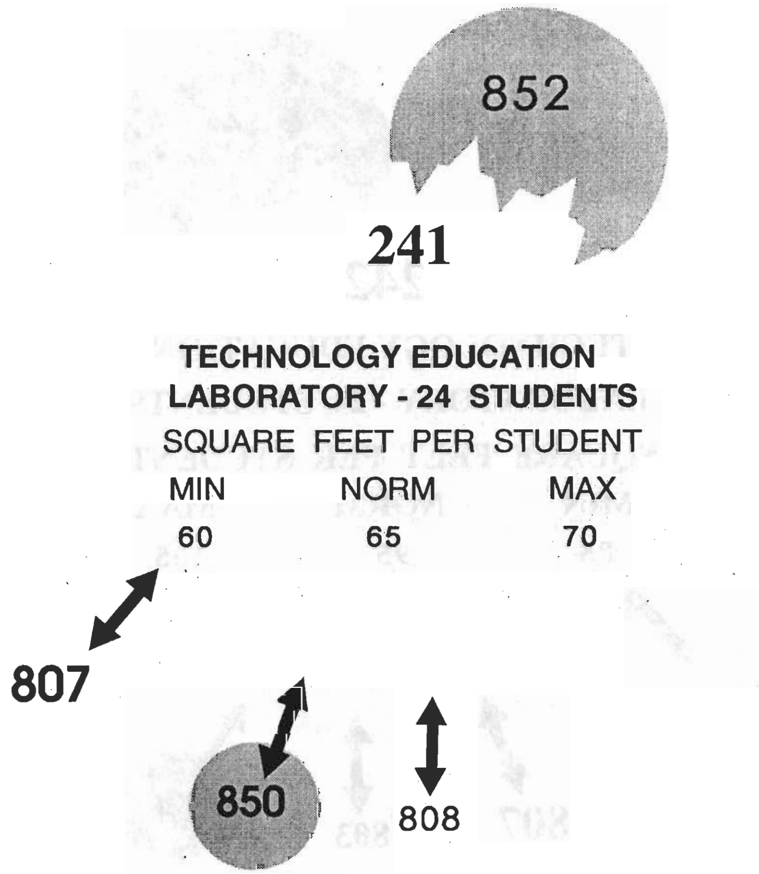


FISH	DESIGN CODE/DESCRIPTION	NET SQUARE FEET		
		Min	Norm	Max
240	Laboratory (NSF x 24 students = total sf)	85	95	105
803	Darkroom	90	100	110
808	Storage, Material Small	70	90	110
849	Storage, Projection Large	240	310	380
851	Storage, Tool Large	250	310	370
852	Resource Center	750	800	850
*854	Darkroom	200	225	250

*Graphic Communications only, may be a variance

TECHNOLOGY EDUCATION LABORATORY

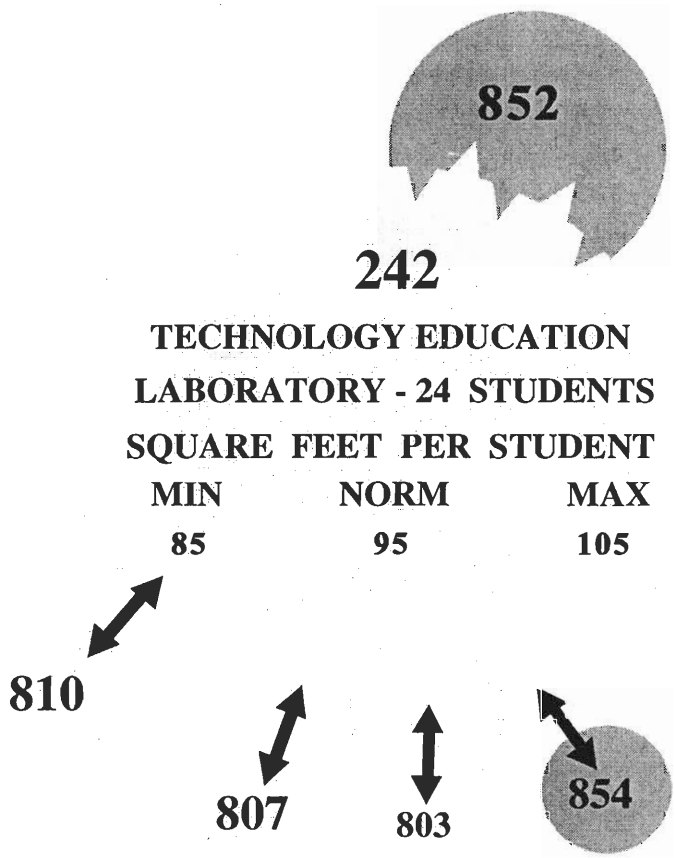
SMALL



FISH	DESIGN CODE/DESCRIPTION	NET SQUARE FEET		
		Min	Norm	Max
241	Laboratory (NSF x 24 students = total sf)	60	65	70
807	Storage, Equipment	300	315	330
808	Storage, Material Small	70	90	110
850	Storage, Tool Small	165	195	225
852	Resource Center	750	800	850

TECHNOLOGY EDUCATION LABORATORY

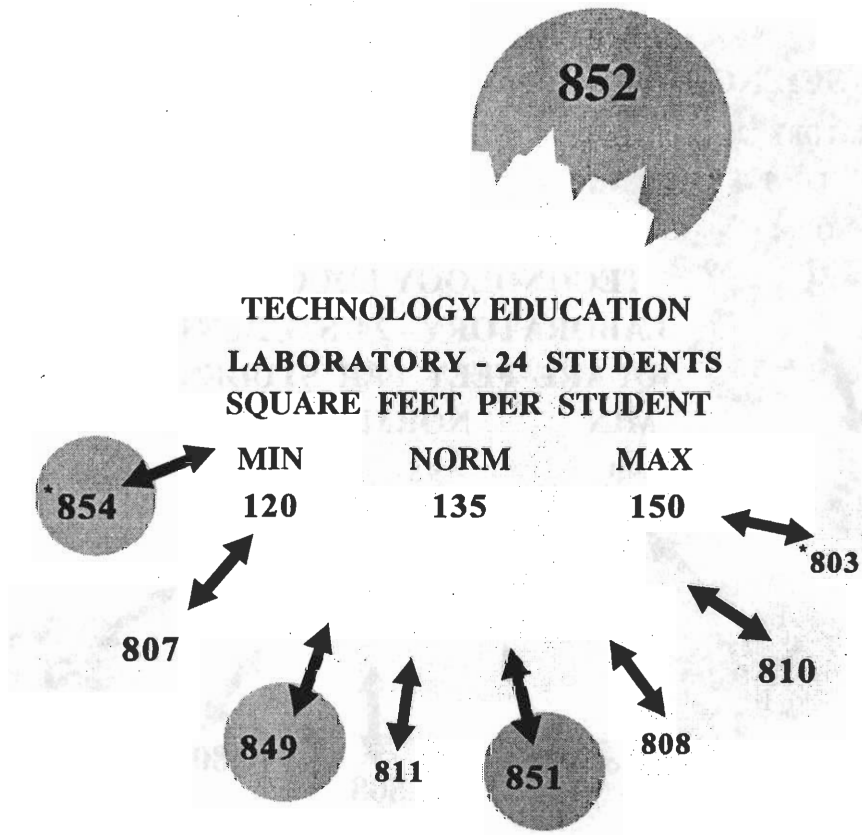
MEDIUM



FISH	DESIGN CODE/DESCRIPTION	NET SQUARE FEET		
		Min	Norm	Max
242	Laboratory (NSF x 24 students = total sf)	85	95	105
810	Storage, Material Large	220	395	570
807	Storage, Equipment	300	315	330
803	Darkroom	90	100	110
*854	Darkroom	200	225	250
852	Resource Center	750	800	850

*Graphic Communications only, may be a variance

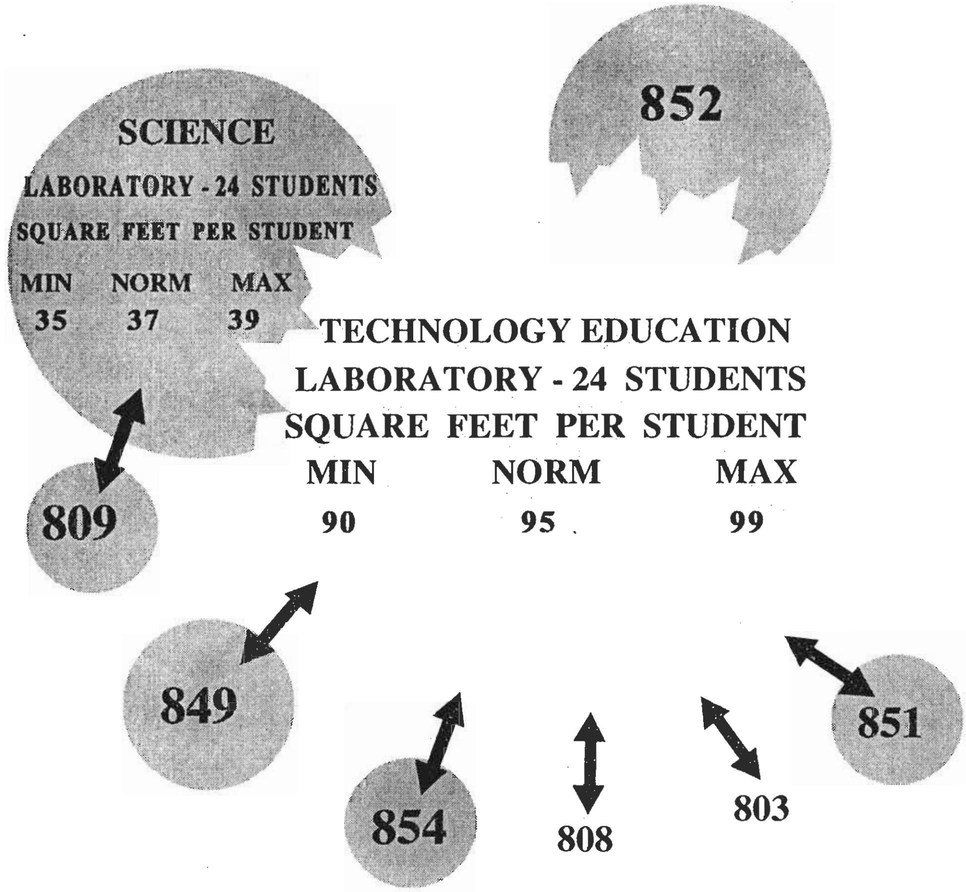
TECHNOLOGY EDUCATION LABORATORY
LARGE



FISH	DESIGN CODE/DESCRIPTION	NET SQUARE FEET		
		Min	Norm	Max
243	Laboratory (NSF x 24 students = total sf)	120	135	150
803	Darkroom	90	100	110
807	Storage, Equipment	300	315	330
808	Storage, Material Small	70	90	110
810	Storage, Material Large	220	395	570
811	Storage, Outside	45	50	55
849	Storage, Project Large	240	310	380
851	Storage, Tool, Large	250	310	370
852	Resource Center	750	800	850
*854	Darkroom	200	225	250

*Graphic Communications only, may be a variance

TECHNOLOGY AND SCIENCE LABORATORY



FISH	DESIGN CODE/DESCRIPTION	NET SQUARE FEET		
		Min	Norm	Max
242	Technology Education Laboratory (NSF x 24 students = total sf)	85	95	105
027	Science Laboratory (NSF x 24 students = total sf)	35	37	39
809	Storage, Material	120	150	190
803	Darkroom	90	100	110
808	Storage, Material Small	70	90	110
849	Storage, Projection Large	240	310	380
851	Storage, Tool Large	250	310	370
852	Resource Center	750	800	850
*854	Darkroom	200	225	250

*Graphic Communications only, may be a variance.

"F I S H"
A SAMPLE FACILITIES INVENTORY

AGENCY :
FACILITY :
CHECK USE : SENIOR HIGH   GRADES HOUSED : 09 -12   CAPITAL OUTLAY CLASSIFICATION : I   VALIDATION DATE

CAPITAL OUTLAY FTE FOR 94/95 BY GRADE

PK		01		03		05		07		09	570	11	422	PK-12		TOTAL	1898
KG		02		04		06		08		10	534	12	372			ADULT	

PARCEL	019	OWNER	SCHOOL BOARD	PARKING	DEVELOPED	PLAYGROUND	YES
		ACRES	20	ATHL. FIELD	YES	WATER SRC	PUBLIC
		YEAR ACQ	1955	DRAINAGE	INADEQUATE	SEWAGE	PUBLIC
		BLDG. PLAN	COMBINATION OF	LANDSCAPE	DEVELOPED	POLICE	COMBINAT
						FIRE RATE	06

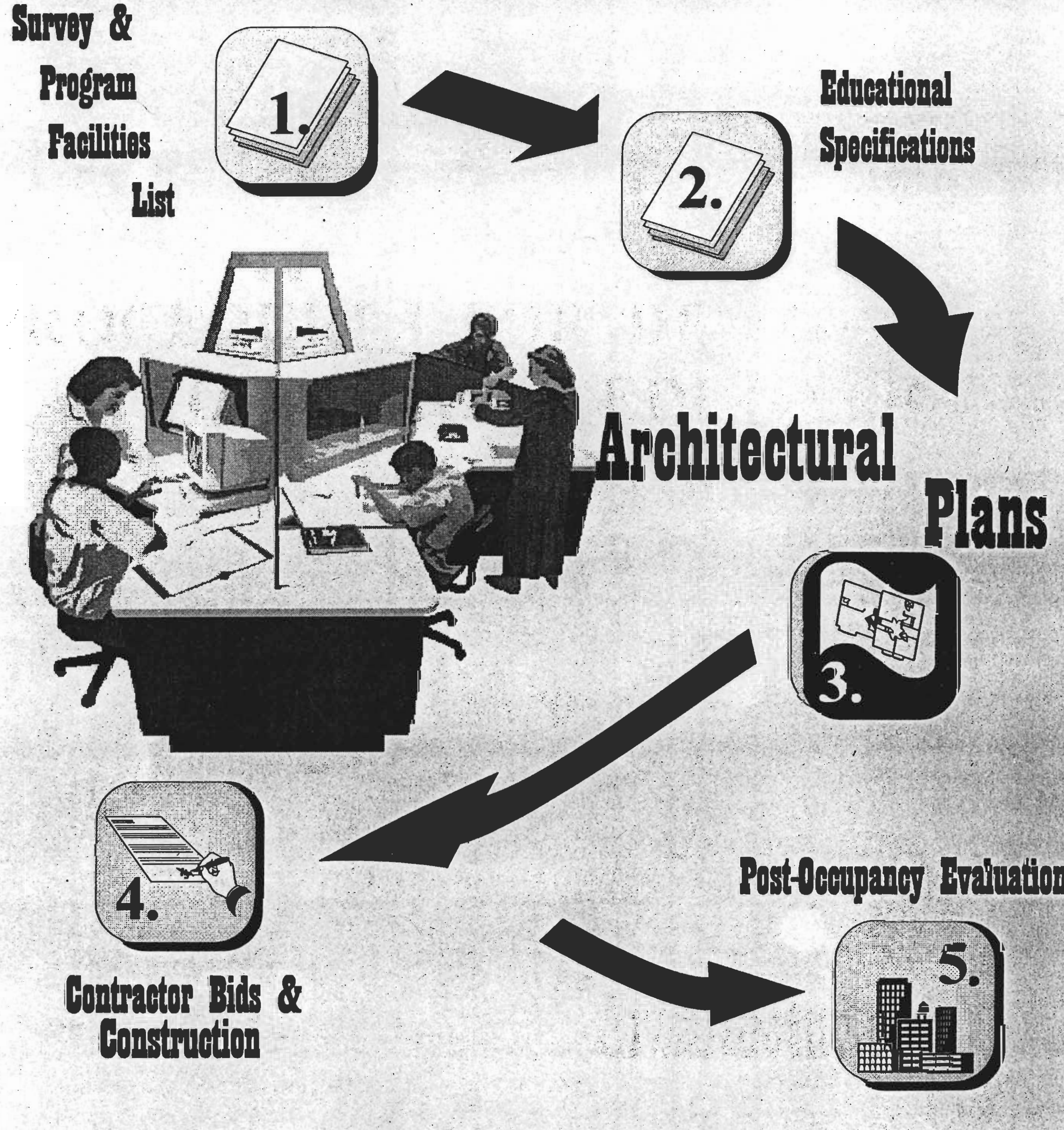
BUILDING	12	STRU COMP	CONCRETE	ARTIF LIGHT	UNSHIELDED FLUO	COOLING	NONE
OWNER	SCHOOL BOARD	WALLS	BRICK	LIGHT ADEQ	ADEQUATE	HEAT SOURCE	OIL
PRIME USE	SENIOR HIGH	CORRIDOR	SINGLE OUTSIDE	TELEPHONE	NONE	DISTRIB	CENTRAL
YEAR CONST	1963	STORIES	01	INTERCOM	ONE WAY COMPLET	CAPACITY	ADEQUATE
REL UNITS	0	MECH VENT	YES	EDUCAT TV	NONE		

ROOM	SQ FT	DESIGN	STUDENT STATIONS	FLOOR LOC	FLOOR COVER	YEAR CONST	COND	AGY	PAR	FAC	BLDG
001	316	272 VOCATIONAL LAB SUPPORT SPACE		01	COMPOS	1963	SATIS	342	019	0019	12
001A	80	808 MATERIAL STORAGE (SMALL)		01	CONCRE	1963	SATIS	342	019	0019	12
001B	120	809 MATERIAL STORAGE (MEDIUM)		01	CONCRE	1963	SATIS	342	019	0019	12
002	175	272 VOCATIONAL LAB SUPPORT SPACE		01	COMPOS	1963	SATIS	342	019	0019	12
003	87	808 MATERIAL STORAGE (SMALL)		01	COMPOS	1963	SATIS	342	019	0019	12
004	2,209	242 MEDIUM TECHNOLOGY LAB	23	01	CONCRE	1963	SATIS	342	019	0019	12
005	352	272 VOCATIONAL LAB SUPPORT SPACE		01	COMPOS	1963	SATIS	342	019	0019	12
006	143	315 TEACHER PLANNING OFFICES)		01	COMPOS	1963	SATIS	342	019	0019	12
007	176	818 LOCKERS/RESTROOM/SHOWER		01	TERRAZ	1963	SATIS	342	019	0019	12
008	26	331 CUSTODIAL SERVICE CLOSET		01	CONCRE	1963	SATIS	342	019	0019	12
009	24	822 PUBLIC USE RESTROOM (MALE)		01	TERRAZ	1963	SATIS	342	019	0019	12
009A	23	818 LOCKERS/RESTROOM/SHOWER		01	COMPOS	1963	SATIS	342	019	0019	12

BUILDING	11	STRU COMP	CONCRETE	ARTIF LIGHT	UNSHIELDED FLUO	COOLING	NONE
OWNER	SCHOOL BOARD	WALLS	BRICK	LIGHT ADEQ	ADEQUATE	HEAT SOURCE	OIL
PRIME USE	SENIOR HIGH	CORRIDOR	SINGLE OUTSIDE	TELEPHONE	NONE	DISTRIB	CENTRAL
YEAR CONST	1963	STORIES	01	INTERCOM	ONE WAY COMPLET	CAPACITY	ADEQUATE
REL UNITS	0	MECH VENT	YES	EDUCAT TV	NONE		

ROOM	SQ FT	DESIGN	STUDENT STATIONS	FLOOR LOC	FLOOR COVER	YEAR CONST	COND	AGY	PAR	FAC	BLDG
001	1,094	047 SR HIGH ART	20	01	CONCRE	1963	SATIS	342	019	0019	11
001A	1,008	241 SMALL TECHNOLOGY LAB	7	01	CONCRE	1963	SATIS	342	019	0019	11
001B	124	809 MATERIAL STORAGE (MEDIUM)		01	CONCRE	1963	SATIS	342	019	0019	11
001C	105	315 TEACHER PLANNING OFFICE		01	CONCRE	1963	SATIS	342	019	0019	11
002	396	272 VOCATIONAL LAB SUPPORT SPACE		01	CARPET	1963	SATIS	342	019	0019	11
003	1,570	241 SMALL TECHNOLOGY LAB	20	01	CONCRE	1963	SATIS	342	019	0019	11
004	168	809 MATERIAL STORAGE (MEDIUM)		01	COMPOS	1963	SATIS	342	019	0019	11
005	24	821 STAFF RESTROOM (BOTH SEXES)		01	TERRAZ	1963	SATIS	342	019	0019	11
006	100	808 MATERIAL STORAGE (SMALL)		01	COMPOS	1963	SATIS	342	019	0019	11
007	1,243	244 SMALL INDUSTRIAL LAB	11	01	CONCRE	1963	SATIS	342	019	0019	11
007A	127	317 GENERAL SCHOOL SPACE		01	CONCRE	1963	SATIS	342	019	0019	11
007B	273	810 MATERIAL STORAGE (LARGE)		01	CONCRE	1963	SATIS	342	019	0019	11
008	168	700 INSIDE CIRCULATION		01	COMPOS	1963	SATIS	342	019	0019	11
009	32	821 STAFF RESTROOM (BOTH SEXES)		01	TERRAZ	1963	SATIS	342	019	0019	11
010	196	809 MATERIAL STORAGE (MEDIUM)		01	COMPOS	1963	SATIS	342	019	0019	11

PROCEDURES FOR DEVELOPING A TECHNOLOGY EDUCATION LABORATORY



SECTION 3

TECHNOLOGY EDUCATION FACILITIES ARCHITECTURAL PLANS

ARCHITECTURAL PLANNING:

The Florida Legislature, through statutory requirements, influences architectural involvement in facility development and planning for all sixty-seven public school districts. These Laws are enacted to insure uniform safety and sanitation requirements and provide local government entities proper direction relative to issues of public concern. The "State Requirements for Educational Facilities" (SREF) document has changed during the 1994 Legislative Session. Florida's current laws provide for only limited authority over architectural plan development. However, architects' involvement in public school facility planning is carefully monitored and regulated by Federal, State, and local governments and by contract agreement with a local School Board.

Responsible planning of public school facilities emanates from the Educational Specifications that reflect recommendations set forth by professional educators. The Architectural Plans, when approved by the School Board, are negotiated for contract and construction. Upon completion of the project's final design phase, a Certificate of Occupancy is needed before admitting students and staff into the facility.

There are three basic phases of architectural planning: **Schematic Phase**, **Preliminary Design Phase**, and **Final Design Phase**. However, two important preliminary steps are necessary to prepare architectural design plans that meet requirements for final approval by local school officials and the School Board:

Step A. A **Pre-design** and School Board approved document referred to as Educational Specifications, which is outlined in a previous section of this report.

During Pre-design, a School Board appointed architect takes charge of all planning and assumes responsibility for the project design phase and additional building requirements such as design codes, safety/environmental regulations, government standards, constraints imposed by funding and existing conditions. A preliminary meeting with school officials is necessary to identify and clarify all the project requirements and interpret the School Board approved Educational Specifications. Project planning committee members and directors of Facilities and Technology Education should also be present during this time. Project meetings involving remodeling and/or renovation of an existing facility should be conducted at the actual place of construction to help clarify specific details.

Step B. Upon receiving the School Board approved Educational Specifications, the architect also becomes involved in creating physical spaces.

This is the Architectural Design phase of planning with a Schematic design outlining program requirements in greater specificity and instructions for a contractor, revealing in detail the complete planned facility. Each new Design phase builds upon a previous phase and allows input from District administrators, the planning committee and the School Board.

THE SCHEMATIC DESIGN PHASE:

The **Schematic Design** phase consists of site and building preliminary drawings which must meet conceptional design criteria as outlined in the project Educational Specifications. These plans are then evaluated by the planning committee for compliance with all major program goals.

The planning review for Technology Education should give special attention to the overall relationship between this program and other disciplines as well as for continuity among other Technology Education program spaces. However, if the project is remodeling or new construction for only Technology Education, the initial plans should show placement of both furniture and equipment.

Also projects involving remodeling and renovation require close scrutiny of all designated existing spaces plus the careful evaluation of codes, existing mechanical and electrical capabilities, and other underlying physical conditions. Should the Educational Specifications include information on the inventory (FISH) and other spaces to be incorporated into the project, verification of this space information must be completed by the architect.

THE PRELIMINARY DESIGN PHASE:

During the **Preliminary Design** phase, the basic elements of the schematic design are carried forward into the individual room dimensions. This phase includes fixed furnishings and equipment. Location takes on greater depth and sharper focus.

The planning committee members have a greater role during the Preliminary Design phase because this is the last practical opportunity for them to make a substantial contribution to the project. For Technology Education related projects careful attention to detail becomes critical due to the complexity and detail of program needs.

During this Phase, the architect will present existing spaces along with formal evaluations of code, existing mechanical and electrical capabilities and all other underlying conditions.

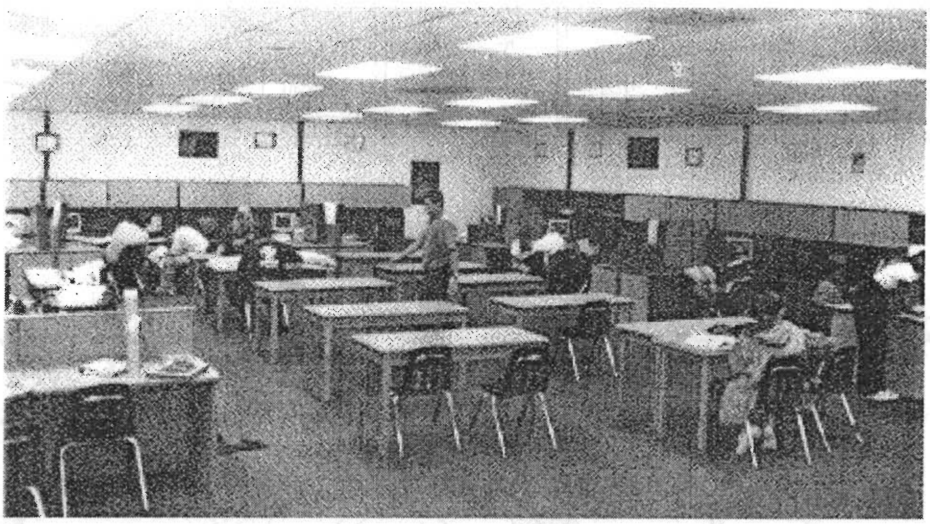
The Educational Specifications shall contain information about the inventory "FISH" and spaces to be incorporated into this project, but verification of all space information must be completed by the architect.

The architect should submit at least one set of Schematic documents to the review committee to allow every option for making intelligent decisions. By this process, **Phase II** and **III** of the **Architectural Plans** are brought into graphic reality and valuable feedback is provided to the architect from the educational community.

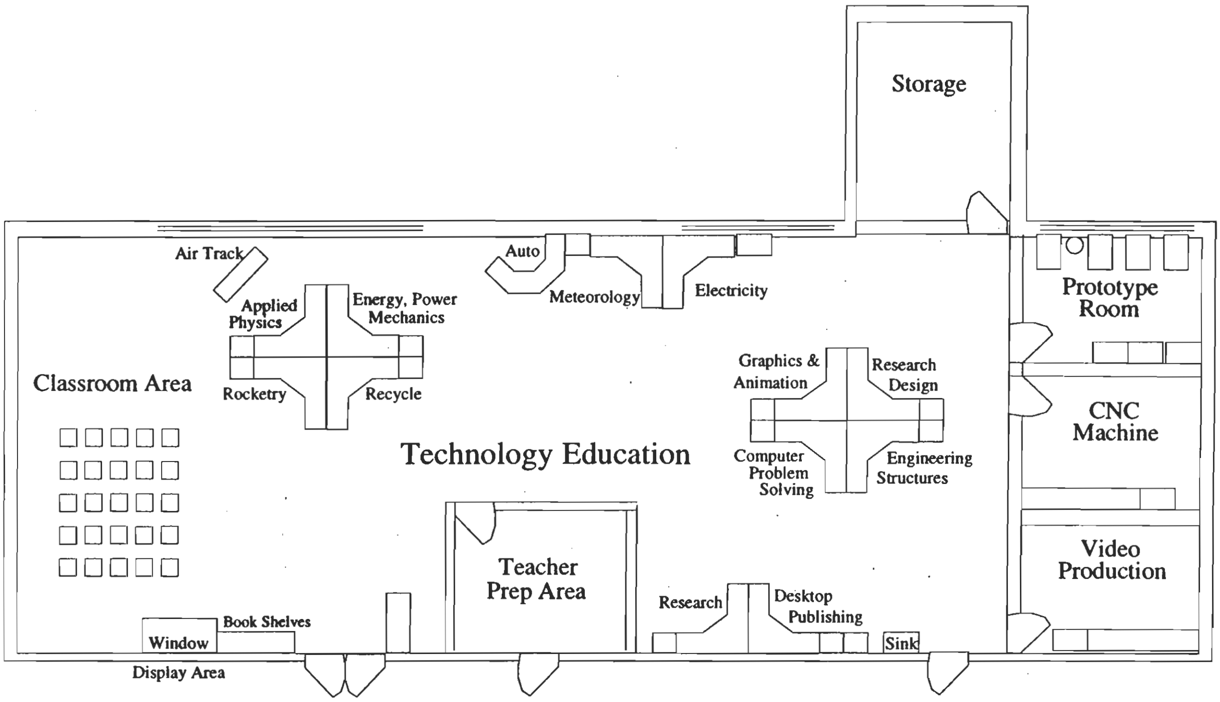
After the planning committee accepts the **Schematic Design** this document is submitted for formal review by local Administration and the School Board.

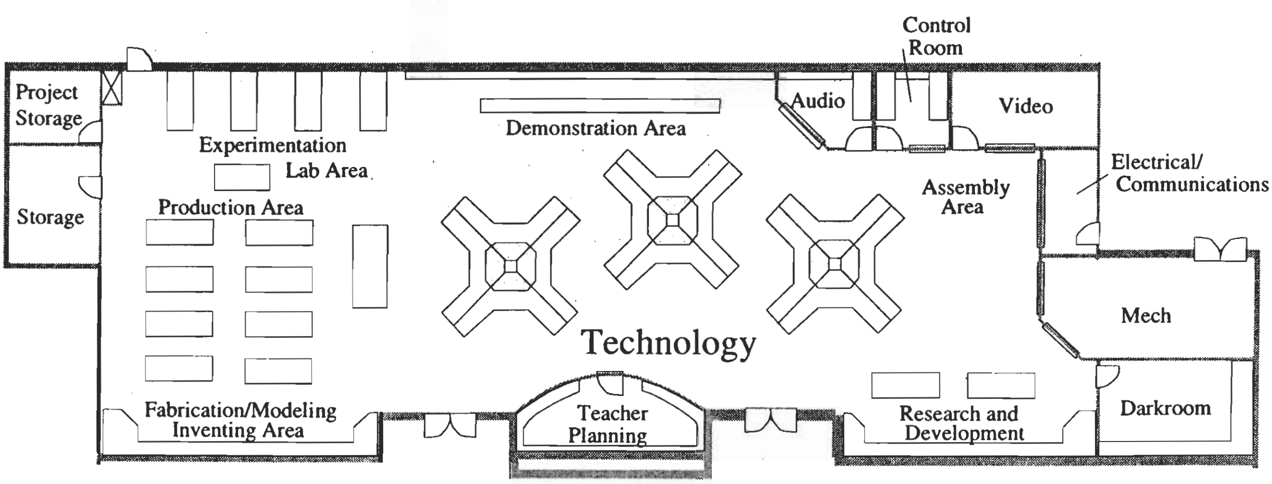
THE FINAL DESIGN PHASE:

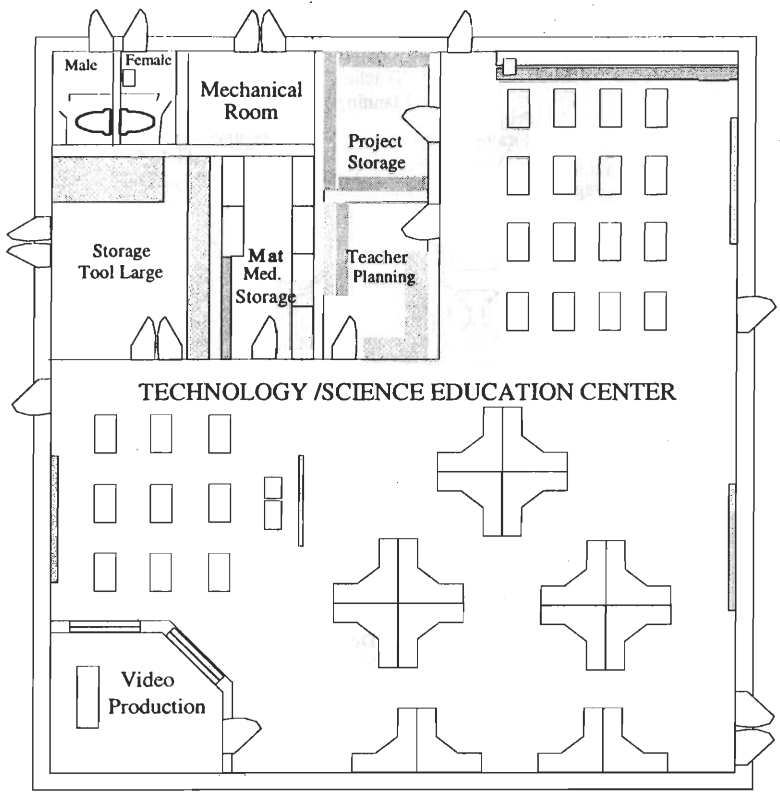
During the **Final Design** Phase, the architect completes detailed documents which will form the contract for construction. These documents consist of construction drawings and written technical specifications. All spaces and systems must be fully described, including demolition, site work, structural work, roofing, doors, windows, finishes, equipment, plumbing, heating and cooling, fire protection, lighting, power, and electronic communications. There must also be a detailed cost estimate and a safety and energy compliance report. The final documents shall accurately reflect the previous planning, the changes by architects, review committee, administration and the School Board. If there are substantial changes in the final design that were not reviewed by the outside planning committee, school officials should proceed toward evaluation and approval. Upon completion, the **Final Design** documents are returned to District administration and School Board for approval, and advertised for bidding by State Certified Contracting Firms. The **Final Design** Phase of planning may also receive Florida Department of Education approval prior to contract at the discretion of the District School Superintendent.

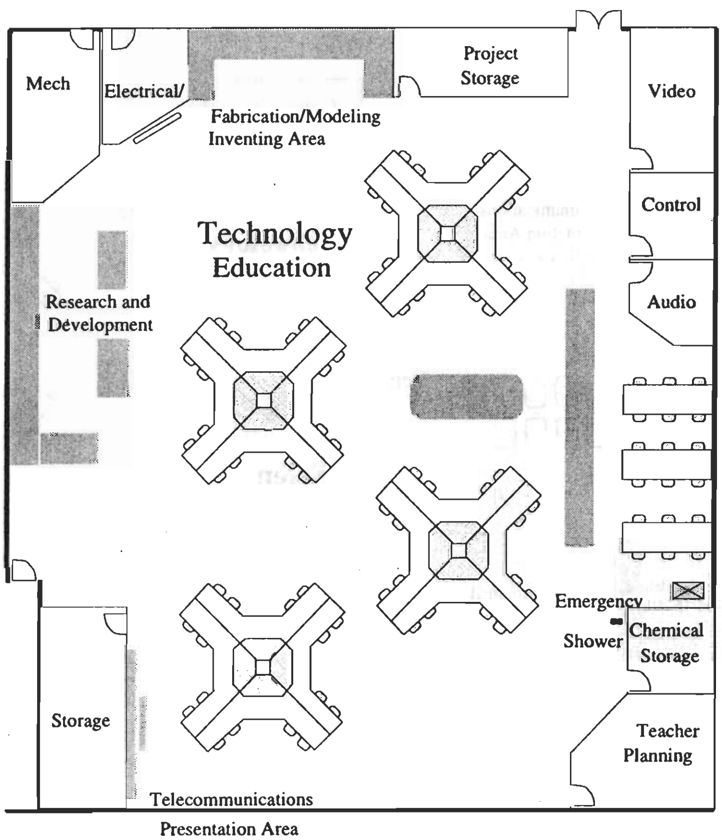


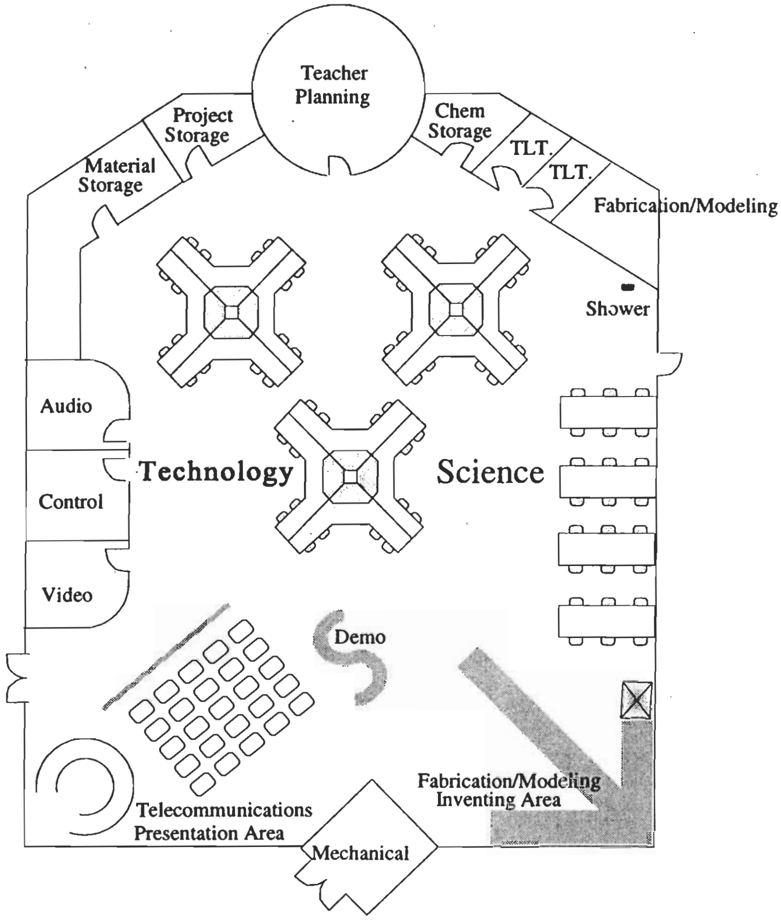
SAMPLES OF TECHNOLOGY EDUCATION SCHOOL LABS

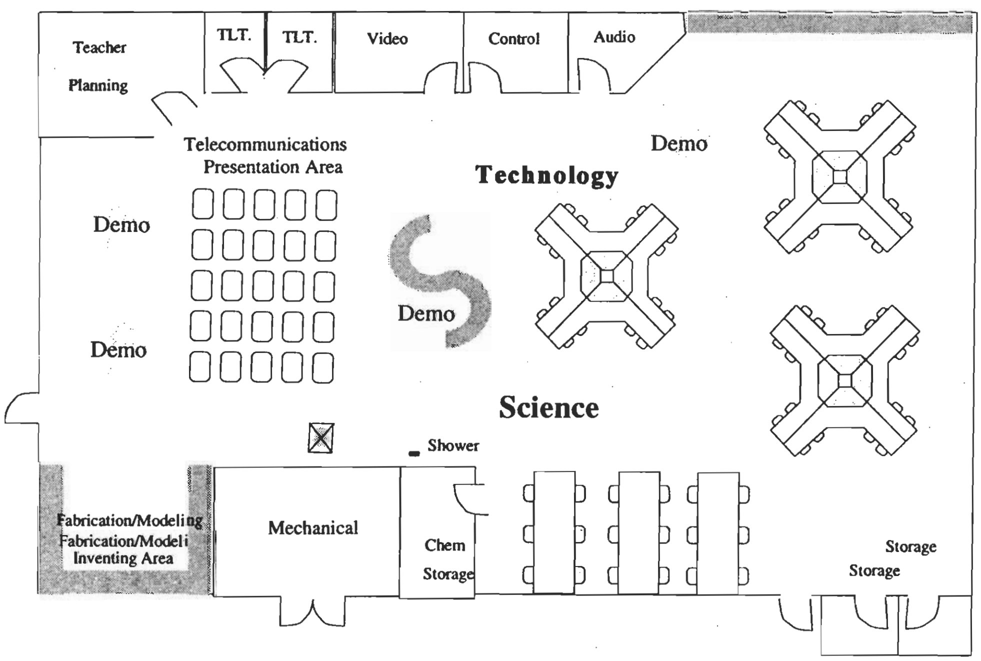





Male
Female
Mechanical Room
Project Storage
Storage Tool Large
Mat Med. Storage
Teacher Planning
TECHNOLOGY /SCIENCE EDUCATION CENTER
Video Production


Mech
Electrical/
Project Storage
Video
Fabrication/Modeling Inventing Area
Technology Education
Control
Research and Development
Audio
Emergency Shower
Chemical Storage
Storage
Teacher Planning
Telecommunications Presentation Area


Teacher Planning
Project Storage
Material Storage
Chem Storage
TLT.
TLT.
Fabrication/Modeling
Shower
Audio
Control
Video
Technology
Science
Demo
Fabrication/Modeling Inventing Area
Telecommunications Presentation Area
Mechanical


Teacher Planning
TLT.
TLT.
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Control
Audio
Telecommunications Presentation Area
Demo
Technology
Demo
Demo
Demo
Science
Shower
Fabrication/Modeling Inventing Area
Mechanical
Chem Storage
Storage
Storage

PROCEDURES FOR DEVELOPING A TECHNOLOGY EDUCATION LABORATORY

SECTION 4

CONTRACTOR BIDS

THE CONTRACT DOCUMENTS: From bidding through construction.

Several important steps are necessary to complete the process of planning for and accepting contractor bids. First is the pre-construction activities; then the construction from the beginning through substantial completion. This is similar for all projects as well as for Technology Education projects including remodeling, renovation or new construction. Educators must be aware of the important aspects of contract agreements and follow all regulations during documentation preparation. It is also important that administrators and architects maintain a realistic dialogue with both contractors and sub-contractors regarding every phase of work.

THE BIDDING PROCESS

The **Contract Document**, prepared by the Office of Facilities Planning, must contain guidelines for bid preparation and for completing the formal contract agreement. This document is carefully scrutinized by all parties during the pre-bid meeting. Ordinarily, this meeting is held about two weeks after formal advertisement for bids. Attendees at the pre-bid meeting usually consist of contractors, architects, engineers, local administrators, and a local project coordinator. The agenda consists of questions by contractors and sub-contractors regarding the scope of work, the contract and bid proposal requirements, and clarification of all warranties. The final phase plan requirements and cost estimates are also discussed to establish parameters for the contractors bid proposal.

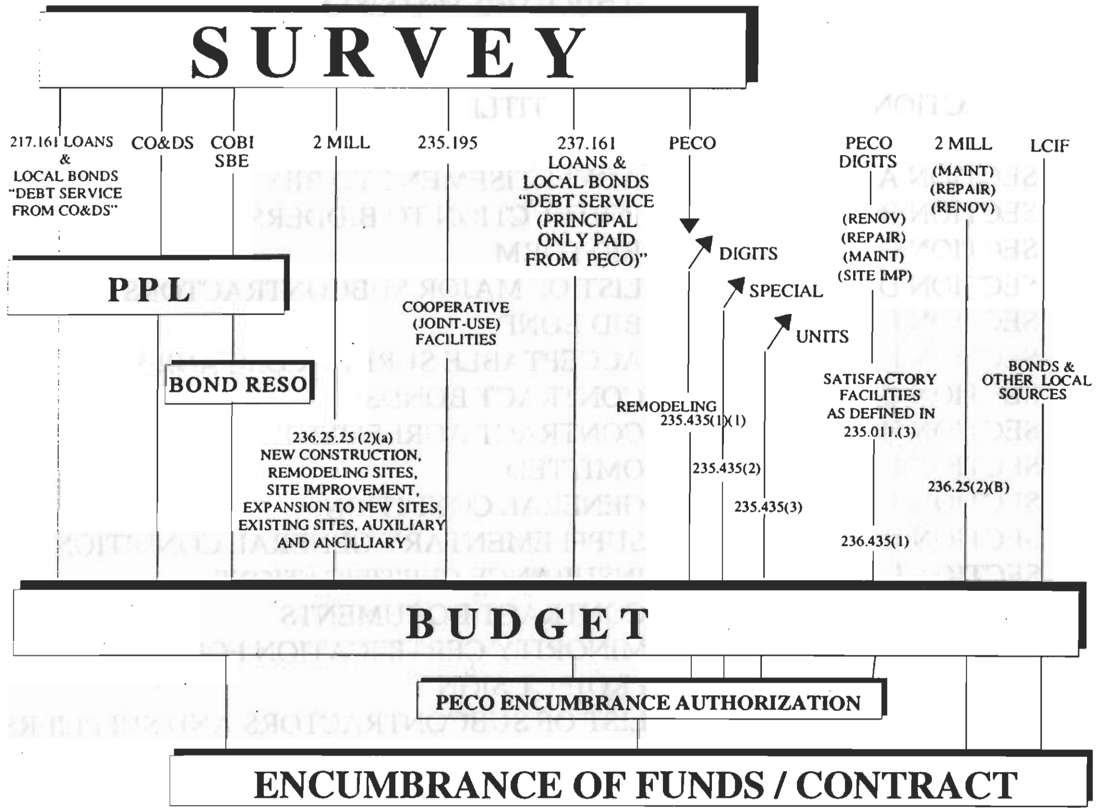
Approximately two weeks after the pre-bid meeting, the formal **Bid Opening** is scheduled to disclose the apparent low bid or alternative bids. This forum of bidders allows everyone the opportunity to personally attend. A final School Board decision may occur either during this meeting, or be delayed two or three days depending upon the contract scope and sequence containments. Bids may be rejected if all favorable conditions are not met. The School Board shall proceed to re-advertise for new bids if a contract was not granted during the Bid-Opening meeting.

THE CONSTRUCTION

However, if the School Board rules favorably, a **Pre-construction** meeting is then scheduled within the following week to discuss all important aspects of the contract. Items discussed are: Who does the work, how the work will be organized, when and where work occurs, the site layout, location of equipment and supplies, identification of all working personnel (i.e., laborers, foreman, suppliers, etc.), the certification of workers, and safety and security provisions during or after working hours. Attending this meeting are school administrators, principals, teachers, the project coordinator, the Technology Education coordinator (if the project is Technology Education), architects and engineers, the contractor and sub-contractors, and district maintenance staff. This may be held at the actual site for additions to existing facilities or for remodeling or renovation projects.

To insure proper supervision of all construction, district representatives should plan periodic meetings to observe what is being done, to review contractor reports, flow sheets of activities, and any changes that require architect or engineer review and approval. Construction **Change Orders** are an important part of any agreement between the contractor and School Board because architectural planning and cost factors are involved. After substantial completion of the proposed facility and a review of the punch list of items is completed, an inspection by a certified building inspector is scheduled. Agreements for disbursement of funds is contained within the contract or is determined by the funding source as in special State or Federal Grant proposals. After a final settlement with the contractor, the facility is then ready for occupancy.

SURVEY - FINANCE RELATIONSHIPS



CAPITAL OUTLAY FUNDING

THERE ARE TWO MAJOR SOURCES OF FUNDING:

(1) State funding sources
- [A] PECO (Public Education Capital Outlay)
- [B] CO&DS (Capital Outlay and Debt Service)
- [C] LOANS
- [D] COBI (Capital Outlay Bond Investment Fund)
- [E] SBE (State Board Education Bonds)
- [F] Lottery
- [G] Special Legislative Funds

(2) Local funding sources
- [A] 2 Mill (statutory)
- [B] LCIF (bonds, gifts, etc.)
- [C] Federal Grants

The utilization of funding sources often restricts their use. Therefore, careful planning is required to avoid violations of legal expenditures of these monies. An example is the use of state sources of funding co-mingled with local sources. In this situation, State requirements would prevail unless specific uses for each source of funding could be identified. The chart above will illustrate funding sources and their proper application.

Funding is available for a variety of construction needs. An example would be specific funding for only remodeling projects and new construction, but not renovation. It would be advisable to consult with local district finance personnel or have them contact the Commissioner of Education or the Capital Outlay Office of the Department of Education during the early stages of project planning.

PROJECT MANUAL AND CONTRACT DOCUMENTS*

TABLE OF CONTENTS

SECTION	TITLE
SECTION A	ADVERTISEMENT TO BID
SECTION B	INSTRUCTION TO BIDDERS
SECTION C	BID FORM
SECTION D	LIST OF MAJOR SUBCONTRACTORS
SECTION E	BID BOND
SECTION F	ACCEPTABLE SURETY COMPANIES
SECTION G	CONTRACT BONDS
SECTION H	CONTRACT AGREEMENT
SECTION I	OMITTED
SECTION J	GENERAL CONDITIONS
SECTION K	SUPPLEMENTARY GENERAL CONDITIONS
SECTION L	INSURANCE CERTIFICATIONS
SECTION M	CONTRACT DOCUMENTS
SECTION N	MINORITY CERTIFICATION FORM
SECTION O	PROJECT SIGN
SECTION P	LIST OF SUBCONTRACTORS AND SUPPLIERS

DIVISION	TITLE	DIVISION	TITLE
Division 1	General Requirements	Division 9	Finishes
Division 2	Sitework	Division 10	Specialties
Division 3	Concrete	Division 11	Equipment
Division 4	Masonry	Division 12	Furnishings
Division 5	Metals	Division 13	Special Construction
Division 6	Wood and Plastics	Division 14	Conveying Systems
Division 7	Thermal & Moisture Protection	Division 15	Plumbing and Mechanical
Division 8	Doors & Windows	Division 16	Electrical

*The full document has been omitted because each local school district develops its unique set of criteria.

CONSTRUCTION

THE CONSTRUCTION PHASE

During the construction phase, significant changes are uncommon and the planning committee involvement is very minimal. Changes are usually handled through a "change order" process with extra costs involved. Approval for these costs must come from District administration after consultation with the School Board. Changes that affect Technology Education should be reviewed by a Technology Education supervisor.

Renovation and certain remodeling projects are often completed during school hours. However, coordination is necessary between facilities planners and principal in order to isolate the work area from students and teachers. Any problems encountered by the school administration should be cleared through the facilities planner rather than with a contractor.

THE INSTALLATION OF FURNISHINGS AND EQUIPMENT

The installation of furniture and equipment is the final activity of facility planning and construction. Built in components may be installed under the general contract, but any installation completed by an independent sub-contractor or school personnel requires careful coordination with the project architect who is in charge. Technology Education equipment installation, testing and balancing requires a specialized type of construction, operation, and maintenance. District administration and maintenance staff must obtain warranties and operating manuals for conducting in-service staff training on all new technology components and systems.

PROCEDURES FOR DEVELOPING A TECHNOLOGY EDUCATION LABORATORY

SECTION 5

OCCUPANCY AND POST-OCCUPANCY EVALUATION

After completion and inspection for occupancy, the approved facility is occupied, equipment training begins, and students arrive. Plant maintenance personnel should become familiar with all construction materials and finishes as well as the mechanical, electrical, and electronic systems. The principal should list problems that require correction and notify the Facilities Director prior to the final contractor cost settlement. It is advisable to operate equipment and systems during their warranty period and have the maintenance personnel follow all warranty instructions.

A Post-occupancy evaluation (POE) of the facility provides valuable information regarding the adequacy of performance relative to its design elements. This evaluation from the user, designer and builder shall guide future facility planning. Further information about Post-occupancy evaluation is available from the Florida Department of Education, and is continued in this section.

POST-OCCUPANCY EVALUATION

This evaluation is divided into six parts, each of which focuses on specific objectives:

1. Define post-occupancy evaluation, and examine the reasons why post-occupancy evaluations should be conducted.
2. Identify what should be analyzed as part of the post-occupancy evaluation.
3. Determine when post-occupancy evaluations should be conducted.
4. Determine who should conduct the post-occupancy evaluation.
5. Develop a methodology and format for the post-occupancy evaluation.
6. Provide written documentation outlining the post-occupancy evaluation results.

This outline is useful as an introduction to a post-occupancy evaluation. The primary tasks in the first two steps are designed to answer three important research questions.

What is a post-occupancy evaluation?
Why do a post-occupation evaluation?
What should be analyzed in doing the post-occupancy evaluation?

The remaining four steps are procedural in nature and more related to research documentation.

WHAT IS A POST-OCCUPANCY EVALUATION?

Post-occupancy evaluation (POE) means the evaluation of a building after the Certificate of Occupancy has been issued, or in the case of educational facilities, the evaluation of a facility after the school district has taken possession and moved into the facility.

Evaluations may be conducted at any phase of planning, design, construction, and occupancy of the facility. However, this evaluation focuses exclusively on the completed facility after occupancy, and on the programs upon which the design was based.

During an evaluation process, information is gathered from users/occupants of the facility. This information is then analyzed to determine how well the facility is currently serving the purpose for which it was originally designed, and what features are successful or not successful. The evaluators then propose changes and improvements in the existing facility and future facilities.

WHEN SHOULD THE POST-OCCUPANCY EVALUATION BE CONDUCTED?

A building evaluation can be done anytime after occupancy, but typically the process of evaluation begins after users have occupied the facility long enough to become familiar with its operation and functions. Normally, the post-occupancy evaluation occurs after the first full year and, if possible, while being used. This evaluation should involve at least two on-site visits and each visit should last two or three days minimum.

WHO SHOULD CONDUCT THE POST-OCCUPANCY EVALUATION?

The post-occupancy evaluation should be conducted by those who were involved in deciding the evaluation objectives and techniques, when to evaluate, and how to fund the evaluation. The foremost decision is who shall conduct the evaluation, the local district personnel or a team from the outside.

Once the decision on staffing has been made, the question of who shall be a part of the survey becomes the most important next step in the process. Most post-occupancy experts agree that the users of the facility should be involved in this evaluation process.

THE METHODOLOGY AND FORMAT FOR A POST-OCCUPANCY EVALUATION

One effective approach is to gather data at varying times after occupancy. These data may originate from several sources:

1. Interviews with students, faculty, and staff.
2. Observation of the new facility in use.
3. Monitoring of environmental conditions including light, temperature, noise, and humidity.
4. Existing facility documents and the project history.

Preliminary Strategies for Gathering Data.

In this phase, the evaluation team begins to collect quantitative data immediately following the final inspection of the facility. This process will document and summarize the project and provide the quantitative information on the facility. This information can be obtained by a review of project files and facility documentation, and through interviews with those most familiar with the project. Key people for this interview process are district staff, project architects, contractors and suppliers.

Also, in this phase, it is important to ensure that personnel and resources are available for the evaluation.

WHAT SHOULD BE ANALYZED IN A POST-OCCUPANCY EVALUATION?

Careful consideration should be used in deciding what will be evaluated in a single project. A comprehensive evaluation is not technically possible; however, three major points should become the focal point of the post-occupancy evaluation.

1. Is the facility **economical** to operate and maintain?
2. Does the facility **function** as intended and does it help or hinder the educational program?
3. Does the facility **perform** adequately and does it provide appropriate shelter?

Educators are primarily concerned about facility economy, function, and performance. These three points are included in the Florida model for a post-occupancy evaluation. They are defined as follows:

The **Economy** (i.e., the utilization of space, time and resources.)

a. The efficient use of space, time, and resources.
b. Ease of maintenance and repair.
c. The use of appropriate materials and technology.
d. The relative quality of materials and construction.
e. The facility's response to the natural and built environment.

The **Function** (i.e., the use of space and its impact on the educational programs and the comfort, safety, and convenience of the users.)

a. Flow, orientation, accessibility and supervision of circulation.
b. The use of space standards for allocation of programmed activities.
c. The intent or actual use of the space for intended program activities and relationships, or non-program activities.
d. Comfort, safety, and convenience.
e. Fixed and movable furniture and equipment.
f. User satisfaction.

The **Performance** (i.e., the adaptable, environmental, and aesthetic quality of the facility.)

a. Imagination and innovation in design and construction.
b. The performance of the structural, mechanical, natural, and electrical building systems.
c. The quality of light, sound, temperature, and humidity controls.
d. Color, texture, space, and perceived aesthetics.
e. The social image and character of the facility.
f. Indicators such as vandalism, theft, etc.
g. Indicators of change and adaptive use of the facility.

COLLECTIVE EVALUATION DATA

The primary data collection procedure consists of two visits followed by data analysis, evaluation and conclusions. Each visit is separate; however, data from the first visit becomes useful for the second visitation team. Pre-visit preparation with district administration is essential for successful data collection and for conducting the Post-Occupancy Evaluation.

Once the evaluation team is chosen, an organizational meeting is conducted to acquaint all members on the procedures to be used and to hand out informational materials on the facility to be visited. This meeting could be held at the facility and may include local administration coordinators.

THE FIRST VISIT:

This occurs after the warranty inspection which is approximately one year after substantial completion of the facility. The data gathering team consists of the coordinator and two team members who visit the facility and collect information through a series of structured questions and conduct several tests on environmental conditions.

A. Structured questionnaires - A sample of personnel involved in the daily use of the facility (faculty, students, administrators, custodians, food service, librarians, etc.) are asked to complete a questionnaire soliciting quantitative and qualitative information about the facility. Their response provides direction for all the subsequent interviews that occur during the second visitation.

B. Site and building questionnaires - They are designed to elicit quantitative information from administrators who were involved in the planning, design, or construction of the facility. The user questionnaire is designed to elicit information from individuals involved in the daily use or who have access to qualitative information about the function and performance of the facility. Quality of performance tests are also conducted relating to economy, function, and performance of the facility.

THE SECOND VISIT:

This occurs approximately one month after the first visit. During this three to four day visit, team members will gather data through group and individual interviews in a conference setting or while walking through the facility, or from observations of the facility during occupancy.

A. Group Interviews - Homogeneous groups of three to six walk through the facility and are asked open-ended questions regarding their feelings on the facility. They may also respond to various questions of importance that were revealed in a previous response. This procedure allows the users to answer questions that were very difficult to answer in the structured questionnaire.

B. Individual Interviews - Personal interviews are conducted with chairpersons of the educational specifications committee, the architect, contractor, chief administrator of the facility, and the maintenance supervisor. These individuals have intimate knowledge of the functioning of the facility and of the design decisions that influence economy, function, and performance.

C. Observations of Facility Use - Team observations are used at various times to review issues from the previous data gathering activity. Standardized forms structure and record this data.

DATA ANALYSIS, EVALUATION RESULTS AND CONCLUSION

In the data analysis, the evaluation coordinator and team members tabulate and analyze the data after each visitation. This analysis occurs in two stages.

FIRST STAGE:

This stage begins immediately after the first visit and concludes prior to the second visitation. Its four components are content analysis, statistical analysis, comparative analysis and investigative analysis.

A. Content Analysis - The evaluators analyze the content of responses to the open-ended questions in each of the structured questionnaires and to their observation of facility use.

B. Statistical Analysis - Frequent counts of percentages are calculated for each of the closed-ended questions in the structured questionnaires.

C. Comparative Analysis - The physical monitoring data and space utilization data are compared with the results from the staff orientation, the structured questionnaires, and the observation of the facility use.

D. Investigative Issues - The results of each of the above listed data analysis techniques are reviewed to identify issues for further investigation during the second visit.

SECOND STAGE:

This stage begins immediately following the second visit. Its five components are content analysis, comparative analysis, physical monitoring, observations of facility use, and collect space utilization reports/class schedules/program changes.

A. Content Analysis - The evaluators analyze the content of the response to each open-ended question of the group interview, the personal interviews, and observations of the facility use.

B. Comparative Analysis - The results from the first evaluation visit are compared with the results from the second evaluation visit.

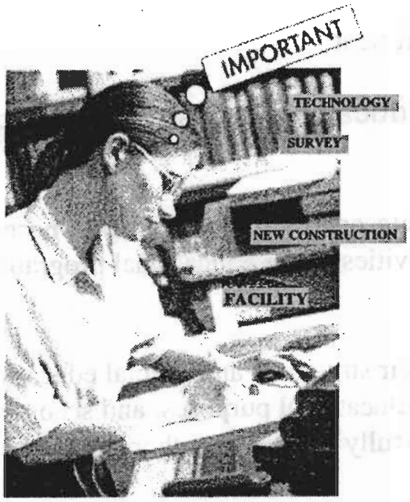
C. Physical Monitoring - Temperature, noise, light, and humidity are recorded as an objective measurement for comparison with results from other data gathering techniques.

D. Observations of Facility Use - The evaluation team observes the facility at various times to identify unusual use patterns and deviations during scheduled activities.

E. Collect Space Utilization Reports/Class Schedules/Program Changes - This documentation needs updating since completion of the Educational Specifications to be a valid reference for comparison with the results of other data gathering techniques. Standardized forms are used during both the group and individual interviews and observations. These forms also provide valuable documentation from individual team members for the final report.

EVALUATION RESULTS AND CONCLUSION

The results of each of the data analysis techniques are reviewed to formulate conclusive statements concerning economy, function, and performance. These statements are compared with the Educational Specifications to formulate a final conclusion about the economy, function, and performance of the facility.



GLOSSARY

Ancillary Plant - is comprised of the building, site and site improvements necessary to provide such facilities as vehicle maintenance, warehouses, maintenance or other administrative buildings necessary to provide support services to an educational program.

Architectural Plans - a project of future construction planned by an architect or engineer who translates an Educational Specification document into drawings and specifications.

Auxiliary Facility - the spaces located at educational plants which are not designed for student occupant stations.

Board - unless otherwise specified, a district school board. The term "Board" does not include the State Board of Education.

Capital Outlay and Debt Service - funds derived from sources authorized by Section 9(d) Article XII of the State Constitution.

Capital Project - for the purpose of S.9(a)(2), Article XII of the State Constitution, as amended, means sums of money appropriated from the Public Education Capital Outlay and Debt Service Trust Fund to the State system of public educational agencies as authorized by the Legislature.

Certificate of Occupancy - a document certifying that the facility is approved for public use. Approval is given by someone who is a certified building inspector.

Change Order - written instructions that differ from the original contract and do not conflict with the Educational Specifications.

Commissioner - the elected official who has limited statutory authority over the Florida Department of Education and has membership in the Florida Cabinet.

Completion Date - the acceptance date, when the School Board approves the work, in whole or in part.

Construction Documents - plans and specifications pertaining to particular construction projects including amendments, addenda, bidding and bid documents, field orders and change orders, all of which are part of the Contract.

Construction Project - the use of plans and specifications by a contractor to assemble materials, develop land, erect a building and/or modify an existing structure.

Department of Education (DOE) - Florida Education Department.

Division of Applied Technology, Adult & Community Education (DATACE) - a division under the Deputy Commissioner for Educational Programs.

Educational Plant - comprises the educational facilities, site and site improvements necessary to accommodate students, faculty, administrators, staff and the activities of the educational program of each plant.

Educational Facilities - the buildings and equipment, and their structures and special educational use areas that are built, installed or established to serve primarily the educational purposes, and secondarily the social and recreational purposes of the community, which may lawfully be used as authorized by the Florida Statutes and approved by Boards.

Educational Plant Survey - every five years the District School Board shall arrange for a study of all existing facilities and make recommendations for new construction, remodeling, renovation of existing facilities and programs, to develop or improve existing sites in order to meet requirements for housing the projected student population, and provide an analysis of expenditures for projected capital outlay projects.

Educational Specifications - the detailed list of programs, based on the Survey, including the space chart criteria and a detailed description of each space for constructing the proposed facility.

Facilities List - descriptive spaces and programs of an educational or ancillary facility that identifies each type of structure to house students and support services. The Facilities List best illustrates a School Board philosophy on the type of learning environment for each student and where students should be housed.

Florida Inventory of School Houses (FISH) - a descriptive list of spaces and other demographic information of each public school agency, site, facility, building and rooms. This information is housed at the Computer Center in Tallahassee, Florida. Information from each Public School District is transmitted to and stored in the Computer Center for use by State Officials and the Public School Administrators and School Boards.

Gross Square Footage - the total of net assigned square footage, plus the non-assigned square footage. (See the Educational Specification document for details.)

Instructional Space - a Survey recommended capacity bearing space used primarily for students.

Maintenance and Repair - the upkeep of educational and ancillary plants, including but not limited to roof or roofing replacement short of complete replacement of membrane or structure; repainting of interior or exterior surfaces; resurfacing of floors; repair or replacement of glass; repair of hardware, furniture, equipment, electrical and plumbing fixtures; and repair or resurfacing of parking lots, roads and walkways. Maintenance and repair shall not include renovation except for the replacement of equipment with new equipment of equal systems meeting current code requirements, providing that replacement item neither places increased demand upon utilities services or structural supports nor adversely affects the function of safety to life systems.

Net Square Footage - interior covered floor areas of a facility measured from wall to wall except for covered walkways and roofed courtyards, which measure roof outlines.

New Construction - any construction of a building or unit of a building in which the entire work is either new or a new addition connected to an existing building.

Post-Occupancy Evaluation (POE) - the evaluation of a building after it has been occupied for a specific period of time, usually a year.

Problem Solving - a formal process for arriving at the "best" solution of a problem with respect to the constraints and specifications outlined in the design brief.

Project Facilities List - all spaces to be constructed by function and area within the recommended budgeted funds and Survey recommendations.

Project - **Architect/Engineer**- responsible for the translation of specific educational requirements into drawings and specifications.

Project Manual - the document including bidding requirements, sample forms, conditions of the contract, and technical specifications.

Project Priority List (PPL) - a comprehensive list of Survey recommended construction projects approved by the Commissioner of Education.

Public Education Capital Outlay (PECO) - funds derived from State generated taxes for facilities construction.

Remodeling - the changing of existing facilities by rearrangement of spaces and their use. Includes but is not limited to the conversion of two classrooms to a science laboratory or the conversion of a closed plan arrangement to an open plan configuration, or vice versa.

Renovation - the rejuvenating or upgrading of existing facilities by installation or replacement of materials and equipment including but not limited to the interior or exterior reconditioning of facilities and spaces, replacement of air-conditioning heating or ventilating equipment, fire alarm systems, emergency lighting, electrical systems and complete roofing or roof replacement including complete replacement of the membrane structure.

Site - a space of ground being occupied or to be occupied by an educational facility or program housed within a building as part of an educational facility.

Site Development - work that must be performed on an unimproved site in order to make it usable for the desired purpose, or work incidental to any new construction to make the addition usable.

Site Improvement - work that must be performed on an existing site to improve its utilization, correct health and safety deficiencies, meet special program needs or provide additional service areas.

State Requirements for Educational Facilities (SREF) - rules and recommendations for public school facilities design.

Student Capacity - the estimated number of students to be housed at a given time based upon a percentage of utilization for each individual facility or a group of buildings.

Student Stations - the net square footage recommendation for each student by program and grade level.

Substantial Completion - the point in work completion of a project, where the architect declares the owner can occupy or use the facility for its intended purpose.

Supplemental Survey - a survey of additions to a facility, or the remodeling and renovation of existing facility at any time within the five year period should conditions appear to justify a change in the proposed building program as previously outlined in the original five year Educational Plant Survey.

Technical Specifications - a portion of contract documentation consisting of written requirements for materials, labor, equipment, construction systems, standards, and performance of contractual related services.

Technology Literacy - the possession of information on new technology, technology systems, the processes used in technological discovery, the intelligent use of current technological products, and the importance of technology to individuals and to our society.

Technology Design and Problem Solving - the formal process in problem design identification and solution clarification; developing a design brief, exploring alternative solutions, modeling, testing, evaluating and when necessary refining the solution, and final documentation.

Transdisciplinary - learning that involves various subject areas or disciplines.

Uniform Building Code (UBC) - requirements for planning and developing a public education facility.

APPENDIX VI – SOURCES OF ENVIRONMENTALLY FRIENDLY INFORMATION

The following are some of the sources of information that can be used to search and investigate to obtain ideas and information for the promotion of environmental development.

The GEO Web Sites (http://www.geonetwork.org/)

Global Environmental Options (GEO), a non-profit organisation founded in 1994, provides a gateway to on-line resources for the green design community. The GEO site features green design news and events as well as a searchable link library and Green Bookstore, which contain hundreds of resources on sustainable topics.

The Green Design Network is a resource for all those interested in building and designing a sustainable future. Featuring the Green Building Resource Center, the Network is a tool for finding products, case studies, experts, publications, regional resource directories, web links and more.

Our National Parks are facing the greatest challenges in their history. This site contains links, books and news about the Parks as well as information on the "Greening of the Parks", including projects in the Grand Canyon, Yellowstone, and elsewhere.

Coming Soon - The Green Living Center will provide simple solutions for living lightly on the earth. Here you will find room by room suggestions for your house, consumer tips, interactive forums and more.

EETIC (Energy and Environmental Technologies Information Centres) was established in 1996 to encompass three IEA (International Energy Agency) programmes:

1) CADDET (Centres for the Analysis and Dissemination of Demonstrated Energy Technologies) Energy Efficiency (http://www.caddet-ee.org/). Here you can find over 1,600 projects form around the world that demonstrate the application of energy-efficient technologies. In addition, summaries of all technical publications and the most recent newsletters are available.

2) CADDET Renewable Energy (http://www.caddet-re.org/) Here you can find Renewable Energy Register, with descriptions of around 400 renewable energy projects from around the world, and details of other publications in this field. If your work involves decisions on renewable energy projects - you can benefit from the high quality, up-to-date information available through CADDET Renewable Energy. CADDET offers you information on full-scale commercial projects that are operating in the member countries. This information is made available through four main products: A Renewable Energy Database of full-scale projects, available on-line, a

quarterly Renewable Energy Newsletter, Technical Brochure Case Studies of selected renewable energy projects, and Reports which follow up on topics of interest.

3) GREENTIE (Greenhouse Gas Technology Information Exchange) (http://www.greentie.org). Here you can find a searchable Directory of approximately 7,500 organisations offering expertise and/or products to help mitigate gas emissions. Any organisation located in a GREENTIE-sponsored country offering products or expertise in greenhouse gas reduction internationally can apply for free entry in the Directory by filling in the form available on the Internet site.

4) UNIDO (www.unido.org/) - UNIDO has the skills to help developing and transitional economies use energy more efficiently and sustainable. UNIDO's objectives are to improve efficient use of power and fuel by industry; reduce emission of greenhouses gases and pollutants; encourage the local manufacture of appropriate energy-related equipment through technology transfer and capacity-building; and increase the number of fundable industrial energy projects. UNIDO also encourages international co-operation in promoting energy conservation, efficiency, research and development, as well as in disseminating knowledge of new energy-related technologies for industry.

5) CORDIS (www.cordis.lu) - As an integral part of the European Commission's INNOVATION Programme, CORDIS provides information on a vast range of research, development and innovation activities undertaken on a European level.

6) Global System for Sustainable Development (GSSD) (http://gssd.mit.edu/)

APPENDIX VII - LIST OF INCENTIVES OFFERED BY INVESTIGATED COUNTRIES

Some example incentives to develop Cyprus' infrastructure are:

a) Incentives for the Manufacturing Sector
b) Incentives for High Technology Industries
c) Incentive for Acquiring Proprietary Rights
d) Incentives for Strategic Projects
e) Incentives for Small-Scale Companies
f) Incentives to Strengthen the Industrial Linkages Scheme
g) Incentives for the Agricultural Sector
h) Incentives for the Tourism Industry
i) Incentives for Operational Headquarters (OHQs)
j) Incentives for Research and Development
k) Incentives for Training
l) Incentives for Export
m) Incentives for Software Development
n) Incentives for Computers and Information Technology Assets
o) Incentives for Multimedia Super Network (MSN)
p) Infrastructure Allowance
q) Incentives for International Procurement Centres
r) Incentives for Promoting Cypriot Brand Names
s) Tariff Related Incentives

Some example incentives given by the governments of the countries investigated to promote development are:

a) 10-year tax holidays for new-export orientated companies
b) 2 - 10 years complete tax exemption
c) accelerated depreciation on equipment and buildings
d) fiscal incentives including investment allowances
e) grants
f) training grants on approved programs offered to employees
g) ready built factories and subsidised rent
h) soft loans
i) duty free importation of plant, machinery and all material
j) duty free importation into the EU
k) funds may be easily repatriated and foreign executives receive favourable tax treatment
l) state guarantee with investment grant
m) reinvestment allowance
n) incentives for SME's
o) no restrictions on foreign equity
p) incentives for new technology based firms

q) R&D investment tax credit
r) tax-free grants to assist in employee training
s) low cost facilities (industrial estates)
t) tax exemption for technology development reserve funds
u) direct financial grants in conjunction with national projects
v) long term, low-interest technology development funds
w) reduced prices on land and additional grants provided to construction company to construct.
x) for imports related to technology development, up to 4% of the import price can be set aside in an allowance account, and accounted for a loss
y) income tax and corporate tax will be reduced by 10% of the total technology and human resources development cost of the corresponding tax year.
z) VAT exempt for exporters

APPENDIX VIII – FRAMEWORK FOR EVALUATING THE SUITABILITY OF THE ENVIRONMENT OF A COUNTRY FOR PROMOTING TECHNOLOGY ENTREPRENURSHIP (used by Massachusetts Institute of Technology):

1. Finance
- Availability of venture capital
- Access to international markets
- Loans from commercial banks
- Funds provided by the government to hi-tech SMEs
- Corporate ventures

2. Human Capital
- Engineering graduates per annum
- Management graduates per annum
- Returnees after studying/working abroad
- Employment in source organisations

3. Regulatory Regime
- Average number of clearances required to start a company
- Average time to incorporate a company
- Average corporate taxation levels
- Years of tax holiday for a new company
- Level of corruption

4. Role of Multinationals*
- Number of multinationals
- People employed by multinationals
- Amount of money invested by multinationals
- Multinationals collaborating with local universities

*Pay attention to the "nature" of the multinational's activity (e.g. plain manufacturing Vs R&D) in the country

5. Macroeconomic conditions
- GDP/Capita
- Rate of inflation
- Exchange rate
- Average economic growth

6. Presence of Institutionalised Support Networks
- Associations/schools/Institutions promoting technology entrepreneurship
- Cluster/technology park initiatives
- Role of Industry associations
- Role of the government

7. Physical Infrastructure

- Power
- Telecom
- Transportation

8. Innovativeness of People/Industry/Country

- Patents in force per 10,000 inhabitants
- Ratio of industrial R&D to industry revenue
- Research co-operation between companies and universities
- Total expenditure on R&D as a percentage of nation's GDP

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