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CHANGES IN JORDAN'S HIGHER TECHNOLOGY SECTOR (ELECTRONICS AND COMPUTERS): IN THE LIGHT OF PEACE AND OTHER REGIONAL AND INTERNATIONAL DEVELOPMENTS*

by

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I. Introduction

A. Sectoral Background

This is a study of the "higher" technology sector in the Jordanian economy. Comprising electronics and computers (E&C), this sector in Jordan cannot really be described as "high tech" as it encompasses many relatively low technology activities, such as simple assembly of some electronic products. Nevertheless, in relation to much of the rest of the economy, this sector's technology is "higher." In addition, parts of the sector are looking to progress towards high tech and in a few cases have actually started to do so.

One of the toughest criticisms made against Jordan today is being weak in higher tech. And this problem has many facets, particularly the lag in foreign investment coming into the kingdom. Foreign investment is the tool to transfer technology and efficient productive practices thus improving quality and boosting competitiveness. But the investment climate suffers from, among other things, weak implementation of laws and their unjustified complexity. And comparisons with the Israelis leave Jordan looking poor as far as higher tech techniques are concerned.

The mid-1990s have been and continue to be a period of extraordinary challenge for Jordan. Rapid technological progress and world trade liberalization offer enormous potential for evolving a more dynamic pattern of economic growth and industrial exports; but for this to happen, new partnerships between the agents of growth in the Jordanian community are required, as well as more serious linkages with regional and international economies public and private sector organizations.

In particular, foreign direct industrial investment into the country is limited. The challenge for Jordan is to harness the opportunities provided by the system of trade and production which peace is introducing and which the eventual World Trade Organization (WTO) and European Partnership agreements, etc would further accelerate. In particular, industry, which has traditionally been a carrier of technological progress, is called upon to play its part in this process.

In industrialization, the private sector has an obviously essential role, but it cannot meet the current challenges alone. Especially at the earlier stages of industrial technology development, a more proactive part has to be played by the state. Development of the industrial sector as a whole and in particular higher technology products is among the priorities of the government, but due to the limits of internal demand this increase can only be sustained by an expansion of exports and diversification of markets. The specialized institution or organization in Jordan dealing with industrial export promotion is the Jordan Export Development and Commercial Centers Corporation (JEDCO). This organization is nominally controlled in equal parts by the Federation of Jordanian Chambers of Commerce (FJCC), the Amman Chamber of Industry (ACI), and the Ministry of Industry and Trade (MOIT). In fact, the minister of industry and trade in an ex officio capacity chairs JEDCO, and the state has the lion's share of influence within this public/private sector organization, as is the case in others in Jordan.

Otherwise, there is a certain amount of scattering of authority concerning Jordan's industrial and export policies. The Ministry of Industry and Trade is technically responsible for the overall trade regime, but other ministries, including Finance, also carry out functions which have an important bearing on the matter. On the private side, the Amman Chamber of Industry has an obvious interest in promoting manufactured exports and has been more active in the

past few years. In the computer subsector, the Jordan Computer Society (JCS) has been trying increasingly to push the interests of its members.

Divisions in Jordan over government policies are profound among various segments of the economy and between the public and private sectors as a whole. In particular, relations between industrialists and merchants continue to be strained. The arguments on both sides have been the subject of debate for some time. What is different now is that the need for change is perceived as urgent in light of major regional and international developments, including peace with Israel. The greater possibility of change is there in the context of the present, more economically oriented government, and the shorter-term factor of recession is making the tone of the economic debate strident. There has been no doubt for at least the past few months that the country is in recession and that local sales of manufactured goods in general including electronic products have suffered. This situation is being taken seriously by industrialists, with the owners of factories regularly demanding, for example, facilitation of temporary entry and other customs procedures.

Jordanian industrial products in general are not particularly competitive, except to some extent in Arab economies. And in 1990 the impact of the Gulf crisis produced a setback for Jordanian regional exports. Before the crisis, the Gulf Co-operation Council states together with Iraq accounted for the lion's share of the total exports of the country. But the E&C sector did not really figure in this due to its relative youth. However, a revival of the Iraq/GCC markets will be very important for the sector.

Today, the challenges to the sector are serious in light of major changes in the country and rapid developments in the regional and world economies. These includes peace with Israel, but also adhesion by Jordan and other regional economies to the World Trade Organization and to other international economic agreements (including the EU-Med partnership). A possible advantage that the E&C sector has in this connection is its youth. Among the newest within Jordan's industry, many firms in this sector were founded in the 1990s. (In some cases however, the actual larger business which founded the electronics or computer firm was much older.) This could possibly indicate more progressive and modern attitudes among managers unencumbered with old-fashioned ways of looking at technology, industry, and trade.

B. Scope of Work

This paper will examine

1. The Jordanian government's policy towards the E&C sector including:
a. Incentives provided: subsidies, tax and/or financial incentives, export promotion etc.
b. Government regulations governing the sector: entry barriers, licensing, trade regime etc.
c. Support institutions: marketing organizations, export centers, information network, extension and advisory services, standardization centers, design and R&D support, other facilities and support services.
d. State ownership of firms of the sector.

2. Performance of the sector and its competitiveness:
a. Major general problems.
b. Productivity in relation to labor costs, capital intensity, level of technology, technology cost, value added content, cost of raw materials and their sources.
c. Competitiveness in export markets: export performance, problems faced in export markets, value of exports as compared to production, and the position of companies in relation to major international competitors.

d. Competitiveness in the Jordanian market against local and foreign products.
e. Subcontracting with foreign firms: volume, forms and conditions of subcontracting.
f. Competitive advantage over foreign products.

3. Perception of owners and managers of firms towards the present and future impact of peace:
a. Relations with Israeli companies as perceived by firms, in terms of competitiveness, technology transfer, market outlets in Israel, co-operation and subcontracting, etc.
b. Action undertaken or to be undertaken by firms to cope with peace: restructuring of the company, specialization, better technologies, partnerships, etc.

C. Methodology

In order to collect the relevant data, a survey of twenty-one Jordanian firms in the E&C sector was made. The firms were chosen to reflect broadly the country's E&C sector, but they do not by any means constitute a random sample. Interviews were carried out with owners or managers of these enterprises. Information was also obtained from other private sector organizations as well as from mixed and government entities.

Information in general and statistics in particular are often a problem in looking at the Jordanian economy. Traditionally, firms hide important details of their work from any outsider; this even applies to public shareholding companies who are obliged to publish annual reports. In the private sector, many were unwilling to give information. In the public sector, the information available was not up to date.

D. The Electronics Subsector

Jordanian industry has recently become involved in the electronics subsector. The first factory for color TV production was established in Jordan at the onset of this decade and started its production in 1992. There are now three plants for TV production in Jordan, and in all cases technology was imported from various firms in South Korea. Recently, these factories started to add new production lines of other items such as videos, recorders, and radios. All these factories produce color TV sets of different sizes and specifications. Ownership is Jordanian without any significant shareholding from other countries. The factories mostly work one shift of eight hours a day except in special cases when a firm is committed to deliver a specific quantity in a limited period of time.

The production capacity of the three factories is a large multiple of the actual output and they are thus seeking wider marketing of their products. Production processes are alike. The factory gets the full design of the TV set from the mother company in Korea and imports the components (integrated circuits, transistors, etc.) and the boards on which the components are assembled (also from the Korean firm). Components are separated and arranged, then a worker on the production line takes a limited number of each kind to put it in specific places on a board. After the board is assembled, pieces are welded in place and the rest of the parts are put on to produce a finished set. During the production process, the quality of the set is checked in different locations by several persons and pieces of equipment, so that, after the set is fully assembled, quality should match that produced in the original factory.

These companies were established in Jordan to take advantage of the high import tariffs which the Jordanian government has imposed. In that sense their products are "competitive" by Jordanian standards because they are cheaper than imported goods. In fact these TV sets and other goods are artificially cheaper because of import tariffs. However, Jordan wants to

accede to the WTO and will thus have to reduce these and other tariffs. The other problem with these types of industries is that they are based on high capital intensity and are meant to serve large markets. This is obviously not possible internally in Jordan, so these firms will fail unless they secure substantial export sales. The prospect of the Iraqi market eventually coming back on line is particularly enticing.

In fact, Jordan has emerged as yet another stage in the game of international market strategies being played out by Korea's electronics giants. Imports from Korea have traditionally dominated the Jordanian market for television sets. In 1990, the first serious plan was made to manufacture TV sets in Jordan. Two years and a feasibility study later, TV sets were being assembled in Jordan for the first time, at the Sahab industrial estate, with Korea supplying the technology, the technical training, and ninety percent of the input components. Twenty-four thousand TVs were produced in the first year of operation alone and the locally-assembled models began to steal the market. The competition, who faced a 120% duty on the import of the finished sets, were forced to respond. They commenced assembly of TVs in January 1993. The following year, a third begin producing a range of TVs. This brought the combined annual capacity of the Jordanian plants close to 300,000 units.

If the Jordanian market is too small to attract direct Korean investment at this time, the type of relationships established do have distinct advantages for the Jordanian manufacturing sector. The Jordanian companies all view local production of Korean products as the first step on the road to establishing an independent electronics industry in Jordan. One firm is hoping to declare autonomy from its Korean partner by the year 2000. They feel that now that production has been localized the next steps are to manufacture electrical components in Jordan, and then move on into R&D. Keeping to schedule will depend in part on the penetration of export markets, but foreign orders (from among other places France, Lebanon and Kazakhstan) are slowly coming in. These firms are bullish on the issue of input substitution. They already manufacture over forty percent of their components on site. However, the problems of scale should not be played down. For example, if a Jordanian company invests half a million dollars in a new production mold and the style changes six months later, then they have a problem. In any event, partnership with a Korean firm remains a necessity for the time being and all three Jordanian companies are in the process of localizing production of other Korean-designed appliances. These include washing machines, refrigerators and microwave ovens.

Technology flow from the Far East carries a culture imperative; Jordanians have to "industrialize" the minds of mangers, foremen, and others, and this is taking time. The consumer has also been in for some surprises as the battle for retail sales spills over into advertising and customer service. The Asian 'tigers' represent a role model for Jordan's industrial sector. But there is a long way to go before Jordan emerges as the Singapore of the Middle East, and the accelerating pace of techno-industrial development will not make the task any easier.

The rest of the specialized electronics factories in Jordan are smaller that these three, or newer, or both.

E. The Computer and Software Subsector

The Jordanian computer subsector includes around 300 companies, mainly involved in the retailing of computer hardware, software, networks and peripherals. Some firms have since the 1980s been involved in Arabization processes. At the end of the eighties and with the onset of this decade, a few have been putting together packages of ready-made programs. Packages

have been developed in Jordan for financial and administrative applications (including accounting, payrolls, inventory and others) as well as word processing, engineering drawing, and comprehensive implementations such as automating hospitals, banks and industrial works. Some companies manufacture such items as screens, bilingual printers, or electrical circuits for Arabizing most printers available in the Arab markets, and for use with other applications for word and information processing.

Due to the large number of firms, low Jordanian income levels, as well as weak technical awareness, the hardware market is predominantly price-driven. This price dependency has reduced the justification for local hardware-related R&D. Nevertheless, there are a few enlightened, export-oriented companies, which have taken risks in developing hardware, in areas such as Arabization of peripherals, development and Arabization of military MIS and communication devices, and development of hardware based communication protocol converters. The few successful attempts at hardware manufacture have been in fairly specialized areas. This is because for generic computer hardware, only mass production makes economic sense. Where adequate economies of scale cannot be achieved, a strategy of targeting niche markets could be successful. The challenge is for Jordanians to identify and exploit more such niches in the future.

The Jordanian software market is also fragmented and highly competitive. Its fragmentation is primarily attributed to low entry barriers. Firms, at the very basic level, need only programming skills and some hardware. The large number of competitors, coupled with the low technical awareness of the general public, has made the Jordanian software market a price-driven one as well. The situation was further exacerbated in the past by the majority of firms focusing on providing customers with a limited set of applications in traditional areas such as accounting, personnel management, etc. Nonetheless, there are indications that buyers are becoming more technically well-informed with respect to information technology. Similarly, as public awareness increases further, price competition will become less important, and the basis of competition will gradually shift to quality and customer service.

Jordanian companies are involved in software development for Arab countries. These items have been well received because what is produced is often not merely an Arabic version of a Western package, but is adapted to mimic practices used in the Arab world. Firms working along these lines can help in technology transfer and even in developing indigenous R&D capability. On the other hand, a number of software firms appear to be in imminent danger of upcoming international trade agreements. Already vying for a niche in their respective markets, the firms must compete with more advanced international companies.

Jordanian software development skills are currently both good and inexpensive. In recent years, there has been a move away from traditional coding, as more programmers with object-oriented programming skills have entered the market. There has been good development work in creating various types of Arabized MIS and office automation software. There are also many cases in which Jordanian programmers have developed specialized software, such as AutoCAD tools and multimedia applications for education, in addition to attempts at developing artificial intelligence applications. The combination of high skills and low cost can serve as a considerable competitive advantage for Jordan. In many cases, locally-developed custom software is substantially cheaper than Western off-the-shelf application software. Such a situation can serve as an adequate base to build on and create a more robust software industry, in which advanced applications can be developed.

Agents in Jordan for leading world suppliers of high performance visual computing systems are trying to offer solutions in the areas of data base servers, Geographic Information

Systems, visual simulation, film and video, defense and research in the fields of chemistry, medicine and publishing. The chance of these to witness application in Jordan is currently small, but as the country begins to emerge as a service center in the area, it is believed that the scope for regional work, in the field of advertising for example, will increase substantially.

For information technology to start playing a significant role in a developing country like Jordan, several pre-requisites are necessary. These include a well-developed telecommunications infrastructure; and a technically educated and cultured society.

Jordan's telecommunications system has been developed by a government monopoly, the Telecommunications Corporation (TCC). While the telephone network witnessed substantial improvement in the past two decades, little interest has been directed at developing the telecommunications infrastructure necessary for modern information-based economies. Under these conditions, information businesses in Jordan have thus far been restricted. On the other hand, the neglect of the need to set-up data and multimedia-oriented infrastructure has delayed the development of indigenous information businesses. The Jordanian government is aware of the problems caused by delays in upgrading the telecommunications infrastructure. Due to a belated realization that an advanced telecommunications network is an integral part of a healthy and competitive information technology sector, efforts are now proceeding to privatize the TCC. As a first step, licenses have been issued to private paging and cellular telephone operators. Currently, the TCC is being molded into an institution which will be responsible only for providing basic services (telephone, fax, telex) and for creating necessary infrastructure. Other services such as data bank access, the internet and all future information services are going to be left to the private sector. As time passes, and as these private operators and the TCC learn to live with and trust each other, some believe there will be further private sector investment in telecommunications in Jordan. The telecommunication industry is increasingly becoming the domain of the private sector around the world, and Jordan is no exception. As an example, there are already several Jordanian companies and institutions which are working around Jordan's infrastructure to provide additional financial information services, as well as data base and internet access. At the same time, little effort has been made in the manufacturing of telecommunication-related hardware in Jordan. This has been primarily due to security restrictions imposed by the military in the past, as well as the lack of a stronger local information technology industry. As a result, the development of an indigenous telecommunication hardware industry has been delayed. However, with the recent entry of private players into the telecommunications market, and the current proliferation of new technologies, such as satellite communications, some expect that more local effort will be exerted and more investment funds will be channeled into this field.

Jordan's educational system produces qualified personnel in the field of computer science. Their relatively low salaries compared with the West or the Gulf have helped Jordan focus on software production, and not only for the Arab World. India's experience in this field is seen as partly applicable to Jordan. Jordanian universities grant BScs in Electrical Engineering (with specializations in telecommunications, electronics, or computers) or in Computer Science to hundreds of graduates every year. These have on the whole proved themselves to be well-qualified and have succeeded in the Jordanian and other Arab labor markets, before or after continuing their higher education. But measures are needed to improve the educational system so that graduates will be more productive, and encouraged to think creatively. The university in many countries is a real center for R&D, but not in Jordan. (Spending on R&D in Israel amounts to 2.4% of national income, exceeding each of France, Britain and Korea in this area, let alone Jordan.)

The lack of guarantee of intellectual property rights (IPR) is proving to be an obstacle to the development of the Jordanian computer industry. Jordan unfortunately lacks serious enforcement of copyright laws, and this has so far reduced the possibility of serious software development in the country. But the kingdom has recently committed itself to WTO membership. There is, therefore, a near-term requirement that the Jordanian market start abiding by copyright law. Respect for intellectual property rights will allow better prices to be charged for intellectual work and creativity. In the process, Jordanian software developers will be forced to pool resources and integrate their efforts, while less serious players are expected to drop out of the market.

Intellectual property issues are becoming serious in the computer subsector. Many firms are now aware of the new initiatives contemplated by the Jordanian government concerning copyrights, patents, and trademarks, and how the implementation of these initiatives will improve business. IPR is an issue that is being stressed by, among others, the JCS . The Society has helped raise the question of how the kingdom's computer industry stands to gain from implementing intellectual property rights, and has participated in a national debate on IPR. The JCS sees many advantages for Jordan's computer industry from increased intellectual property protection, including the chance to:

1. Create economic incentive to produce local software applications or hardware for use in Jordan and elsewhere.
2. Obtain international protection for Jordanian software and hardware in all Berne Convention countries.
3. Provide access to more advanced software from outside Jordan and obtain necessary support for upgrades.
4. Create jobs in the Jordanian computer services industry as increased foreign investment brought about by additional international confidence in the Jordanian IPR system creates a demand for additional programmers and operators.
5. Provide greater access to high technology information systems, such as e-mail, Internet, multimedia, etc. as confidence is increased in the Jordanian IPR regime which could protect these systems.
6. Facilitate joint ventures or other partnerships with foreign firms to jointly develop advanced technology including local production of chips.
7. Create compatibility between Jordanian produced projects and products produced in other countries.
8. Generate additional consumer demand for software as higher quality products become available.
9. Create greater respect for the computer industry as consumers, government and the private sector realize that there is more to the industry than illegally copied software. This will become even more important as a new copyright law is enforced.

II. Survey Results

A. Ownership Structure

All firms were private sector organizations. Of the twenty-one, there were ten private corporations, nine partnerships, and two public shareholding companies.

B. Level of Activity

Nineteen of the companies are in the production stage, while one is being established and one is stagnant.

C. Capital Investment

This information was omitted by four companies. The value of capital investment for the rest per firm ranged between JD12,000 and JD 22,000,000, averaging JD2.7 million.

D. Personnel

This information was omitted by two companies. The number of staff in each firm ranged between 3 and 412, averaging 70.

E. Main Items Sold

The items the surveyed companies produce include telephones, answering machines, security systems, elevator controllers (with and without speed control), distribution boards, control panels, banking, insurance, and imaging systems, software systems, multimedia equipment, ERP (Enterprise Resource Planning) packages, CIM (Computer Integrated Manufacturing) products, air conditioning controls, computer cases, PCBs (Printed Circuit Boards), printers, terminals, Arabization boxes, televisions, videos, microwaves, electrical panels, controls for washing machines and refrigerators, audio equipment, personal computers, PLCs (Programmable Logic Controllers) and computer training.

F. State Policy towards the sector

1. Incentives

The response to the question on whether there were any incentives provided by the government to the industry was mainly negative, and many companies even went so far as to say that the state was actually hurting their business. Questions about country policy towards the sector revealed that the overwhelming majority of the companies are not given incentives by the government. No firms receive any subsidies or financial incentives, and only two received tax breaks (in the form of exemption of exports from Income Tax) and help with export promotion. All of the companies said that there are no trade quotas or non-tariff barriers like qualitative restrictions governing the imported goods competing against them. Eighteen of the companies stated that there are tariffs on imports of similar products.

The abolition of income tax on exports in 1994 was important to some businesses. The result of this is that some companies have or intend to increase their production and investment for export.

A large majority of the companies reported that there were no institutions supporting the sector. Of the five who are helped by marketing organizations, two were assisted by public entities three by private firms. Six companies were supported by exports centers; five of these depended on JEDCO and one on a private company. Private information networks supported two companies. Only one company claimed that it was assisted by firms providing advisory services and design and R&D support, all private.

Firms made the usual complaints about the general difficulties in dealing with Jordanian government departments.

Procurement policy by state organs was not a serious complaint, with the Jordanian government giving local purchases an edge over foreign articles.

2. Licensing

Government regulations concerning the sector required sixteen of the companies surveyed to get a particular license. Businesses were however largely unaware of the elimination of the requirement for "no objections" certificates from ministries as a step which could improve the process of registration with the MOIT.

3. Trade restrictions

Regarding trade restrictions such as quotas, or non-tariff barriers such as qualitative restrictions, firms complained that they suffered from some of these problems when exporting, but could not count on the Jordanian government's imposition of restrictions to help local companies compete against imported goods. ISO 9000 is increasingly hampering some exporters' activities; it and other non-tariff barriers (impinging on quality) were seen as a problem by some exporters.

4. Customs

Only one company said that it does not have to deal with customs. Some of the rest noted that average time for customs clearance of goods has decreased over the past two years, while others remarked that the quantity of required customs documentation per shipment has not decreased, but the number of required signatures has decreased. Companies however were generally not aware of imminent or actual changes in Jordanian Customs regulations (e.g. proposed changes in the law requiring rationalization of the customs fines system, the development of an import/export guidebook by the Customs Department, and the new regulation allowing importers not to declare detailed intended use of goods upon importation).

5. Institutions Supporting the Industry

The general feeling among firms regarding support institutions such as JEDCO was mainly lukewarm, though some found it useful. The country's Royal Scientific Society on the other hand was not even recognized by most companies as trying to play a significant role in Jordan's higher technology.

For the computer subsector, the JCS was considered useful. Its meetings were felt to have some -- though limited -- impact, but the government was "not listening" to problems faced the computer subsector in particular. On another level, it was admitted that the JCS were trying to improve the situation by helping to organize an annual technology exhibition in Amman, but the impact of such an effort was limited. The society is also organizing symposia and meetings of firms in the subsector, but the overall usefulness of this support was questioned.

Nevertheless, most firms worked on their own go to foreign exhibitions and have their own network of marketing and distribution. There was in the opinion of most firms no serious attempt to inform Jordanian firms about trade agreements and other aspects of international relations which might impinge on Jordan's business.

Services of marketing organizations, export centers, and information networks, as well as advisory, design and R&D support were all provided by private organizations such as chambers of commerce. However, these services were not significant and their impact is seen as limited. Some efforts have been undertaken by the Jordan Computer Society but the results

are still very modest and do not involve strategic decisions and actions to promote and sustain the whole industry; in general, it was only private publications and magazines which gave information on the industry situation as a whole or on specific Jordanian companies. These publications are usually distributed in the Middle East, and do not reach markets or potential customers elsewhere.

On the whole, firms complained that there were no serious attempt to create institutions aimed at supporting this industry. The ACI tries to solve some problems connected to the Jordanian government (such as customs duties, power costs), but the impact of such actions is very limited, partly because the Jordanian merchants' lobby is very influential.

The country's revamped Investment Promotion Corporation (IPC) is viewed favorably my some firms. Although most have never visited the IPC nor received any of its services, companies rates the services of the IPC as potentially important. Locating an overseas partner is seen as a significant service provided by the IPC. The 1995 investment law's increased range of incentives is important to some in the higher technology business in Jordan. The customs and exemptions under this law are potentially very important to their business, as are the law's provisions for tax exemption.

G. Performance of the E&C Sector and Its Competitiveness

1. Problems faced by the sector

Firms were asked to rank problems constraining production as "very serious," "serious" "moderate," "of little importance," or "unimportant." The order in which problems are listed below reflects their overall seriousness, with limited demand as the greatest problem and labor laws/social costs as the least for the sector as a whole.

a. Limited market demand was seen as the major headache. No firm dismissed this issue as unimportant, and only four saw it as of little importance. Seven firms considered it to be moderate, and three serious. Seven companies put it down as a very serious problem.

b. Customs duties was the second biggest issue overall for the sector: six firms saw it as a very serious problem, five as serious, seven as moderate, none as of little importance, and three as unimportant. Customs formalities and extra costs relating to bribes were seen as a problem. A manufacturer complained about lack of customs protection because his output is considered a raw material for the other producers and imports competing against him pay relatively low customs. Other manufacturers noted that customs duties gave Jordanian industry only a small measure of protection.

c. Local Competition ranked third as an overall issue. This was a very serious problem for five firms, serious for none, moderate for ten, and of little importance for four. Only two firms considered this issue as unimportant.

d. Foreign Competition was seen as a very serious problem by three firms, with six others feeling it was serious, five as moderate, three as of little importance, and four companies dismissing it as unimportant.

f. Availability of skilled labor was seen as a very serious problem by three firms. Five companies considered this issue to be serious, four moderate, four of little importance, and five firms unimportant. No serious technical assistance to the subsector is being provided by the state or others. In order to improve production, some firms have undertaken in-house

training at their own expense; firms noted that it was especially difficult to find qualified people on the technical and managerial levels.

g. Access to finance was a very serious problem for four firms. Eight others considered it to be serious, three to be moderate, three to be less important, and two unimportant. The need for medium- and long-term financing was noted.

h. Transport/Port services was a very serious problem for no firms. One saw it as serious, six as moderate, seven as less important, and seven as unimportant.

i. Access to material inputs were a very serious problem for only two firms. Eight firms saw customs as a serious problem, three as moderate, three as of little importance, and four as unimportant. Customs duties on similar products were seen as too low. In particular, duties were low compared to neighboring countries where the government protects the industry by adequate customs. On the other hand, some firms complained of high customs duties on imported raw materials. Temporary entry for raw materials was a possible way around paying customs duties, but there were complaints about temporary entry being subject to too many procedures and controls. Some firms thus preferred to pay duties rather than resorting to temporary entry which practically turns out to be more expensive than duties.

j. Utilities (power, water, telecoms etc) was seen by only two firms as a very serious problem. Two others saw it as serious, two as moderate, three as less important and eleven as unimportant.

k. Labor laws-social costs was the least important problem for the largest number of firms (ten). No firms saw it as a very serious problem, only one as serious, one moderate, and nine as of little importance.

2. Productivity

a. Technology Of the companies surveyed, nine imported their technology and know-how, eight of them obtained it locally, and four tapped both domestic and foreign sources for technology. The countries from which the technology and know-how were imported included Singapore, Italy, US, Japan, and Korea. Thirteen of the companies invested in machinery, ten of them in new, one in used and one in both new and used machinery. Seven refrained from answering the question, while only one has not invested in machinery lately. While eight companies either did not give the age of their machinery or the question was inapplicable to them, the average age of machinery was 7.5 years. Many companies acquired their equipment from Taiwan, Korea, Japan, US, and Germany. Other countries included Spain, Switzerland, Turkey, Malaysia, UK, and Italy.

b. Material inputs Most companies imported their major imports (twelve), while three companies used locally produced inputs. Four companies obtain their inputs from abroad and the local market, and two did not answer the question. Companies imported inputs from Malaysia, Germany, France, Spain, Belgium, UK, US, Korea, and Italy, with the last three countries most important. The companies appear to have similar experiences concerning imports. Sixteen of them do not find imports difficult to obtain, four have difficulty and one did not answer. Only one company said that it does not pay any customs duties on imported inputs. The majority of companies imported their major inputs (twelve), while three companies used locally produced inputs. Four companies obtain their inputs both from abroad and the local market, and two did not answer the question. Companies imported their

inputs from Malaysia, Germany, France, Spain, Belgium, UK, US, Korea, and Italy, with the last three countries most important.

c. Machinery Thirteen of the companies have invested lately in machinery, eleven of them in new machinery, one in used items, and one in both new and used machinery. Seven refrained from answering the question, while only one has not invested in machinery lately.
The age of machinery averaged seven years, ranging from machinery acquired within the past year to eighteen years ago. Seven firms failed to answer the question.

In answer to the question concerning which country the new equipment came from, Japan, the US, South Korea, and Germany were main suppliers, while Spain, Switzerland, Taiwan, the UK, Turkey, and Malaysia were less important.

On average, the companies are producing at 46% of plant capacity.

3. Competitiveness in export markets

On the whole, the export market does not appear to be thriving for the electronic industry. Of the companies surveyed, thirteen export. The percentage of total production being exported was 20-60 %, with the average at 43%. The percentage of exports to Arab countries was 5-100%, with the average at 83% (leaving exports to non-Arab countries at 0-95%, with an average of 17%). Export markets were established by participation in fairs abroad, visits by foreign missions, and independent missions. Seven companies established export markets by participation in fairs abroad; three by foreign trade mission visits; and ten by independent initiative. (These figures add up to more than the "thirteen" exporters due to the use of more than one method by individual companies in the establishment of export markets.)

Export markets were established and maintained in a variety of ways that showed the strength of the international network of the Jordanian private sector. The Gulf war does not appear to have weakened these connections. More conventional methods of export marketing by participation in fairs abroad were cited by firms and visits to Jordan by foreign trade missions by others. "Independent initiative" meant mainly going through Jordanian living in Europe, Arab countries, the US and elsewhere who acted as intermediaries. The surveyed exporting firms typically had sister companies, offices, agents and/or other intermediaries in places abroad, particularly the US. These tended to be in charge of marketing but sometimes performed other tasks. The Arab network of Jordan was also important, though it tended to rely more on visits to by independent Arab businessmen.

The main export items included air conditioners, PLCs, elevator control mechanisms, HMS, TLS, TVs and audio products, software packages and electrical accessories.

Firms which were not exporting cited several reasons for this. One firm working with South Korea mentioned that it was the Korean's policy not to export goods co-operatively produced in Jordan. One firm mentioned that it was still working to get ISO certification before exporting. Weaknesses in marketing, uncompetitive prices, lack of finance, and international standards of products (software in particular) being different from Jordanian output were also cited as causes for lack of exports.

Major competitors in export markets were mainly Arab products as well as those from such regional economies as Cyprus and Turkey.

4. Competitiveness in local markets

Sixteen companies compete with foreign or locally produced products; the other five did not answer.

Foreign products (as opposed to local ones) were seen as competing with those of eleven respondents. Two of these also replied that their competitors were also local goods, and two more agreed with this to a lesser extent. Italian and French products were specifically cited.

Estimated share of the market for local products was in the range 5-100%, averaging 48%. Total market share ranged from one to eighty percent, averaging fourteen percent, with Taiwanese and Italian competing goods specifically cited. Several firms had no clear idea concerning this.

5. Subcontracting

Of the seventeen companies who answered the question on subcontracting, only five are subcontractors to foreign firms. The average percentage of output subcontracted was 41%. The subcontractors deal with the US, Germany, Italy, the Far East, and Dubai.

Outsourcing more technologically oriented products was seen by some as one direction in the subcontracting chain. It was generally thought that cooperation and subcontracting will involve the Gulf countries, Egypt, Iraq, Jordan, Israel, and Syria.

6. Competitive advantage

The advantages of Jordanian firms compared to foreign ones were seen as mainly centering around lower cost, particularly that of skilled labor which was involved in production, repair, maintenance, training, and technical back up and support. This made Jordanian exports cheaper to produce and hence allowed them to compete more effectively with foreign products.

H. Impact of the Peace Process and Other Changes

1. Eventual Accession to the WTO

The impact of the WTO agreement on business was seen as neutral by six firms, while five think it will have negative effects. Those expecting a negative impact fear fiercer competition, the closing of new markets, copyright requirements, and dumping.

2. Eventual Euro-Jordanian Partnership

There was almost an identical response to the question about the impact of the Euro-Jordanian partnership agreement, which eliminates tariffs between Jordan and the EU by the year 2010. Again, six firms foresee no effect, and five foresee a negative one. Two companies expect to reap benefits from the partnership agreement. Many companies are concerned with the greater competition they will face under the agreement. In addition to reducing Jordanian production, one firms claims it will put "obstacles in the face of Jordanian exports" like requiring quality certificates. A supporter of the agreement explains that it will reduce company costs and improve their competitiveness.

3. Peace with Israel

Asked about the impact the peace process will have on business, many firms omitted some, several, or all of the questions. While many firms opted not to answer, five claim that there has been no effect on business thus far; four claim peace with Israel is having a negative impact; and two say they are experiencing or anticipate a positive impact. Israel's robust market is viewed with optimism and pessimism. Those who would say the glass is half-full look forward to having a wider and greater market to tap. Those who see a half-empty glass deem Israel's abundance of capital and investment potential dangerous. One firm view peace with Israel as a means to export more easily to the West Bank. Many noted the obstacles placed by Israel on Jordanian exports. Other firms remarked that Israelis have a lot of investment in software, and that this is "very dangerous" for Jordan.

4. Countries in the region which will affect the Jordanian E&C sector

Questions about which countries in the region will affect the Jordanian market indicated that most regional states will be influential in the local economy. Saudi Arabia, Turkey, Syria, Israel, Cyprus, Egypt, Iraq, and the United Arab Emirates were the countries thought to have the strongest impact the market in terms of competitiveness. The transfer of technology will be affected by UAE, Israel, Cyprus, Turkey, and Egypt. The companies anticipate new markets to open in the Gulf countries, Iraq, Syria, Jordan, Israel, and Palestine. The Israeli market appears to have the most potential impact on the Jordanian market.

5. Actions that are and will be undertaken in light of peace

Asked about such moves as restructuring of the company, specialization, better technologies, new products and processes, and partnerships with other countries firms tended to be pessimistic or even cynical. Many firms omitted some, several, or all of the questions.

When asked what actions are and/or will be undertaken to cope with the peace situation, most companies did not answer. Of the six which did respond, a third claimed that, on the individual level, they were doing well and did not expect to make any adjustments. The other four firms cited the need to introduce new technologies and new products. In addition to those two actions, one firm expects to take many measures to cope with the situation, such as specialization and processes partnerships.

On the level of the sector as a whole, some firms advocated that the FJCC lobby the government more strongly and effectively.

On the national level, the companies foresee that quite a bit of action will be undertaken to cope with the peace situation, including economic restructuring of the company; specialization; better technologies; new products; partnerships with other countries; and new business strategies.

6. Possible government action

Most of the companies vociferous in explaining how the government could make the E&C sector more competitive. Firms felt that the Jordanian government could make the sector more competitive in a variety of ways. Almost every company wants the government to stop interfering with the industry. They object to the sales tax. They call for the reduction of customs duties on imported inputs; elimination of excessive bureaucracy in government departments; the enforcement of intellectual property rights; the promotion of Jordan as an

exporter of technology; the establishment of a body of 'quality and standards for technology;' aid to participate in international trade shows; and assistance in specialty training. Provision of data bases and support in marketing regional exports were also called for.

III. Conclusion

The electronics and computer sector is rapidly becoming more important to Jordan's economy as well as to society as a whole, but a vision for the country's higher technology which includes serious planning and a clear strategy is lacking. As can be seen from the survey, and as further confirmed by conversations in and elsewhere with others involved in the Jordanian sector, Jordan's government policy, such as it is, is seen as ineffective. Incentive measures provided (such as subsidies, tax and financial incentives, and export promotion) are seen as inadequate. state support institutions such as marketing organizations, export centers, information networks, extension and advisory services, standardization centers, and the provision of design and R&D help are viewed by firms as non-existent or at best grossly inadequate.

On the other hand, the performance of the private sector and its competitiveness leave a lot to be desired. For purposes of serious regional and international competition, Jordan's electronics sector productivity (as gauged by labor costs, capital intensity, and level of technology) tends to be low, output is small, and long-term financial capital is scarce. Expenditure on R&D by is severely limited due to the absence of long-term planning. These elements are obviously not entirely under the control of the private sector to deal with them as they wish, but the weaknesses in Jordan's higher technology are anyway clear.

Major problems to do with the aftermath of the Gulf crisis are still nagging industry in Jordan. Meanwhile, a recession which started last year threatens to become deeper, exacerbating structural problems. Productivity is inadequate. Competitiveness is threatened, and various problems are being faced by Jordanian firms in regional and other export markets. Competitiveness in local market with regard to imported foreign products is also problematic. Subcontracting is seen as a way out by some firms, but this process is still in its early stages. The private sector under these circumstances is calling upon the state to do something. Some of the industry's demands are reasonable and legitimate, but others smack of mercantilism.

Perception of managers of firms of the impact of peace are dim and vague.
Relations with Israeli companies are seen by very few managers in terms of competitiveness, technology transfer, market outlets in Israel, specialization of the company, co-operation and subcontracting. Action undertaken or to be undertaken by the managers to cope with the peace situation, including restructuring of the company, specialization, better technologies, partnerships, are scant.

That the state should be called upon to do something under these circumstances is normal. But what? Higher tariffs are out of the question, but the emergence of an economic order based on the WTO will mean that Jordan's sector, given its present attitudes, may have a tough time adjusting to a plethora of new rules.

Standards and specifications are still not a subject of serious attention in the higher tech sector in Jordan. This will become a major problem as standards such as ISO 9000 are being applied in other countries, particularly Israel.

Jordan cannot afford to neglect the higher technology sector of its economy. Since Jordan has limited natural resources and significant human resources, economic prosperity will to a great

extent depend on the ability to develop specialized, high value-added industries, to maximize the benefits of its investment in the education of its people. Few, if any, economic sectors offer the high value-added content of information technology. To achieve such an objective, focus should be placed on removing barriers to information technology development. This includes ending the telecommunications monopoly (which is already happening), and the quick introduction and enforcement of copyright laws (which is in the process of happening). At the same time, Jordanian companies should begin in earnest to seek joint ventures in the field of specialized hardware manufacturing. More important, the software industry should focus on establishing R&D joint ventures, as well as marketing arrangements with organizations that have a worldwide reach. Only by expanding the market, and integrating the country with the rest of the outside world can an advanced technology sector be developed in Jordan.

Merging and integrating existing industries may be a necessity at the local level; and trying to merge at the Arab level is possible too. For example, the production capacity of only one of the three TV factories which exist in Jordan is more than Jordan's need of this commodity. Integrating makes it possible for producers to benefit from research, production and marketing possibilities available to them. Increased production capacity as a result of merger will decrease the unit cost of products.

Industrial integration between Arab countries is a necessity in order to produce components and parts in the field of electronics; and the agreement between investors on the imperative ways to achieve it. In the light of global changes and economic integration, this has become a pressing necessity.

On the other hand, working with the Israelis is also emerging as an option. This choice is being encouraged by the TRIDE scheme, a trilateral Israel/US/Jordan project which seeks to encourage joint ventures among firms from the three countries. Funding for TRIDE comes from one million dollars contributed in equal shares by each of the three states and, eventually, repayment income from companies participating in successful TRIDE-funded projects. TRIDE supports US-Israeli-Jordanian company partnerships dedicated to developing and commercializing non-defense-related innovative products or processes, though not necessarily exclusively in the E&C sector. Funds are paid directly to the participating companies.

TRIDE actively recruits potential strategic partners from the US and introduces them to target Israeli and Jordanian corporations. The companies meet and independently agree on a financial, legal and operating framework. In other instances, companies that have already decided to co-operate contact TRIDE directly. Target Israeli and Jordanian companies will have competitively priced technological and production expertise in the field in which the US firm has a relative market advantage. The Israeli and Jordanian partners must be willing to be guided by and/or cooperate with a US partner in the process of product development and commercialization, and may also have access to European and Asian markets.

TRIDE funds fifty percent of the companies' expenses in developing a product to the stage of commercial readiness. Such funding, which is off-balance sheet, is provided in the form of a conditional grant, which does not entitle TRIDE to equity or intellectual rights. If the project is a commercial success, TRIDE receives repayments from the recipient of up to a maximum of 150% of the funding. Companies not realizing commercial benefits from the project are not under any obligation to repay TRIDE. The Jordan Technology Group (JTG) acts as the Jordanian technical consultant to TRIDE. JTG screens project proposals and the companies behind them before advising the IPC which takes the decision on whether to allow the project to be presented to TRIDE for funding.

So far, three TRIDE projects have been approved. The first brings together a US company with the Israeli firm Shnud and the Jordanian firm Sedco to create a document management system in Arabic which uses optical character recognition to deal with malleable texts. The second involves the Jordanian firm Computer and Communication Systems with the Israeli company Edusoft and a US firm to Arabize educational multi-media educational material, including technical and vocational items. The third links up the Jordanian company CEB with the US and Israeli segments of Motorola to create an Arabic language-based browser software.

TRIDE appears to have suffered from an excessive "veto" by the Israeli side which appears to want to monopolize certain technologies and projects, instead of co-operating with Jordanians. This is probably not surprising, and it goes without saying that Jordan and Israel have a lot of distance between them in terms of business culture and entrepreneurship, not to mention political differences. These factors will act to slow down work with Israel , which admittedly could have a lot to offer Jordan in the E&C sector. In any case, the Jordanian potential in E&C seems to be there, The question now is how skillfully Jordanians use their modest but interesting resources in this sector to make it more dynamic and progressive.

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Statistical Appendix

Table 1: Major Electronics Subsector Indicators

Total firms	3
Total workforce	435
Output (JD)	12,465,000
Intermediate goods (JD)	6,034,000
Value added (JD)	5,217,000
Gross fixed capital formation (JD)	0
Average workforce per firm	145
Average output per firm (JD)	4,153,000
Gross output per employee (JD)	28,721
Value added as a percentage of output	41.9%
Average investment per firm (JD)	
Total salary charges (JD)	860,000

Table 2: Cost of Raw Materials and Services (in thousands of JD)

Total	1,214
Communications	11
Rent of buildings and equipment	26
Bank services	124
Cleaning & waste disposal	6
Travel expenses	20
Advertising & publicity	117
Accounting & legal fees	8
Other	775

* JD0.71 = JD1

Source: state Industrial Survey, 1994 (latest edition)