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Towards a Viable Computer Industry in Developing Nations: The West Bank Case

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1 Introduction:

The scarcity of natural resources and the prevailing political conditions place severe restrictions on the economic development of the West Bank. On the other hand, certain characteristics of the West Bank economy such as the abundant and steadily increasing supply of highly educated technical workers make the creation of industries with substantial requirements in skilled human labor an attractive area of development to face future challenges in the field of employment. Examples are high tech industries in general, and information-technology-based industries in particular. The latter include hardware and software development, computer controlled machinery, design of computer-based instructional materials, electronic publishing and data collection and distribution. However, in addition to the political situation, the insufficient infrastructure, limitations on funding opportunities, inadequate planning and the state of the existing economic structures have unfavorable influence on this line of development.

In this paper we investigate the possibilities of establishing viable information-technology-based industries in the West Bank. We discuss the factors favoring and those limiting this path. We outline the types of industries that can be most appropriate for the local conditions and point to the effects of possible changes in the environment on the paths of development of these industries.

We also offer suggestions to help create a more stimulating atmosphere for the development of such industries and point to the costs involved.

The material presented here is based on the author's watch of the information technology market in the West Bank and on the study of the experiments of other nations in this field.

2 The Status of Information Technology in the West Bank:

Computerization started at a fairly late stage in the West Bank, even as compared with other developing nations. The first computers appeared in the mid seventies. The first decade was of computerization characterized by the slow pace of computer introduction and the dominance of larger installations. However, towards the mid eighties the process of computer introduction into the local market accelerated. The number of installations increased rapidly. Computers entered many new enterprises, and later homes, and more activities were computerized. The personal computer became the major hardware in use. Computer science departments and programs started appearing in local educational institutions. A large number of local software houses, hardware distributors, and computer maintenance and service centers came into existence. The number of people joining

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computer science programs and computer literacy classes increased rapidly and steadily. Graduates in computer-related disciplines found it easier to land jobs in a generally tight job market. These trends persisted despite the unfavorable political circumstances.

The process of computerization was not well-planned. Computer usage is almost limited to the service sector or the service departments of enterprises. Computerization decisions were often based on prestige-related considerations rather than on sound economic and performance grounds. The economic impact of computers was not studied within individual enterprises and the hidden costs of training, software acquisition and future maintenance were often ignored. The nonuniform distribution of computer companies and the unfair trade and promotion practices created difficulties to all participants of the computerization process[1, 12].

It is worth noting that while the local markets for information technology products are limited, the West Bank shares the same language and culture with a relatively large market for these products in the Arab World[7, 8].

3 Potential Resources for Information Technology Industry:

We believe that the limited natural resources of the West Bank and the diminishing job opportunities for university graduates in the traditional job markets outside the country mandate an effort to create an industry capable of absorbing large numbers of highly skilled workers and directed towards export. Information technology-related industries can be a major area of economic development of the West Bank during the second part of the nineties. In addition, it is our view that the infrastructure needed solely for the support of such industry is limited. Most elements must be established anyway to serve other developmental needs of the country. Information technology industries can even help better utilize the existing infrastructure and thus achieve better returns on the investment. In fact information technology elements such as reliable communication links, computer networks, electronic mail systems, specialized databases and many others are becoming integral components of the industrial infrastructure itself and one couldn't hope to attract even traditional industrial activities without their creation[3]. The following factors can be of great potential importance in the establishment and maintenance of a viable computer industry in the West Bank:

3.1 Personnel and Computer Literacy:

The number of computer professionals and professionals with computer training is large and growing rapidly. In addition to the traditional sources of these graduates (foreign and Arab universities) the local institutions of higher education are establishing programs in computer science/engineering and related disciplines. Already two schools offer majors in computing and a third offers a minor. Other institutions are in the process of adding new computer science programs. Computer courses and computer literacy classes are being incorporated into the educational programs of students of different specialties. University-wide compulsory courses in computing are in effect or being contemplated in many institutions. Similar phenomena are being observed in community colleges. In addition, many private educational institutions are offering introductory courses and training programs for computer users. The demand on these programs is substantial and growing. Computers are being introduced into selected elementary and secondary schools. The state of affairs is still far from satisfactory in this regard. However, it is encouraging that many school teachers and administrators are expressing interest in incorporating computing into their schools. Financial considerations are the main obstacle facing this process. Computers are becoming a household commodity. Growing numbers of children are developing interest in computers and acquiring basic computer skills at an early age a fact that will, in our view, reflect positively on future computer utilization.

The effect of all the above is a reasonable supply of computer professionals and people capable and interested in introducing computers into their fields of specialization and a more computer literate society in general. This can lead to more acceptability of high technology and appreciation of its potential benefits.

3.2 Market properties:

By Third World standards the number of computer installations in the West Bank is reasonable. The average wage of workers is not high. However, since the cost of living is imposed by the dynamics of the economy of a foreign power, computer systems are relatively inexpensive when compared to other commodities[12].

The number of computer companies is quite large when measured to the size of the local market. The birth and death rates of computer companies is relatively high. To survive many of these companies are forced to cut overheads, reduce personnel and/or offer only a restricted range of services. The cumulative experience in these companies is valuable and can serve as a basis for a more ambitious effort in this field.

Many computer professionals are offered additional incentives to stay on the job and therefore the salaries here are generally above average. However, compared to their counterparts in industrial countries, labor costs in the West Bank are modest. This, combined with their physical closeness to potential markets in the Arab World and Europe, give West Bank industries the potential to offer competitively priced products. Additionally, the high cost of imported systems constitute a barrier to the introduction of foreign products into the local economy and therefore the savings offered by the local industries will encourage further introduction of information technology products into the local market and increase the demand for continued technical support and services.

3.3 Cultural Setting:

The West Bank shares a common language and cultural heritage with other parts of the Arab world. However, due to the separation from the rest of the Arab World resulting from the long occupation, West Bank institutions had to develop business contacts with foreign enterprises to meet their needs including those in the information technology area. The adaptation of foreign technology to local needs had to develop on its own without much coordination with institutions performing similar activities in other Arab countries. On the one hand this mandated the duplication of effort and the frequent use of inferior products at higher costs. On the positive side it led to the accumulation of a certain amount of knowledge in localizing computer products to the local needs (especially in the area of *product Arabization*) and the development of software packages that can be very helpful for future business ventures.

4 Possible Paths of Development:

Among the tracks along which computer industries can develop within the West Bank context are the following:

4.1 Software Development:

The creation of computerized systems to meet the needs of the local markets and/or packages to perform standard procedures that are in demand in large numbers. This includes the creation of novel operating systems, database management tools, language translators, expert systems shells and others. Since similar developments will be taking place simultaneously in other countries, the locally produced systems must have a competitive edge in terms of their pricing (reflecting the lower costs of development), their ability to deal with foreign languages, their adaptability to local laws (e.g. taxation systems), and their compatibility with the local value systems. The default configuration of the produced systems can be *regular* but a procedure must exist to retailer them for the specific needs of the target environments. Of major importance in this regard, and may be a good point to start with, is the modification of software engineering tools to accommodate foreign languages so as to use them in future software development efforts.

4.2 Joint Ventures:

These can take the form of contracting/subcontracting arrangements with foreign companies to produce systems or parts of thereof in the West Bank. Such arrangements can be especially helpful in the area of producing local components for computer products. This will enable foreign companies to benefit from the cheaper labor costs and the familiarity of the staff with the local needs.

4.3 Value Added Development:

The process of creating complete systems from scratch may not be feasible due to the size of the local market. Efforts can be concentrated on the value addition to products produced elsewhere. Examples of such activities can be the addition of supplementary boards to perform specific tasks to computer systems such as arabic support boards, algorithms for specific control problems (say in textile manufacturing), font generation, design and the creation of one-of-a-type instruments for specific needs and the design of systems to cater for the needs of the aged and handicapped in the area.

4.4 Localizing Information Technology Products:

Many of the above listed activities are indeed directed towards the adaptation of information technology products to the local market. However, we would like to stress the following points in this regard:

- The design of instructional materials directed to the Arabic market that takes into account the variations within the target audience. This is not a mere adaptation of ready packages by adding Arabic support but involves the creation of indigenous systems to teach such subjects as the Arabic language, its grammar and rules of writing, local history and geography, religious studies and other similar topics.
- The design of arabized systems to meet the specific needs of the local markets such as those for the study of local phenomena and culture (databases on religious and social affairs, bibliographic data, linguistic study tools...) and making them accessible to a wide user community. Another area is that of computer-based and electronic publishing systems, hypermedia and multimedia systems design and exploitation.

4.5 Research and Development:

A sizable portion of the highly qualified and experienced individuals can be employed in especially established research and development centers. These centers can be autonomous or affiliated with existing institutions of higher education and industries. The work of such centers to serve as a basis for new or improved products and can define future directions of product development in the rapidly changing market of information technology products. These centers can also offer consulting and product evaluation services to industries and other enterprises and therefore improve the quality of information technology products.

5 Problems and Possible Solutions:

In this section we address the problems facing the establishment of information technology-based industries in the West Bank and the possible measures that can help overcome these problems.

5.1 Factors Hindering Information Technology Development:

1. The isolation of individual computer systems, users, and manufacturers from the outside world and from each other due to the absence of networking activities and connections with the outside world[10]. This leads to problems of information exchange and slows down collaborative efforts and introduces delays in the product design and marketing cycles and feedback from customers. This also limits access to foreign expertise and literature in the field.

2. Personnel and training issues:

While the market is being supplied with reasonable number of graduates, the suitability of their training for the specific needs of the local market is questionable. Graduates of foreign schools are usually not familiar with the peculiarities of Arabic data processing and the needs of the local environment. Graduates of local institutions suffer from the same problem as well as that of inadequate instruction in such vital aspects of computer science as software engineering and complexity of algorithms. This leads to the waste of on-the-job time in retraining them for their new positions and places pressure on the industry especially in view of the fact that fast developments in information technology render many of the studied material obsolete or in need of frequent comprehensive revisions. The problem is compounded by the lack of local reputable publications on high tech issues and the large time and expenses involved in obtaining foreign literature in the computer field which are of limited value anyway due to the language barrier.

3. The absence of standards even within the small West Bank market. As a point in a case, more than five different Arabic character sets are in use in local products in the West Bank. This leads to incompatible systems and difficulties in data transfer and exchange.
4. The absence of legislation to regulate computer related activities. This includes the lack of clear provisions to protect the rights of software developers against illegal copying and misuse, the lack of measures to protect the computer market against unfair trade practices, and the lack of legislation to protect individuals against unauthorized access and misuse of data on them stored in computer systems. These factors, coupled with inaccurate reporting on computer matters in the media, lead to a certain degree of apprehension on part of the community towards information technology products[13].

5.2 Corrective Measures:

Some of the problems facing computerization in the West Bank are objective and beyond the control of the local population. On the other hand, we believe that many of the encountered obstacles have their origins in the poor management of existing computer resources and the incorrect priorities of resource allocation during the computerization process.

To ensure the competitiveness of an information technology industry several measures are to be adopted, including:

1. Improvements on the existing infrastructure to ensure the connection of local enterprises with each other and with the outside world. This includes maintaining a link with the outside world even at substantial initial costs until the interested people realize the importance of this link and start using it at which time it can be converted into a commercial venture. Such a link is needed anyway to connect institutions of higher education and research centers to the outside world to insure timely access to scientific literature and data. Educational institutions can serve as centers for networking activities. However, the networks must be made accessible (may be against a cost) to industrial enterprises and private individuals.
2. Initiate legislation and/or codes of conduct for computer professionals and other participants in the computerization process and the propagation of these measures to the largest possible

audience. This process requires the participation of the judiciary, educational institutions, professional computer societies and the media[13].

3. Institute continuing education programs to update the knowledge of computer professionals and users. These activities can be carried out by existing educational institutions, the creation of publications and correct reporting in the media, the organization of conferences, workshops and training courses. In addition, computer science programs offered by local institutions must undergo regular reviews and updates to ensure the competitiveness of their graduates. Faculty members must be kept up-to-date through joint research and exchange programs with foreign schools and access to major publications in the field.
4. Major standardization effort directed towards designing, adopting and publicizing standards in information technology. An important issue here is the compatibility locally developed products with international standards to the local developers to ensure accessibility to international markets. The adherence to standards can be by choice. However, long term benefits of adhering to these standards in the form of improved product competitiveness must be emphasized.
5. The creation and support of centers to carry out scientific research in the various fields of computing, especially in areas relevant to the projected paths of industrial development. Mechanisms to ensure wide and fast dissemination of the results of this research to the interested parties must be considered. Public support for such an effort is needed especially at the earlier stages. A shift to private sponsorship can be anticipated after the industrial potential of this research is evident.

We must stress the importance of the coordination of activities directed at encouraging information technology-based industries this area to avoid the duplication of effort and to direct it towards achieving the projected goals. Bits and pieces of support to individual enterprises can't create a competitive industry and may be counterproductive by encouraging incorrect computerization practices. This is evident in the present state of affairs in the West Bank where different elements of the needed resources are scattered at various locations but not enough of them at any single place to allow for a successful computerization effort. Collaboration between the participants of the process is needed for the success. This collaboration can be in sharing the costs of library material, networking activities, development of educational programs, standardization effort and many others. It may be of valuable to create a consultative body of highly qualified professionals to study the market and draw a *national computerization policy* and to set guidelines for activities in this area to all interested parties and to set priorities of support to the funding organizations.

There is much to learn from studying the experiments of other nations, especially those of East Asia in this field[3]. The successes in that area and the development in Eastern and Western Europe and the resulting shifts in international relations will contribute to a stiffer competition for the world markets[5]. This can serve as an additional incentive for a quick action in this field

6 Conclusion and Remarks:

In this paper we argued that information technology-based industry has the potential of becoming an important sector of the economy and an important tool for development in a third world nation such as the West Bank. This track of action faces many obstacles and the success of this approach cannot be taken for granted. We pointed to the possible obstacles facing this path and the potential solutions. Consideration must be given to balancing the needed public support, especially at the earlier stages of development, and the efforts of the private sector in this area.

The changing political conditions in the region carry the potential of opening new markets and improving the local infrastructure on the one hand and increasing the competition on the other and therefore call for more attention to the issues raised in this paper.

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