

STRATEGIES FOR  
TECHNOLOGY-BASED ECONOMIC DEVELOPMENT

by

AMAL MUHAMMAD MUSA ALAYAN

B.E.E. Kuwait University (1985)

Submitted to the Alfred P. Sloan School of Management  
and the School of Engineering  
in Partial Fulfillment of the Requirements for the Degree of  
MASTER OF SCIENCE IN THE MANAGEMENT OF TECHNOLOGY

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

May 1993

© Amal Muhammad Musa Alayan 1993. All rights reserved.

The author hereby grants to MIT permission to reproduce and  
to distribute copies of this thesis document in whole or in  
part.

Signature of Author \_\_\_\_\_  
Alfred P. Sloan School of Management  
May 7, 1993

Certified by \_\_\_\_\_  
Edward Roberts  
Thesis Supervisor

Certified by: \_\_\_\_\_  
John Preston  
Thesis Reader

Accepted by: \_\_\_\_\_  
Rochelle Weichman  
Director, Management of Technology Program

Dewey  
MASSACHUSETTS INSTITUTE  
OF TECHNOLOGY

JUN 18 1993

**STRATEGIES FOR  
TECHNOLOGY-BASED ECONOMIC DEVELOPMENT**

by

AMAL MUHAMMAD MUSA ALAYAN

Submitted to the Alfred P. Sloan School of Management  
and the School of Engineering on May 7, 1993  
in partial fulfillment of the requirements for  
the Degree of  
Master of Science in the Management of Technology

**ABSTRACT**

Success in the Middle East peace negotiations will lead to the creation of a new state: the state of Palestine. A new state with a traumatic history and without natural endowments requires much creativity in developing man-made comparative advantages. Because technology is behind man-made comparative advantage and will be decisive in determining any nation's competitive edge in the twenty-first century, this report proposes strategies for economic development based on the prevailing international trends in technology change and commercialization.

Rapid technological change, increased cost of innovation, international diffusion of technology, and increased competition are new realities that are now fostering more and more strategic alliances of mutual benefit to companies worldwide. A strategy whereby the public sector helps the private sector enter new technology-based businesses through international strategic alliances is presented through a case study of the United States-Israel Binational Industrial Research and Development Foundation (BIRD). BIRD-sponsored projects between US and Israeli companies are analyzed to understand the factors that influence the design and performance of strategic alliances. The case study clearly demonstrates an opportunity for a nation to increase its high value-added exports and to enhance a high-technology sector. It also demonstrates the significance of international support in the form of strategic alliances (BIRD-type) as opposed to direct foreign aid in promoting a nation's economic development, creating mechanisms for organizational learning, and facilitating binational relations that may transcend political and cultural barriers between nations. The implications of such a strategy on the Palestinian setting are presented through recommendations for the Palestinian Economic Development Group (EDG) -- a

credit institution concentrating at present on industrial economic development in the Palestinian Occupied Territories -- the West Bank and Gaza Strip. In incorporating a case study on the EDG , the thesis documents the environmental factors which have shaped the business environment in the Palestinian Occupied Territories.

The thesis addresses the question of whether a high-tech entrepreneurial region can be planned and whether such planning can give a competitive edge to a country in a 21st-century technology. It examines the critical role of university-industry-financial sector cooperation in encouraging entrepreneurship and commercializing technology. To demonstrate the dynamics of such cooperation, an MIT-spinoff company in biotechnology, built around the invention of a Palestinian woman entrepreneur, is presented. From the case of this company, Amira, and models of the high-tech entrepreneurial region of which Amira was an outgrowth, strategic implications for the Arab world are drawn. These implications highlight the viability of a corporate state venture capital strategy that would facilitate other proactive long-term strategies which include among others in-house technology development in the Arab World. The corporate state venture capital strategy is particularly recommended for a country in the Arab World like Kuwait where need exists for coordinating overseas financial investments with activities of the commercial sector and the university/research institutes.

Thesis Supervisor: Edward B. Roberts  
Title: David Sarnoff Professor of  
Management of Technology, and  
Chairman, MIT Center for  
Entrepreneurship

## ACKNOWLEDGEMENTS

I would like to thank Edward Roberts for supervising my dissertation work. In a skillful way, he often gathered insight from my thoughts and feelings. He gave me guidance where needed, provided constructive feedback, and facilitated my access to information that enriched my learning experience. I owe him sincere gratitude for his personal support.

I would like to thank John Preston for taking the time to listen and give his valuable insights on which I have built. His notion of "wealth creation" rather than "wealth shifting" contributed a solid foundation for this work. His entrepreneurial spirit and commitment for change have been a source of inspiration.

I would like to thank the Fulbright Student Scholarship Program for providing financial support for my study at MIT. Special thanks to Bruce Stanley, Mark Viso, and Sarah Harb at Amideast-East Jerusalem and to Leigh Peele at Amideast-Washington for administering my Fulbright award.

I would like to thank Rochelle Weichman and Jennifer Mapes at the Sloan Management of Technology Program, for warmth and personal care.

I owe much gratitude to the people who took the time to respond to my questionnaires and interviews, to give their insights and/or to critique my ideas. For their contribution and help I thank Samir Huleileh, Kamal Hassouneh, Munir Fasheh, Rima Kaddurah-Daouk, Lita Nelson, Tom Andrews, Fernando Quezada, Antoine Zahlan, Kypros Kouris, Edward Mlavsky, Kamal Saad, Graig Jones, and Gloria Doubleday.

I wish to thank teachers and peers at MIT who shared their thoughts and ideas. I will definitely miss the intellectual affinity established at MIT through intensive discourse.

I am grateful to my father, mother, sister, and two little brothers, for their care, encouragement and sustaining love. I am also grateful to the friends who challenged my work, commented on it, and showed their continuous emotional support as I progressed from one phase to another in the preparation of this thesis. My special thanks to my best friend Hanan Baddar.

May this experience be a contribution for a peaceful future in Palestine to light my little brothers' futures and to give them space for growth in our beloved Jerusalem. May this experience be a contribution for a better future for Kuwait, where I grew up and to whom I owe much of my growth to date. May this experience be a contribution for a more productive and peaceful Middle East for the sake of all.

Amal Alayan  
Cambridge, Massachusetts  
1993

## TABLE OF CONTENTS

	PAGE
Abstract . . . . .	2
Acknowledgments . . . . .	4
Table of Contents . . . . .	6
CHAPTER ONE: PALESTINE: REUNITING A NATION AND CREATING A NEW STATE . . . . .	8
1. Introduction . . . . .	8
2. Historical Background . . . . .	9
3. Macroeconomics in The West Bank and Gaza Strip Since 1967 . . . . .	12
4. The Impact of Military Permits on Business . . . . .	19
5. The Rise of Palestinian Credit Institutions . . . . .	20
6. Building a Future Palestine: Construction as a Locomotive . . . . .	22
7. At the Crossroads . . . . .	25
CHAPTER TWO: TWO FRAMEWORKS FOR STRATEGIC ANALYSIS . . . . .	29
1. Introduction . . . . .	29
2. Environmental Analysis Framework (EAF) . . . . .	30
3. Roberts & Berry's Framework for Optimum Entry Strategies . . . . .	34
CHAPTER THREE: INTERNATIONAL STRATEGIC ALLIANCES . . . . .	46
1. Introduction . . . . .	46
2. US-Israel Binational Industrial Research and Development Foundation (BIRD) . . . . .	47
A. Historical Background . . . . .	47
B. The Israeli Environmental Factors . . . . .	49
C. The US Environmental Factors . . . . .	50
D. BIRD Projects' Evaluation Process . . . . .	51
E. BIRD's Involvement in the Strategic Alliances . . . . .	54
F. BIRD Companies' Motivation for Strategic Alliances . . . . .	57
G. Partner Selection in BIRD Projects . . . . .	57
H. Problems and Disagreements in BIRD's Strategic Alliances . . . . .	58
I. Remarks on BIRD . . . . .	60
3. The US-India PACT Alliances and PACER Consortium Projects . . . . .	64
4. The Palestinian Economic Development Group (EDG) . . . . .	66

**TABLE OF CONTENTS**  
(continued)

	PAGE
CHAPTER FOUR: HIGH-TECH PLANNED ECONOMIC DEVELOPMENT . . . . .	75
1. Introduction . . . . .	75
2. Bygrave & Timmons' Model for High-Tech Economic Development . . . . .	78
3. Massachusetts Institute of Technology (MIT) . . . . .	82
4. The US "First Biotech Super-Incubator" in Worcester . . . . .	87
A. Background . . . . .	87
B. Massachusetts Biotechnology Research Institute (MBRI) . . . . .	89
C. Commonwealth BioVenture Inc. (CBI) . . . . .	93
5. Amira . . . . .	97
6. Some Strategic Implications for the Arab World . . . . .	104
REFERENCES . . . . .	110

## CHAPTER ONE

### PALESTINE: REUNITING A NATION AND CREATING A NEW STATE

#### 1. Introduction

The economic lives of Palestinians have been fragmented and their society has been dispersing since the war of 1948 and the partition of Palestine. However, Palestinians have never lost courage, determination, a sense of identity, and the will to return to their homeland -- Palestine. If the ongoing Middle East peace negotiations succeed, an interim period of five years is expected before a Palestinian state is established in the West Bank and Gaza Strip. This period will call for much creativity to deal with the challenges of establishing a new state.

This chapter opens with an historical background of the West Bank and Gaza Strip, followed by their macroeconomics since the 1967 war. To capture the impact of the environment at the macro level on the micro business level, the author will touch on the role of Israeli military permits in controlling the industry structure and dynamics. Because the Palestinian credit institutions have recently risen as vehicles for economic development in the West Bank and Gaza Strip, the author touches on these vehicles of change with a focus on the Palestinian Economic Development Group (EDG) which is the



credit institution concentrating now specifically on the industrial sector.

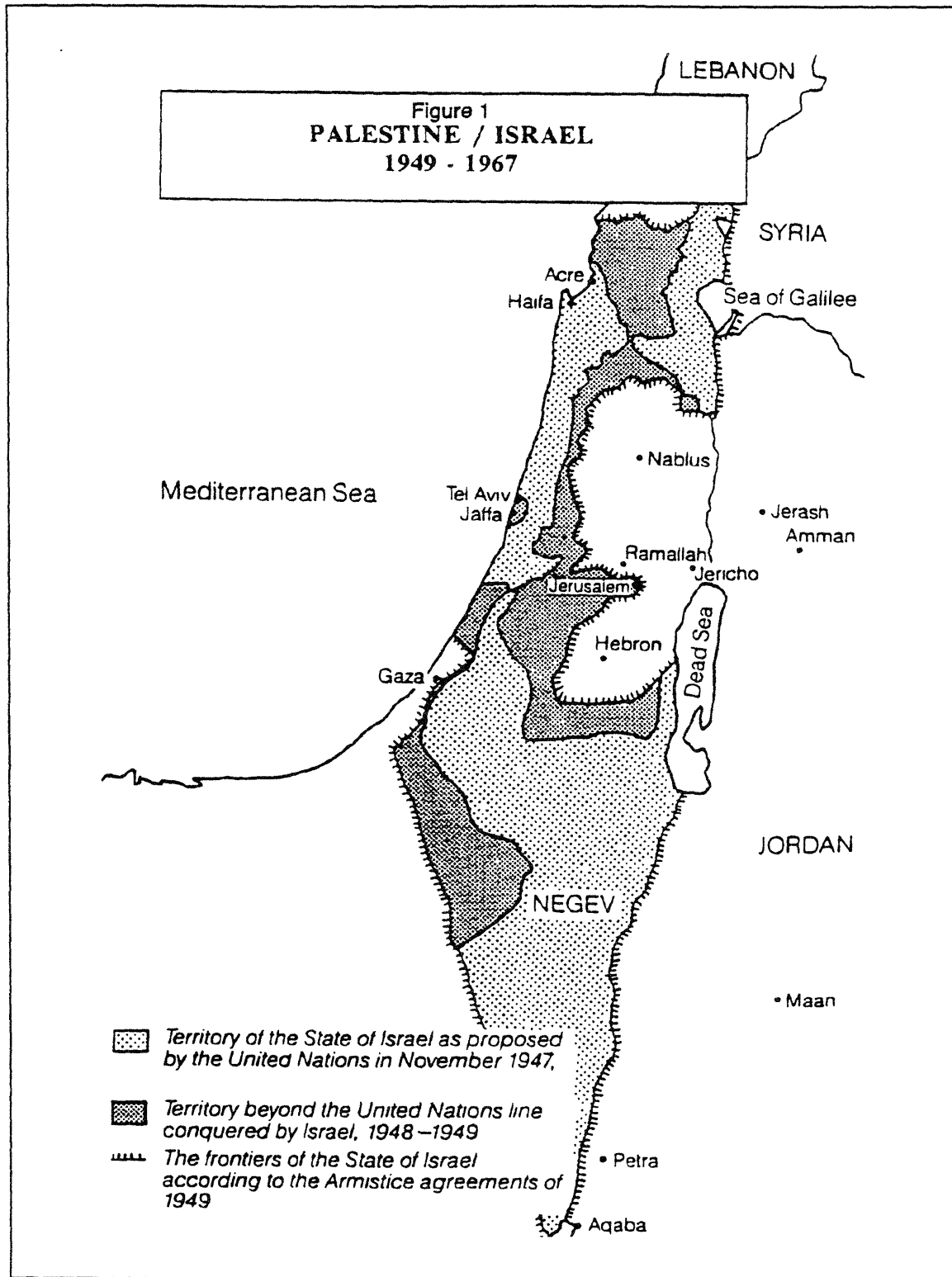
Because the construction of approximately 182,000 houses has been identified by the Palestinian leadership as both a challenge and an opportunity in the process of creating the state, the author will focus on this industry illustrating the opportunity yet addressing another challenge in parallel -- the challenge of consolidating two Palestinian economies, one crippled by years of prolonged occupation and oppression, and a more sophisticated Palestinian economy in exile, represented mostly by Palestinian entrepreneurs who managed to rebuild their wealth and their technological capabilities in competitive surroundings.

As we are now at the crossroads of the peace negotiation process, this chapter will close with a metaphor from an international context: Bretton Woods and the emergence of the Marshall Plan. The author concludes with those strategic thrusts with which the Palestinian leadership has defined the role of science and technology in future Palestine.

## **2. Historical Background**

Neither the West Bank nor Gaza was a distinct entity before 1948. Both were integral parts of Palestine, a country within

the Arab world with a total area of 10,162 square miles or 26,323 square kilometers. Palestine extended from the Lebanese and Syrian borders in the north to the Sinai Peninsula and the Gulf of Aqaba in the Southwest, and from the Mediterranean in the West to the Jordan river in the east. The 1948 war was fought as a result of Arab rejection of British policies for a Jewish homeland in Palestine. The Arabs felt the threat of demographic change in Palestine resulting from the huge influx of European Jews in the aftermath of WWII. The Arabs lost this 1948 war, Israel was established as a Jewish state within historical Palestine, and over 714,000 Palestinians were left as refugees outside their homeland in parts of Palestine that remained in Arab hands -- the West Bank and Gaza strip -- and in neighboring Arab countries (PASSIA 1990 -- all references are documented fully in the References section at the end of this thesis). In 1967 Israel won a second war against the Arabs, and as a result additional Palestinians became refugees as Israel occupied the West Bank and Gaza Strip, now referred to as the Palestinian Occupied Territories. The West Bank area is 5,800 square kilometers and the Gaza Strip area is 363 square kilometers (see map, figure 1 on the following page). Since 1948 the Arab nations (excluding Egypt since the 1978 Camp David Agreement) and Israel have existed in a state of war. At the time of this writing, Israeli/Arab peace negotiations are underway, giving hope for a new future in the Middle East.



Source: Palestinian Academic Society for the Study of International Affairs (PASSIA)

### 3. Macroeconomics in the West Bank and Gaza Strip Since 1967

In 1987, the year of the outbreak of the Palestinian *Intifada* (uprising) against the Israeli occupation, official estimates put the population of the West Bank and Gaza Strip at 868- and 565-thousand people respectively, excluding the population of East Jerusalem. According to Hamed & Shaban (1992), the combined population of about 1.4 million people had a Gross National Product of \$2.49 billion. This is almost negligible compared to the world Gross National Product which in 1987 amounted to US\$18,870 billion. To elaborate, the combined per-capita GNP of \$1717 in 1987 in the Occupied Territories was slightly lower than that of Mexico (\$1830) for the same year and about one-fourth of that of Israel. Referring to the figures of the period 1970-1987 listed in table 1 (Hamed & Shaban 1992), the average annual real growth rates of per capita GDP were 4.26% for the West Bank and 1.31% for Gaza Strip. The combined average annual growth rate of per-capita GDP for the West Bank and Gaza for the same period was 3.46%. In comparison, the growth rate of per-capita GDP in neighboring Jordan for the same period was 4.23%.

**Table 1** Basic Indicators of Population and National Accounts  
for the West Bank and Gaza Strip 1970-87  
 (figures in million current U.S. dollars)

Year	WEST BANK			GAZA STRIP			COMBINED %GROWTH RATE	
	Pop.	GDP	GNP	Pop.	GDP	GNP	Pop.	GDP
1970	608	123	137	370	52	59	1.7	9.6
1971	623	155	188	370	71	81	2.4	13.8
1972	634	206	262	387	87	115	1.9	17.5
1973	652	248	311	402	114	160	3.3	-4.1
1974	670	415	502	414	157	217	2.8	23.2
1975	675	394	512	426	166	230	1.6	-2.0
1976	683	472	593	437	199	273	1.8	16.3
1977	696	477	601	451	219	295	2.3	-1.8
1978	708	522	650	463	204	288	2.1	16.1
1979	719	595	772	445	263	395	-.7	-2.0
1980	724	826	1020	457	300	449	1.5	16.9
1981	732	682	914	469	297	478	1.7	-7.5
1982	749	749	1016	477	296	491	2.2	8.6
1983	772	800	1110	495	309	553	3.2	-3.9
1984	793	807	1061	510	278	493	2.9	5.1
1985	816	747	958	527	256	411	3.0	-1.0
1986	838	1241	1534	545	366	602	3.0	19.6
1987	868	1313	1718	565	459	773	3.6	-3.8

Despite the apparent growth in GNP, as an indicator of the economic situation in the Occupied Territories growth in GNP can be deceiving. One must consider, for example, the Gross Domestic Product as a ratio of the Gross National Product, which has been less than 100%. This ratio has been decreasing and demonstrating increasing reliance on non-domestically generated income which had reached one-quarter of the income of the West Bank and more than one-third of that of the Gaza Strip by the end of the period considered. The non-domestically generated income is generated from either transfers or worker remittances, and therefore cannot be attributed to improved domestic economic conditions. A better

indicator of the economic situation in the Palestinian Occupied Territories could be the domestic labor market, which has remained virtually unchanged over the period under consideration in spite of an annual population growth of close to 3%. A computation of the average compounded growth rates of the domestic labor force has yielded 0.5% and -0.7% per annum in the West Bank and Gaza Strip, respectively (the average growth rate of the combined labor force is 0.08% per annum). These figures demonstrate that the increase in size of the labor force has been fully absorbed by foreign labor markets in Israel and abroad (Shaban 1992). These alarming results demonstrate the economy's inability to mobilize domestic resources and to achieve growth. To explore the reasons for this, one must look at more economic indicators of the Occupied Territories. Table 2 shows figures for the West Bank (UNCTAD 1992).

**Table 2 West Bank: Selected Indicators**  
(ratios in percent)

Year	1972	1975	1980	1987
Saving/GDP	-14	-23	-12	-14
Saving/GNP	12	7	12	11
Investment/GDP	20	20	32	30
Investment/GNP	15	15	25	24
Housing/private investment	69	81	82	79
Private consumption/GNP	78	90	80	79
Private consumption/GDP	162	178	142	122
Public consumption/GNP	10.5	9	6.5	6.9
Imports/private consumption	61	67	70	61
Imports/GDP	62	76	72	63
Trade balance/GDP	-34	-44	-44	-44
Current account balance	23	-39	-55	-100
Trade balance	-48	-118	-211	-405

Looking at the domestic expenditure and its components, one can gather more understanding about the economic situation in the West Bank & Gaza strip. Private consumption figures appear extraordinarily high, constantly exceeding GDP, and composing the largest component of aggregate demand. This distribution indicates a reliance of the territories on transfers and remittances from abroad. With private consumption exceeding GDP, the negative ratios of domestic savings to GDP can be understood. When foreign flows are incorporated into the picture, the problem with savings takes less dramatic proportions. Turning to the characteristics of private investment, one notices that the bulk of private investment goes to building and construction works (social overhead investment) rather than to capital investment (machinery and equipment). It is noticeable also that imports from Israel and other parts of the world have been absorbing a large percentage of national resources. Also noteworthy is that public expenditure by the Israeli government has been declining. The economy has been unable to mobilize the resources available to it into productive investment, for reasons that include the following:

- a. The closure of all banks that were operating in the Occupied Territories in 1967 by Israel, thus hindering the mobilization of financial resources from private savings to business investment.

- b. Political uncertainty about the future of the area.
- c. Direct Israeli restrictions which made many economic activities contingent on the acquisition of permits from the military authorities.
- d. The Israeli policy of random deportations from the Palestinian Occupied Territories.

Despite the 1967 removal of both geographic and tariff barriers between the Occupied Territories and Israel, and in spite of the use of Israeli currency as legal tender, the Palestinian per-capita GNP in the Occupied Territories is now only one-fourth that of Israel. Moreover, although the Occupied Territories have no control of Israeli currency and have no currency of their own, there have existed systematic differences between the Palestinian and Israeli inflation rates, except for the period between 1976 and 1986 (Hamed & Shaban 1992). These differences would not be expected if the Israeli economy were not protected, or if there had been a true two-way movement of goods and services to equate any price differential between Israel and the Occupied Territories. For example, although any Israeli product can enter the market in the Occupied Territories, some Palestinian products (e.g. pharmaceuticals) are kept out of Israeli markets because these markets are dominated by the government or by quasi-governmental Israeli agencies.



This situation changed to a certain extent after December 1987, when the Palestinian *Intifada* called for a halt to purchasing of Israeli products. Israeli products constituted about 90% of total imports over the eighteen-year period 1970-1987.

To complement this account of the economic impact of the Israeli occupation on the West Bank and Gaza strip, we include two important mechanisms of resource transfer from the Occupied Territories to the Israeli government (Hamed & Shaban 1992). The first is the involuntary monetary integration of the West Bank and Gaza strip with Israel, and the resulting use of the Israeli currency as legal tender. The steady depreciation of the Israeli currency resulted in Palestinians storing value in other currencies, mostly the Jordanian dinar and the US dollar, while Israeli currency has been used exclusively for daily transactions -- a process which resulted in the transfer of a significant percentage of the Palestinian GNP to the Israeli central bank. The second mechanism for resource transfer is a highly protective Israeli commercial policy, coupled with a one-sided customs union on the West Bank and Gaza. The Israeli government collects for itself all tariff revenues generated from imports to the Occupied Territories. All policies that affect the external tariff structure or commodities that flow into the Occupied Territories, as well as the timing of this movement, are

unilaterally designed and implemented by Israel. Averaged over the period 1970-1987 and in terms of 1990 US dollars, a lower bound estimate of \$6 billion to a higher bound estimate of approximately \$11 billion has been calculated by Hamed & Shaban (1992) as the resource transfer resulting from these two mechanisms. These two mechanisms are significant, and the Israeli occupation authorities run their annual balanced budget without accounting for these transfers that qualify as income sources.

The above economic account of the impact of Israeli occupation on the West Bank and Gaza Strip excludes the more significant cost of opportunities and income foregone as a result of non-utilization of Palestinian land which Israel has expropriated, confiscated, or otherwise placed under the control of the Israeli military or settlers. By the end of 1991, such land constituted at least 67% of the West Bank, excluding East Jerusalem which has been completely annexed by Israel.

The situation with water is equally serious. From around 700 million cubic meters annual supply to the West Bank and 60 million cubic meters to the Gaza Strip, some 515-530 million cubic meters is transferred for use in Israel and its settlements in the territories (UNCTAD 1992). Palestinians are strictly forbidden from drilling wells in the Occupied Territories. A Palestinian in the Occupied Territories has

access to only about one-fourth the amount of water an Israeli has access to in Israel, and only one-sixth that of a Jewish settler in the West Bank and Gaza Strip. With respect to agriculture, only 25% of irrigable land in the Occupied Territories is under irrigation while 95% of irrigable land beyond the Green Line is irrigated (Palestinian Delegation 1992). Even some Israeli economists believe that the problem of water scarcity in greater historical Palestine is aggravated by Israel's uneconomic use of water in agriculture (discussion with Professor Shlomo Maital).

#### **4. The Impact of Military Permits on Business**

A project proposal by a manufacturing firm for a factory with a budget exceeding \$50,000 requires a permit from the military authorities in the Occupied Territories. The decision-making process begins with an application to the Trade and Industry Military Officer. This application is then distributed to twelve other military officers, Israeli Intelligence, and the tax authorities. Project approval is contingent on the acceptance of all those involved (telephone interview by the author with Samir Huleileh -- Executive Director of the Palestinian Economic Development Group in East Jerusalem and an Economist with the Palestinian Peace Negotiating Team).

In some cases the Military authorities approve certain manufacturing projects contingent on cooperation with an Israeli competitor, especially if the competitor is a quasi-governmental enterprise. Examples of this forced coordination with competition was exercised in the case of dairy products with the Israeli company Tnova, and in the case of a cement factory with the Israeli company Nesher (telephone interview with Samir Huleileh).

In a 1991 study conducted by George Murad, Head of the Civil Administration Industry and Trade Office of Bethlehem, the ninety manufacturing projects which were approved in the decade 1980-1990 by the Israeli military authorities were surveyed: the average time that the decision-making process took was six years. In another study, the average time was thirteen years for receiving a telephone line for personal or business purposes in the period 1967-1990 in the Occupied Territories excluding East Jerusalem (discussion with Samir Huleileh).

##### **5. The Rise of Palestinian Credit Institutions**

The Palestinian *Intifada* encouraged the establishment of non-profit Palestinian credit institutions that would correct for some militarily imposed market imperfections. For example, the Economic Development Group (EDG) in East Jerusalem was

established in 1987 with the stated objective of encouraging a self-supporting ideology in the Palestinian economy. This was expected to result in: (1) reducing dependence on the Israeli economy; and (2) improving the economic and social infrastructure in the Occupied Territories. EDG defined its strategic intent as that of filling funding gaps resulting from the forceful closure of Arab Banks since 1967 and the lack of other sources of investment funds. In December 1992, an agreement was signed between EDG and the other credit institutions in the Occupied Territories, the Arab Development and Credit Company (ADCC), and the Arab Technical Development Corporation (TDC). The agreement aimed at allowing each credit institution to focus on a specific economic sector and to coordinate as one financial body that could evolve into a Palestinian development bank. As a result of this agreement EDG is now concentrating specifically on the industrial sector.

According to Samir Huleileh, Executive Director of EDG and an active participant in the Israel/Palestine Center for Research and Information (IPCRI), EDG was restricted to projects under \$50,000 until the end of 1991, when the Israeli authorities shortened the decision-making process from six years to six months. This has coincided in his opinion with the influx of new Russian Jews and Israel's need to replace Palestinians working in Israel by new immigrants, a situation which caused

some economists in Israel to suggest measures to reduce Palestinian dependence on job opportunities in Israel and to divert their job search to the Occupied Territories instead. In addition to this, the initiation of the peace negotiation process in the Middle East might have put the situation in the territories under watch by the US and those Israelis interested in peace.

There is a new signal by Israel in the Palestinian Occupied Territories -- the recent approval of the opening of two Palestinian commercial banks and the reopening of a branch of the Bank of Jordan in the Occupied Territories. Although this sounds like a positive signal, it is contradictory that Israel has enforced East Jerusalem's total close off for Palestinians in the Occupied Territories since April 1993. This is extremely serious because East Jerusalem is the economic, cultural, religious and political lifeline for the Occupied Territories.

#### **6. Building a Future Palestine: Construction as a Locomotive**

In a contribution to the Program for Development of the Palestinian National Economy, Zahlan (1993) addresses some challenges facing the future state of Palestine. Zahlan sees the near future requirement for 182,000 housing units as a locomotive for the new Palestinian economy and an opportunity

which could enable Palestinians to build their market driven technological capabilities across the value chain in the construction industry including but not limited to consulting and contracting.

Michael Porter (1990) believes that careful management of the chain of discrete value-generating activities in an industry, and the ability of a nation's firms to exploit linkages with home-based suppliers and customers, can be decisive for the nation's competitive position in that industry.

In the process of managing such a value chain, particularly in the construction industry, another challenge remains to be addressed, the challenge of consolidating two Palestinian economies, one that was crippled by prolonged years of occupation in the Occupied Territories and a more sophisticated Palestinian economy in exile mostly represented by Palestinian entrepreneurs who managed after the loss of their homeland in 1948 and 1967 to rebuild their wealth in intensely competitive surroundings. There are already concerns among local contractors in the Occupied Territories of the anticipated wave of competition.

Consolidated Contracting Company (CCC) is a potential participant in the future construction industry in Palestine. A case study on CCC is presented by Zahlan (1991). CCC was

created in 1952 in Lebanon by three Palestinian entrepreneurs who were able to grow the company to being one of the world's top 100 international contractors. The three entrepreneurs Kamal Abdul Rahman, Hasib Al-Sabbagh and Said Khoury were graduates of the American University of Beirut. Their entrepreneurship started in Palestine: Kamal Abdul Rahman, together with the late Emile Bustani, was a founding member of the CAT construction company and executed projects for the Iraq Petroleum Company (IPC) in historical Palestine. Hasib Al-Sabagh set up his own construction company in Haifa where he secured building contracts. Said Khoury owned an engineering office in Safad, his home town. In 1948 the war, the partition of Palestine, and the establishment of Israel resulted in the loss of their livelihood. Like the thousands of Palestinians who lost their wealth and were deprived the right to return to their homes after the war of 1948, these entrepreneurs had to pursue their careers outside of their home country. As a result they settled in Lebanon and established CCC.

With time, CCC established thirteen subsidiaries in different countries. It also invested in the development of two firms which provided offshore technologies for the oil industry: the first is National Petroleum Construction Company Ltd. (NPCC) where it owns 30%, the remainder owned by Adu Dhabi National Oil Company. The second is Consolidated Contractors



Underwater Engineering (CCUE), which was consolidated with Comex M.E. into a new subsidiary called Comex Consolidated Contractors Ltd., registered in the United Kingdom.

The complexity and scale of some of the mega-projects that CCC handled, such as the Nizar-Hamarit roadway project in Oman which exceeded \$300 million dollars in value, gave CCC the chance to build its technological capabilities and international competence. The wide spectrum of expertise required by such projects made CCC enter into many joint ventures and consortiums with large international firms which facilitated a lot of technology transfer.

## **7. At the Crossroads**

At the end of the World War II, the United States introduced a new idea: the idea of making the enemy richer. The interesting thing is that it worked. Nicely put by Thurow (1992):

When an intense debate raged at Bretton Woods as to what should be done about the Japanese and German economies, there were those that argued for the Roman solution-sow the fields of Carthage with salt and permanently destroy its economy. But in the end what many at the time viewed as an extremely naive American approach prevailed. The American idea was that if countries could be rich, they would be democratic. If their richness depend upon selling in the American market, they would be forced to be allies of the United States. Fifty years later, the US income went up so did everyone else's.

As with colonial philosophy prior to WWII, Israel's purpose in the Occupied Territories has not been to make the enemy richer. Now with peace negotiations slowly underway between the Arabs and the Israelis, Palestinians are aspiring for their independence, the return of the Palestinian refugees of the 1948 and 1967 wars, and control over their land and water resources. The Israelis in turn need security and access to Arab and Islamic markets. One wonders whether another Bretton Woods could be concluded with the inception of a new Marshall Plan for the friend and the foe devastated by the wars of the past forty-five years in the Middle East: a Marshall Plan that would put an end to forceful shifting of natural-resource endowments; a Marshall Plan not based on forms of charity from the rich to the less privileged which have already proved ineffective and devastating in the Arab world, but rather, a Marshall Plan that will enable all parties to build their own man-made comparative advantage, and implement strategies for productive employment.

As technology is behind man-made comparative advantage, it is the premise of this report that technology-based business strategies are not only central to the creation of the Palestinian future state, but also may become means to facilitate win-win situations and creative resolutions to disputes in the Middle East. In the Program for Development of the Palestinian National Economy, the role of science and

technology in future Palestine is defined by the Palestinian leadership (Zahlan 1993) with a number of strategic thrusts that carry implications for the strategies discussed in the following chapters:

- a. to orient the economy of future Palestine towards export.
- b. to ensure no monopoly on activities leading to the analysis and formation of science and technology policies in the future Palestinian democratic society.
- c. to adopt methods aimed at assisting private investors and entrepreneurs upon whom the economic future of Palestine will depend.
- d. to establish linkages between researchers and consumers of research through appropriate financial sponsorship and incentives.
- e. to foster close and mutually beneficial economic relationships with other nations with special emphasis on the Arab states.

The chapters that follow do not offer a comprehensive technology-based solution to the complex problems of either the new Palestinian state or the Middle East. This thesis does not propose to spell out a Marshall Plan; however, by bridging the gap between the macro and micro levels of technology-based business development, and by scanning some relevant international trends in technology change, this thesis

presents scenarios that carry strategic implications for the Middle East in general, and for the Palestinian setting in particular. Chapter two will present two frameworks for strategic analysis. These two frameworks will be used in chapters three and four. Chapter three will concentrate on the formation of international strategic alliances as a national technology-based strategy. Chapter four will address the question of technology-based planned economic development suggesting corporate state venture capital strategy as an entry strategy that could facilitate other proactive long-term technology-based strategies for the integration of the Arab World in the future world economy.

CHAPTER TWO  
TWO FRAMEWORKS FOR STRATEGIC ANALYSIS

1. Introduction

This chapter introduces two frameworks: The Environmental Analysis Framework and Roberts & Berry's Framework for New Business Optimum Entry Strategies. The first was developed by James Austin to modify the popular Michael Porter Strategic Competitive Analysis Framework in order to capture the complexity of the business environment in less developed countries (LDCs). The second framework was proposed by Roberts & Berry principally for firms in developed countries entering new businesses through the development of new products-markets. By fusing these two frameworks in the following chapters, the author focuses on business development issues in a less developed country without losing relevance to global trends. Furthermore, fusing these two frameworks helps integrate the macro- and microeconomic dimensions of new business development. The strategies presented here for the entry of firms into new businesses can be pursued as national strategies by viewing a nation-state as a corporation. Implementation of some strategies presented here will be analyzed through case studies in the following two chapters.

## 2. Environmental Analysis Framework (EAF)

James Austin (1990) proposes a systematic way of analyzing the business environment, and the variables that shape it, through the Environmental Analysis Framework (EAF). The EAF starts by categorizing the multiple environmental variables that impinge on a business into four factors: economic, political, cultural, and demographic. These factors influence each level of the firm's environment, starting from the most distant international level, to the national, to the industrial, and finally to the company level (Figure 2).

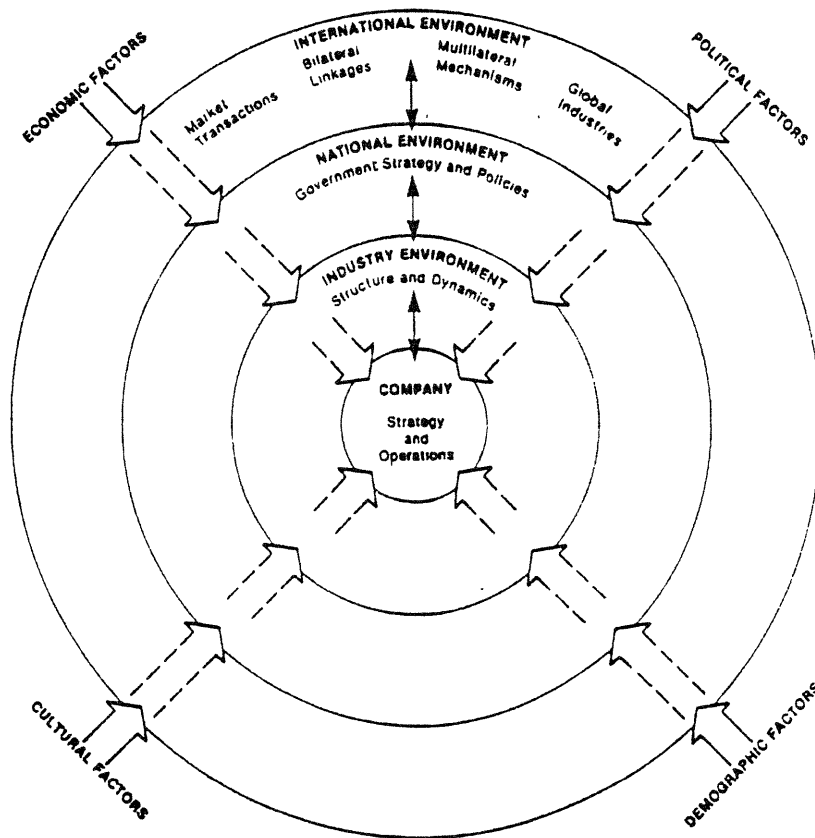


Figure 2 Environmental Analysis Framework

## Environmental Factors

The EAF probes the four broad environmental factors through their more specific components: The EAF subcategorizes the economic factors into natural resources, labor, capital, infrastructure and technology. Political factors include stability, ideology, institutions, and geopolitical links. The cultural factors in the EAF are subdivided into social structure and dynamics, perspectives on human nature, time and space orientation, religion, gender roles, and language. And finally, the subdivision of demographic factors includes population growth, age structure, urbanization, migration, and health.

## Environmental Levels

The environmental factors listed above influence each level of a firm's environment. The EAF shows that these levels are interactive, meaning that actions on each level by any of the environmental factors can affect the other three levels.

### i. The International Level

The emphasis here is first on the normal market transactions that link LDCs to each other and to the Developed Countries (DCs). Second emphasis is on special bilateral linkages such as trading agreements that join an LDC to another

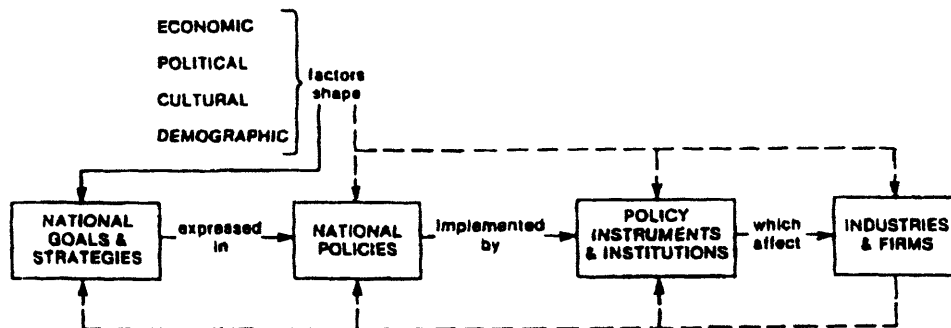
country. Third, multilateral mechanisms such as the International Monetary Fund (IMF). Fourth is on the global industries and corporations that link LDCs to other countries.

ii. The National Level

Given the central role of the government in shaping the business environment in an LDC, the emphasis here is on government strategies which are expressed in national policies. These policies, Austin states, are not always explicitly stated in LDCs. To understand them, one must analyze their implementation via policy instruments and institutions. Three broad categories of policy instruments are identified in the EAF: legal mechanisms such as tax laws, administrative mechanisms such as industrial capacity licenses, and finally, direct market operations where a state-owned enterprise participates in the economy as buyer, seller, creditor, or facilitator. While these policy instruments and institutions affect industries and firms, the latter through their actions can influence policy-makers and alter national strategies and implementation mechanisms. The result is what Austin calls the "Public-Policy Impact Chain" (Figure 3). The comprehension of the iterative nature of the process illustrated in the Public-Policy Impact Chain can be empowering to LDC firms and industries. The iterative nature of the Public Policy Impact Chain



emphasizes the responsibility that the business community should bear in the economic development process. It also describes a powerful mechanism for societal democratization.



**Figure 3 Public Policy Impact Chain**

iii. The Industry Level

Porter's "five forces" (1985) are defined as follows: intensity of rivalry (between actual competitors), substitution pressures (from potential substitutes), barriers to entry (against potential competitors), suppliers bargaining power (as suppliers benefit from selling to industry firms), and buyer bargaining power (from customers exerting their influence). To these, Austin adds the "mega force" of government actions thus modifying Porter's model. In addition to adding a sixth force, the EAF modifies

Porter's framework by explicitly exploring the role of the four environmental factors -- the economic, political, cultural, and demographic -- in shaping each of the six competitive forces so as to enable managers in LDCs to undertake more comprehensive and meaningful competitive analysis.

iv. The Company Level

The EAF was designed to help managers systematically identify and analyze the implications of the environmental factors on strategic decisions and operating actions at the firm level.

**3. Roberts & Berry's Framework for Optimum Entry Strategies**

In the process of technology-based new business entry, two basic strategic questions are addressed by a firm:

- a. Which products-markets should be entered?
- b. How should these products-markets be entered most successfully?

To answer the second question, Roberts & Berry (1985) proposed a framework based on whether the new business addresses new markets, new products, or both. The framework applies relevant literature to create a matrix that clearly shows, depending on a firm's degree of familiarity with a technology and a market, the optimum entry strategies from a set of options that

include internal development, acquisition, licensing, strategic alliances, and minority investment of venture capital.

Although a literature review by these authors find that the familiarity of a company with a technology or a market is the critical variable that explains much of the success and failure of new business approaches, Roberts & Berry propose entry strategies even for the extreme situation where both the technology and a market may be new to a company, a situation that is not favorable yet might be inevitable in a developing country that is building its economy from scratch and willing to experiment, take risks, and learn.

To understand the proposed framework one should understand first how the framework defines a company's "newness" and "familiarity" with new markets or new products. To borrow the definition proposed by the authors:

- Newness of a technology or service: the degree to which that technology or service has not formerly been embodied within the products of the company.
- Newness of a market: the degree to which the products of the company have not formerly been targeted at that particular market.

- Familiarity with a technology: the degree to which knowledge of the technology exists within the company, but is not necessarily embodied in the products.
- Familiarity with a market: the degree to which the characteristics and business patterns of a market are understood within the company, but not necessarily as a result of participation in the market.

Roberts & Berry do not confine the definition of the market here to the five competitive forces -- (1) intensity of rivalry, (2) barriers to entry, (3) substitution pressures, (4) supplier bargaining power, and (5) buyer bargaining power which constitute the popular Porter model for industry and competitive analysis; they include also the appropriate pattern of doing business that may lead to competitive advantage. In this sense, Austin's EAF is more relevant to what is meant here by a market.

Roberts & Berry show that with some simple tests one can distinguish between "base technologies" and "new technologies," and between "base markets" and "new markets." Within the new technology category, they also propose a set of questions that distinguish a new familiar from a new unfamiliar technology. The same applies to new markets. Consequently, Roberts & Berry place this new business conceptually on a 3x3 matrix.

Having defined a framework for entry status, Roberts & Berry used their literature survey to fill the 3x3 matrix with suggested strategies for new business entry, depending on a firm's entry status. The result is The Technology-Market Familiarity Matrix (Figure 4), slightly modified by the author to include strategic alliances wherever joint ventures (JVs) were suggested initially by Roberts & Berry.

<b>Market Factors</b>	New Unfamiliar	Joint Ventures/ <i>Strategic Alliances</i>	Venture Capital or Venture Nurturing or Educational Acquisitions	Venture Capital or Venture Nurturing or Educational Acquisitions
	New Familiar	Internal Market Developments or Acquisitions (or JVs/ <i>Strategic Alliances</i> )	Internal Ventures or Acquisitions or Licensing	Venture Capital or Venture Nurturing or Educational Acquisitions
	Base	Internal Base Developments (or Acquisitions)	Internal Product Development or Acquisitions or Licensing	"New Style" Joint Ventures ( <i>Strategic Alliances</i> )
		Base	New Familiar	New Unfamiliar
		<b>Technologies or Services Embodied in the Product</b>		

**Figure 4 Optimum Entry Strategies**

## Internal development

Here only in-house resources are exploited as a basis for establishing a business new to the company. Although internal development had been one of the traditional routes for new business development of large firms, this tendency is subsiding in the face of rapid technological change, increased cost of innovation, international diffusion of technology, and increased competition. These new realities are fostering more and more collaboration between companies worldwide. These new realities are discussed further in the following chapter.

For technology-based start-ups, Roberts thinks that in pursuing an internal development strategy a firm could be adopting a focused strategy of building a critical mass of technological skills for a closely related product portfolio, believing that the distinctive competence achieved in its core technology will become the basis of lasting competitive advantage. After building an internal critical mass of engineering talent in a focused technological area, successful firms usually target a focused set of customer needs, then gradually broaden the group of end-users (Roberts 1991).

## Acquisition

Acquisition is the second traditional route for new business entry. Acquisition enables a firm to move very quickly in a diversified way into somebody else's established market/technology position. This is particularly adequate if key parameters for success in the new business field are intangible, such as patents, or R&D skills which are difficult to duplicate via internal development within reasonable costs and time scales. Roberts regards acquisitions of companies in unfamiliar market and technology areas as strategic fallacies. Even related acquisitions are not risk-free. The usual near-term outcome of the acquisitions of small technology-based companies in the United States has been the loss of key people: the founder-entrepreneur, the primary talent upon which the acquired company was based (Roberts 1986).

## Licensing

Licensing is acquiring a technology but not a company. It allows the exploitation of the experience of firms who already developed and marketed the product.

### Internal venture

In contrast to the internal development discussed earlier, in this strategy a corporation enters different markets or develops substantially different products from its existing base business by setting up a separate entity within the existing corporate body that would exploit different diversification opportunities. Roberts finds mixed records in this approach. 3M has been the most consistently successful firm in this strategy. Their success has been a result of their ability in harnessing and nurturing entrepreneurial behavior within the corporation.

### Joint ventures or strategic alliances

Joint Venture (JV) is a term that has been used in literature to refer to various forms of collaboration starting from those entered on a contractual basis -- thus representing the simplest legal structure -- to those entered on corporate bases, i.e. involving the formation of a corporation whose shares are owned by the JV partners. The latter type is the traditional form of Joint Ventures referred to in the Roberts & Berry's Familiarity Matrix. From this point on, the term JV will be used in this thesis to refer to this traditional form.



A Joint Venture has its own administrative hierarchy for setting general operational and strategic policies, and its governing body is usually composed of representatives from both companies. Some advantages to this form of Joint Ventures stem from both partners' equity positions that help align incentives and lower the risks. Other advantages stem from the legal protection that partners enjoy with respect to the technology or other strategic assets which might develop from the Venture. But these JVs entail costs that make this more hierarchical form of governance appropriate primarily for longer-term projects that involve heavy capital or technological commitment from both parties.

To explain firms' motivations to Joint Ventures in general, three theories were developed (Kogut 1988): the transaction costs theory, the strategic behavior theory, and the organizational learning theory. The transaction costs approach argues that firms transact by a mode which minimizes the sum of production and transaction costs, whereas the strategic behavior posits that firms transact by a mode which maximizes profits through improving a firm's competitive position. Studies to date show evidence for both market power and efficiency. But while evidence of market power supports the strategic behavior theory, evidence for efficiency is consistent but not confirmatory of the transaction costs theory. Kogut finds that the two theories are complementary

and not substitutes, and as such, while concentrating on strategic behavior helps analyze the selection of partners and the stability of a joint venture in the context of competitive positioning, the transaction costs theory can be complementary in analyzing problems, for example in bilateral bargaining. The organizational learning theory, on the other hand, rests on the theme that a joint venture can be used as a vehicle by which organizationally embedded knowledge, tacit knowledge, is transferred. There are of course many difficulties associated with transferring tacit knowledge.

Strategic symmetry between partners is key to JV success (Harrigan 1987). This symmetry occurs when partners possess complementary strategic missions, resource capabilities, managerial capabilities, and other attributes that have a strategic fit such that the relative bargaining power of the partners is evenly matched. According to Roberts, in the case of small- and large-company JVs, this symmetry erodes with time in favor of the large company. This is a reason for the more popular strategic alliances between small and large companies. Hlavacek et al. and Roberts find the latter more interesting than the traditional JVs which in their view have limited life and/or growth potential.

Hlavacek et al. and Roberts first defined the "new style" Joint Venture in 1984 as one where a large and a small company

combine their complementary comparative advantages to create a new entry into the marketplace. Such a "New Style" joint venture does not entail the formation of a third company. Although this form of JV is also labelled "direct strategic co-investments," the label that really became popular for them is "strategic alliances." The latter label and others, such as "corporate partnering" and "corporate collaborations," sometimes take broader connotations and are not restricted to alliances between large and small which Roberts and Hlavacek et al. found unique and interesting.

Roberts (1986) makes a distinction between two kinds of alliances, one strategic and one operational. He describes the strategic as those with the objectives of entering into new industry, achieving growth and/or diversification, or trying to preserve a primary business. The operational alliances in his definition are not strategic at all. They are attempts to improve incrementally the performance of the current businesses.

### Corporate Venture Capital

The Corporate Venture Capital (CVC) strategy permits some degree of entry with the lowest level of corporate commitment. Major corporations have exploited this approach with the intention of creating "window" on new technology or merely

making a good return on invested funds. The window on technology is particularly appealing because major new business areas have evolved from innovative high-tech small companies.

Roberts & Yates (1991) found venture capital firms to be the key deal source for the more strategically successful CVCs. Successful CVCs were found to first invest in venture capital funds as venture capital limited partners, then to take more proactive long-run approaches which link the venture capital strategy with broader venture and business development strategies: coupling with internal ventures, forming strategic alliances, engaging in some small company acquisitions, doing some related R&D internally, and so forth.

Roberts emphasizes that companies considering a venture capital strategy must be very careful in choosing the pooled funds to work with. He recommends working with more than one fund. He also identifies the criterion for choice to be compatibility between the objectives and attitudes of the corporation and the venture capitalists being screened.

### Venture Nurturing

In situations when the investing firm provides managerial assistance to the recipient of the venture capital fund, the

strategy is classified as "venture nurturing" as opposed to pure venture capital. Roberts & Berry find this strategy a far more sensible entry strategy into new businesses than simply providing funds.

### Educational Acquisitions

Roberts & Berry find acquisitions for educational purposes a faster route to familiarity than the venture capital "window" approach. A potential drawback in this approach is that it usually requires a higher level of financial commitment than venture capital minority investment which increases risk. These acquisitions must be designed carefully to insure that key people do not leave soon after the acquisition as a result of removal of entrepreneurial incentives.

**CHAPTER THREE**  
**INTERNATIONAL STRATEGIC ALLIANCES**

**1. Introduction**

This chapter discusses the case of the United States-Israel Binational Industrial Research and Development Foundation (BIRD) which encouraged the emergence of similar binational models in other settings. As of 1991, thirty-nine countries had approached the United States Department of Commerce to establish programs extending from the BIRD model. The first extension from the US-Israel BIRD program was the United States-India Program for the Advancement of Commercial Technology (PACT), followed later by the Program for Acceleration of Commercial Energy Research (PACER). These two programs will be touched on in this chapter. This chapter concludes with a case study of the Palestinian Economic Development Group, in order to demonstrate the implications of international strategic alliances on the Palestinian setting.

Methodologically this chapter will view a nation-state similar to a corporation and as such Roberts & Berry's framework will be used in the analysis of Israel's development strategy behind BIRD. As most BIRD projects do not involve the establishment of a third organization, the term strategic alliances will be used for the BIRD projects.

Working also within Austin's Environmental Analysis Framework, BIRD will illustrate how this development strategy and the national business environment implementing it, are being shaped not only by national but also by international economic, political, cultural, and demographic factors. As mentioned, technology is defined within the economic factor in Austin's Environmental Analysis Framework and as such the BIRD case will illustrate how technology in one country, the US in this case, carries competitive implications for a company in another country, Israel in this case.

## **2. US-Israel Binational Industrial Research and Development Foundation (BIRD)**

### **A. Historical Background**

BIRD was established in 1977 by the governments of the United States and Israel to promote and support non-defense industrial research and development alliances between US and Israeli companies. BIRD is financed through an endowment -- initially \$60 million, later raised to \$110 million -- that was contributed equally by the two governments. BIRD cost-shares 50:50 with each partner in a US company-Israeli company alliance. If the budget of the Israeli company for the project is  $x$  and the budget of the US company for it is  $y$ , BIRD would invest half the total budget, i.e.  $1/2 (x+y)$ . BIRD does not

acquire equity stakes in companies it supports. If a project fails, all parties lose the money invested; if it succeeds, BIRD receives royalties -- a pre-tax expense to the payer -- up to a maximum of 150 percent of the BIRD investment.

The concept of the BIRD Foundation was developed in the United States-Israel Advisory Council, formed in 1976 during the Carter administration. The agreement first emphasized R&D collaboration, and was later expanded to encompass R&D and commercialization. As such the cooperation includes all applied scientific activities needed in the process through which an innovation becomes a commercial product, including product engineering and manufacturing.

There are three categories of BIRD-funded projects with different formalities associated: full-scale projects, which have a total budget in the range between \$200,000 and \$2,500,000 and a total duration between one to three years; mini-projects, which have a total budget of less than \$200,000; and tests of feasibility of new concepts, which have a budget of \$60,000 or less.

In its first ten years of existence, BIRD funded 106 full-scale projects and 50 mini-projects and tests of feasibility. Out of these, 44 percent, or 69 projects, led to the sale of a new product. Out of these 69 projects, 18 had sales of over



\$1 million and 2 had sales of over \$100 million (Yahalomi 1991).

By end of 1992, BIRD had started its 330th project and had invested about \$92 million so far as its 50 percent cost-share. Of these projects, 175 led to sales. BIRD claims that the total business generated to the benefit of companies in the two countries as a direct or directly traced result of BIRD support is in the vicinity of \$3 billion (BIRD 1992 Annual Report).

#### **B. The Israeli Environmental Factors**

Two Israeli factors are relevant to BIRD formation and progress, one is the economic and the other is political.

Since its establishment in the aftermath of the 1948 war, the Israeli government realized that Israel is too small to achieve an efficient scale of production in many industries by serving its own domestic market alone. It also realized that lack of natural resources meant investing in human capital, encouraging R&D, and building a strong scientific and technological infrastructure that will support an export-oriented economy. Until 1991 there were over fifty-thousand scientists and engineers in Israel, of which about ten percent were engaged in industrial R&D. This number is increasing

with the influx of Russian Jews. Exports of Israel's high-tech industries have grown from nearly \$300 thousand in 1978 to nearly \$3 billion in 1991. The free-trade agreements between Israel and the European Community and between Israel and the US further promote hi-tech exports from Israel (Yahalomi 1991).

### **C. The US Environmental Factors**

Two US factors are relevant to the BIRD case, the first is technology, the second is political.

Technologies affecting most industries are changing rapidly, breeding greater need for strategic alliances worldwide. To understand this, one may think of technologies as living organisms with S-shape life cycles, from birth, to growth, to maturity, to old age. These life-cycles for both products and processes are relentlessly being shortened, and the displacement of mature-to-aging technologies by upstart new ones has become endless and fast, posing new challenges to firms worldwide, including those in the US. Foster (1986) showed that S-curves come in at least pairs: "The gap between the pair of S-curves represents a discontinuity -- a point when one technology replaces another.... Companies that have learnt how to cross technological discontinuities have escaped a trap." As the frequency of these technological

discontinuities is on the rise, firms in the US, as elsewhere, are realizing that their in-house capabilities no longer suffice. The speed of technological change, in addition to rapid imitation, has increased the speed with which new technologies must be commercialized to the point that few firms have the time to assemble all the requisite capabilities in-house. It can be added that the costs of innovation have increased markedly, decreasing the ability of any single firm to make it alone. International diffusion of innovation is decreasing the probability of any one firm, even a multinational, to command all relevant experience for a particular project.

On the political level, the United States government, in pursuing this BIRD program, was among other things seeking a mechanism for supporting developing nations that would bypass the problem of aid monies falling into the pockets of government officials, not into the hands of the people or the free market. The strong Jewish lobby in the US had influenced the US decision in making Israel the first country with whom to share a bilateral industrial agreement.

#### **D. BIRD Projects' Evaluation Process**

Once a US company and an Israeli company have decided on a project, the formalities associated with proposal preparation,

evaluation, and decision-making are dependant on the category of the potential BIRD project. For mini-projects, formalities associated with proposal preparation are minimal and the Executive Director of BIRD makes the decision without outside review of the proposal. For full-scale projects the process is more demanding: The evaluation process starts with tentative assessment of the merits of the potential project by BIRD staff. If the venture looks worthwhile BIRD requests a business plan. BIRD usually gives guidance in developing the business plan. Two to three months after the business plan is finalized, BIRD sends it to the Israeli Office of Chief Scientist (IOCS) and to the US National Institute of Standards and Technology (NIST) to get their assessment of the technical feasibility of the proposed project. Upon receiving these comments, BIRD undertakes a thorough analysis, taking into consideration the venture's expected future cash flow, the Israeli company's competitive position, and the likelihood of the American partner's benefit. At the completion of this stage, BIRD sends the results to three board members in each country. Final project approval is conditional on the consent of four of the six board members.

A strategically important element for BIRD is the US National Institute of Standards and Technology (NIST) which provides accurate measurements, including comments on technological feasibility, technical abilities of project personnel, the

reasonableness of the implementation time horizon, and proposed budget. NIST is a US government organization with a broad base of knowledge and experience. It was established in 1901 to aid manufacturing, commerce, government, and academia through developing the standards, measurement techniques, reference data, test methods, and calibration services that help ensure national and international measurement compatibility. NIST operates on an annual budget of \$260 million (60 percent from the Congress, 30 percent from other government agencies, 10 percent from the private industrial sector). NIST employs a highly skilled staff of 3000 and controls some of the premier research and testing facilities throughout the United States. The reputation of NIST adds great credibility to the proposed venture. Some companies would not invest in projects without the approval of NIST.

The IOCS is an Israeli government agency that operates under the Ministry of Industry and Commerce. IOCS evaluates projects on the basis of the level of technological innovation. IOCS claims preference for projects that demonstrate the potential for the expansion of scientific manpower and result in products with high value-added that are likely to be competitive in international markets. IOCS lacks the personnel and resources to review projects adequately (Yahalomi 1991). It does not assess the management, marketing, and financial capabilities of the applicant firms. In response to the

question of what BIRD can learn from IOCS, sent to sixty Israeli companies, 79 percent indicated that BIRD can learn nothing from IOCS. One of them is quoted as saying: "BIRD can learn how not to work from IOCS" and another saying: "Chief Scientist is too closely tied to Israeli bureaucracy."

#### **E. BIRD's Involvement in the Strategic Alliances**

In principle, BIRD finds the deal between two partners entirely their affair, not BIRD's. Unless specifically invited BIRD does not get involved in deal formation (BIRD 1992 Annual Report). Companies, however, are required to issue a progress report to the foundation on a semiannual basis. In addition, BIRD staff visits companies and reviews their technological development, internal accounting, and commercialization progress. In Yahalomi's study (1991) fifty Israeli companies were asked to mention one change in BIRD's policies or procedures that they could suggest. Only 31 percent suggested no changes to BIRD due to total satisfaction, while 24 percent suggested more involvement by BIRD in the form of continuous monitoring of the projects, active role during partners disagreements, more help in selecting the partners in the US, or more mentoring. Sixteen percent of respondents called for different resource allocation and focus such as allocating more of the money to the Israeli company and targeting only small companies. Sixteen percent called for more resources

and funds, especially to finance the marketing stage. Fourteen percent called for more flexibility in terms of repayment to BIRD or eliminating the dependency on the Israeli Office of the Chief Scientist.

In response to a question addressed to 59 Israeli companies, in Yahalomi's study about what Israeli companies had learned from BIRD's partnership, 35 percent gave answers related to partner relationship management such as "Importance of having strong project managers in both companies involved," "Importance of face to face interaction," or "Two companies must be equally committed to the overall success of the project." Thirty-three percent of the responses indicated a marketing lesson, such as "Spend more time and resources with your customers in learning their needs and integrate them fully in the R&D process," "The specific demands of the US market," and "To define the market niche more carefully." Twenty percent of the responses indicated that the greatest lessons were in technology/R&D. Addressing the same question to 38 US companies, 45 percent of the responses indicated that the greatest lessons were related to partner relationship management. Some quotations from US companies were "Spell out payback responsibilities carefully," "Be more selective in choice of partner," and "Be prepared for communication/cultural problems." Twenty percent of the responses were cost-related: "Off-shore development is possible. Can give low cost

benefits to US partner"; 18 percent referred to marketing lessons: "Control the marketing in the US" or "Need to do more of market study." Ten percent of the responses spoke of time as the key to success; and finally, 8 percent spoke of a need to administer and plan the project jointly.

With respect to the initiation of contact with US companies, Yahalomi's study showed that BIRD had not initiated contacts with US companies in more than 3-7 percent of the total sample. In a phone interview with the previous Executive Director of BIRD, Dr. Mlavsky, he attributed these results to the fact that Yahalomi's data was relatively old and that in the past three years BIRD had actually initiated the contact in about sixty percent of the BIRD projects. Dr. Mlavsky associates this improvement with the development of BIRD Information Tracking System (BITS), a computer information system that is now utilized at BIRD.

A crucial point raised by Dr. Mlavsky is that BIRD is now targeting American companies that have high growth rate, not those that are large. The wisdom behind this is that medium-sized US companies are most likely to engage the company president himself in the BIRD project, ensuring a higher degree of commitment from the US partner.



## **F. BIRD Companies' Motivation for Strategic Alliances**

A survey by Yahalomi (1991), including 97 Israeli and 51 US companies involved in 110 BIRD projects, showed that access to the US market was the main motive of Israeli companies in entering a BIRD partnership. A second motive was access to financial support from the BIRD foundation. For US companies, on the other hand, financial support from BIRD, obtaining technology, and saving time in R&D were found to be the critical considerations in entering an alliance with an Israeli firm.

## **G. Partner Selection in BIRD Projects**

In regard to partner selection criteria, Israeli companies were found to choose partners on the basis of marketing know-how, distribution channels, and access to customers of the potential partner. US companies on the other hand rated technology know-how as the most important factor in partner selection. Exploring the influence of nationality/ethnicity in partner selection, the study revealed that while US firms' choice was influenced by a firm's location in the holy land, Israeli firms indicated that Jewish management or ownership of the US companies were not important in their partnership decisions.

In response to questions regarding the contribution of each partner, 65 percent of the observations indicated that R&D was conducted solely by the Israeli partner. In no case was R&D conducted solely by the US partner. On the other hand, 66 percent of the responses indicated that the marketing function was conducted solely by the US partner. The Israeli partner, by contrast, was never the sole "marketing" partner. With reference to market definition, 56.6 percent of the responses indicated that the US partner was solely responsible for market definition throughout the product life cycle. In only 27.3 percent of responses was the definition of the market shared by both the Israeli and US partners.

#### **H. Problems and Disagreements in BIRD's Strategic Alliances**

In response to questions regarding key problems and disagreements in BIRD alliances, Yahalomi's study showed that the Israeli companies found the principal problems related to the US partner's commitment, especially when there is change in the US corporation's strategy. They indicated other problems as well, including personal communication and the inability of the US partner to deliver. The US companies as well cited problems related to the inability of the partner to deliver, personal communication, partner's commitment, and trust. The US companies cited more problems, on average, with a strategic alliance than did the Israelis.

In studying the correlation between strategic alliance performance and the scale of projects, two performance measures for 56 full-scale projects and 26 mini-scale projects were compared: one being royalties-to-grants measures and the other being a failure/success variable defined as the ratio of number of successes to the total number of projects in each scale category. In creating the failure/success variable, performance was divided into five levels, only two of which were counted in the study as successful. One level was the case where the strategic alliance developed a product that became a commercial success, or where the strategic alliance developed a product for the right market in a timely way and had the potential to become commercially successful judging by the initial strong sales achieved. The empirical findings of a model linking strategic alliance performance to a variety of factors showed (Yahalomi 1991) success to be positively correlated with the size and age of the Israeli company. From a commentary statement by the BIRD office in Boston on the issue of size, it appears that BIRD has a preference for larger Israeli firms. "Bigger Israeli firms are more likely to succeed due to their better managerial skills which give them better understanding of the dynamics of international partnerships. It is also less risky for us." Unfortunately, Yahalomi's study is not clear as to whether the suggestions for more mentoring by BIRD, more involvement by BIRD in partnership selection, and deal structuring were voiced mostly

by smaller Israeli firms, but this is a reasonable assumption based on the available information.

The relationship between industry classification and the performance of the venture, as measured by the success/failure variable for 110 projects, indicates a significant industry effect on the strategic alliance performance. The largest share of success occurred in the software industry (43.5 percent vs. 25.4 percent on other hi-tech sectors), and within the software industry full-scale projects had a greater rate of success (70 percent) than mini-scale projects (23 percent). The superior performance of the software industry was supported also by a high royalty-to-grant ratio of 21 percent. Despite the small sample taken, communication and semiconductor devices appeared to have performed reasonably well while the machinery and the equipment sector seemed to have performed weakly. In the Israeli data base (97 projects), software industry has a lower mean time (18.4 months) in comparison to an average time of 23.65 months spent on R&D for all projects combined.

#### **I. Remarks on BIRD**

The BIRD example reveals that not only national but also international environmental factors carry competitive implications for local firms operating in an LDC. The meshing

and the exchange of core competencies between the technologically innovative but organizationally and managerially less mature Israeli firm and the US partner who has market access and more marketing expertise explain the premise of BIRD strategic alliances. Methodologically a nation-state can be viewed as a corporation, and as such Roberts & Berry's framework (presented in the previous chapter) lends itself easily to the explanation of a strategic alliance as a strategy based on the complementary technology-market variables brought by BIRD partners.

The fact that there is little sharing between the Israeli and US partners in market definition appears problematic, since in today's rapidly moving and highly competitive market it is necessary to employ integrated strategies combining marketing and technology in the design of new products. Urban & Star (1991) report that true integration between technology and marketing occurs only when strategic programs "to make it happen" have been put in place. They give three mechanisms that are typically used by firms to support strategies requiring the integration between marketing and technology: (1) organizational structures, (2) interpersonal relations, and (3) analytical support.

An example of organizational structures that can be formed to integrate marketing and R&D is an integrated design group consisting of marketing, R&D, engineering, and manufacturing.

Cultural conflicts are bound to rise when marketing people are not technically trained, tend to have short-term perspectives, or prefer structured tasks, while R&D engineers or scientists lack training in marketing and management, tend to focus on the long-term, or are comfortable working on unstructured tasks. Actually, these cultural conflicts are very common between R&D and marketing people in many settings. Interpersonal relations and communication can be improved if the marketing people understand the technology underlying the business and if R&D people understand the customer needs.

One good example of an analytical support procedure that can force integration between marketing and R&D is "Quality Functional Deployment" (QFD). In QFD, customer requirements are transformed into detailed engineering specifications through an "integrated design" effort that evaluates simultaneously alternative product designs and production processes, taking the end user into consideration as well as both the functional specifications and manufacturing constraints and efficiencies.

With reference to disagreements and problem variables, both the Israeli and the US companies have cited similar problems that are not distinct from those which are commonly cited in strategic alliances formed within a national border. The question of why such problems rise may find partial explanation in the cultural differences between marketing and technology people, touched on above. Other reasons include overestimating the larger company's distribution capability, overestimating the smaller company's technological leadership, inadequate internal structures and incentives for cooperation, and lastly, power struggles that are amplified due to a common lack of organizational structure in strategic alliances. Roberts believes that structuring such an alliance from the beginning alleviates many conflict problems. In the process of designing and planning for a strategic alliance he recommends the following:

First, not only organizational commitments but also personal commitments should be the basis for strategic alliances. Second, those commitments demand management time and hence if one partner does not devote enough senior time to nurture the relationship, the alliance is bound to fail. Third, the strategic alliance must be based on mutual trust. Fourth, the strategic alliance must offer mutual benefits. The benefits do not have to be the same for all partners: To one it could be exposure, to the other it could be money, growth or learning, yet those different benefits need to be in line with shared expectations up front. Fifth, independence needs to be preserved for partners in spite of the fact that expectations are shared.

The finding that larger Israeli firms perform better in an alliance seems problematic from the point of view of economic

development and job creation. The previous analysis of BIRD's involvement pattern suggests that this is due to insufficient support and mentoring from BIRD, which manifests itself more clearly in the case of smaller and less experienced Israeli firms. Mentoring and nurturing small firms is always hard to do.

In spite of all the problems that leave a lot of room for improvement at BIRD, the BIRD example shows how a development strategy based on the formation of alliances can correct for financial and information imperfection in a developing country and enhance the capabilities of local high-technology firms.

### **3. The US-India PACT Alliances and PACER Consortium Projects**

As an extension from the BIRD model, two technology-based development programs for India were launched by the United States Agency for International Development (USAID). The two programs, PACT and PACER, were aimed at addressing the twin problems in India -- lack of an industrial framework for commercialization of technologies, and lack of funds for industrial R&D. The programs attempted to capitalize on the cost advantage that inexpensive R&D in India would carry to participating US firms. The two programs also attempted to target potential markets in India and abroad.



PACT was the outcome of a 1985 agreement between the US and Indian governments under which USAID provided a grant of \$10 million to establish a technology fund for the promotion and financing of Indo-US R&D joint ventures/strategic alliances. Because USAID lacked the staff, it turned the fund to the Industrial Credit and Investment Corp (ICICI), India's premier development financing institution. Battelle Memorial Institute of Ohio was to provide advice to prospective US participants. PACT finances in the form of conditional grants -- up to \$500,000 -- half the cost of an R&D joint project. Similar to the case with BIRD, a project must be proposed by a US and an Indian company as a team, and if it succeeds and results in commercialization, the R&D joint venture/ strategic alliance must repay to ICIC up to twice the amount of the grant. If the project is unsuccessful, nobody pays anything.

The Program for Acceleration of Commercial Energy Research (PACER) was launched in 1987 by USAID through a grant of \$20 million to ICIC, with the objective of bringing about operational and organizational models in India that would facilitate the utilization of research in developing and commercializing energy technologies. The main strategy underlying PACER is the formation of consortia between energy sector manufacturers and research establishments and/or end-user industries, to develop efficient market-driven products in the energy sector.

In the consortium projects, PACER puts emphasis on industrial firms taking the leading role in identifying their knowledge gaps and finding research organizations and experts to provide the missing input.

PACER was also structured to provide support for fundamental research leading to commercialization at a downstream stage, as well as for energy policy research and analysis. Unlike PACT, PACER does not require a US partner as a condition for eligibility; nevertheless, a US partner is strongly emphasized by USAID. Until June 1992 PACER committed over \$7 million to 15 R&D projects, of which three were successfully completed.

Encouraged by the modest success of the first two projects, USAID has promoted a third program -- Agricultural Commercialization and Enterprise (ACE) -- with a fund of \$20 million.

#### **4. The Palestinian Economic Development Group (EDG)**

The policy of EDG is set by a board of trustees whose twelve members represent a cross-section of the Palestinian society in the Occupied Territories. EDG's West Bank operations are managed by a general manager, and a supporting staff that includes a financial manager, a training officer, four field officers, an accountant, an administrator, and two

secretaries. In Gaza, EDG activities are supervised by a manager who is assisted by two field officers. For the sake of covering a wider geographic area, EDG opened two regional offices -- one in Nablus and a second in Ramallah. Due to curfews and national strikes, the mobility of EDG employees is quite often restricted. While EDG is supposed to work 292 days a year, this number dropped to 240 due to political strikes in the territories, and dropped further to 220 due to forced closures and curfews imposed by the Israeli military authorities.

EC has been the major source of funding for EDG. Approximately 80 percent of EDG's capital (approximately \$8.5 million) came from the EC in the form of grants which are distributed to eligible borrowers strictly on a loan basis. Other main sources of funding have been the Welfare Association (a Palestinian institute based in Geneva), and the Arab Fund for Economic and Social Development in Kuwait.

Until the end of 1992 EDG had supported approximately 342 projects in the West Bank (including East Jerusalem) and Gaza Strip. By the end of 1992, the aggregate volume of credit advanced by EDG to these projects amounted to almost \$3.4 million. The loans have ranged between \$2000 to \$77,000 -- on average approximately \$10,000. This is tiny and cannot possibly be enough to matter to industry.

Recipients of EDG funds are asked to co-invest in the range of 20-50 percent of the total investment, depending on the size of the loan. EDG requires 2-3 credible guarantors to co-sign the loan agreement with a recipient. EDG does not charge commercial interest on its loans, but in order to cover its operational expenses, borrowers are charged an annual service fee of approximately 3 percent of the loan, deducted at the beginning of the loan from the whole amount. Full repayment is expected within a maximum of seven years, which includes a grace period of 6 to 12 months.

When EDG commenced its activities in 1987, the allocation of funds targeted three groups: women, unemployed university graduates, and released political prisoners. EDG funded start-up companies and existing companies. Initially, EDG funded projects in three sectors: agriculture, industry, and service. After the agreement of December 1992 with other credit organizations, EDG now concentrates on the industrial sector. Apparently dissatisfied with the performance of EDG's smaller projects and in response to the recent change in the military authority decision-making process, EDG is now investing in medium-sized to larger projects with budgets above \$200,000 dollars. According to the responses received from a questionnaire sent to EDG, EDG now favors companies with more than twenty employees and more than \$1 million in sales. This might omit some worthwhile start-up companies that

have reasonable budgets in the range \$50-150,000. According to responses from the same questionnaire, EDG now prefers companies with more than one founder, and with experience in marketing. This is very wise and agrees with a research conducted by Roberts (1991). The following declaration by EDG is a translation of the recent shifts in direction:

While EDG is committed to continuing its support of small businesses, it is now clear that larger projects, mainly in the industrial sector, provide a more efficient alternative for generating employment, accelerating the manufacture of Palestinian goods and thereby reducing imports. Projects receiving a smaller scale of credit will continue to be funded from EDG's annual budget with particular focus on groups with unique and specific needs such as the physically handicapped and women.

No data are available at EDG regarding the total sales achieved by sponsored projects, but EDG estimates the number of additional full-time jobs created by EDG-sponsored projects in the vicinity of 1200 to date. EDG has been measuring the success of projects by survival only. Out of 385 projects sponsored by EDG, 325 have resulted in sales; out of these, 290 have repaid part of the loan to EDG, and only thirty have repaid the loan in full.

According to EDG, no EDG-sponsored project to date has resulted in exports from the Occupied Territories. This situation is expected to change, as there are six EDG export-oriented projects to this date and there will be around twenty by the end of the year. According to Samir Huleileh, EDG

Executive Director, the total goods exported from the Occupied Territories across the Jordan River into Jordan are estimated at approximately \$20 million annually. The goods that are exported to Israel on a sub-contract basis are estimated at approximately \$150 million annually. The first category includes stone bricks, processed food, and some metal products such as welding electrodes. The latter category includes mostly shoe wear, textiles, and plastic products, which get re-exported out of Israel.

None of the projects sponsored involve a joint research project with a university, with the exception of market studies that are often conducted by economists at local universities. In principle, EDG has no objection to sponsoring a collaboration between industry and a university, and neither do local universities, in the view of EDG. Some sponsored projects have technology license agreements or contractual joint projects with European companies; however, EDG was not involved in initiating or negotiating terms of such arrangements.

Thus far the role of EC has been limited to organizing exhibitions for Palestinian goods in Europe, but no attempt has been made to initiate and encourage collaboration between European and Palestinian companies. Things might be changing with the emergence of the EC-funded Palestine Trade Promotion

Organization (PTPO). Holland has provided an initial fund of \$650,000 for PTPO, which already has an office in Holland. The EC has awarded a grant of ECU 300,000 for the European-Palestinian Chamber of Commerce.

EDG has not yet approached EC with a request that aims to facilitate access to the EC market, as EDG did not see the small projects it had sponsored until 1992 aimed at export. In March 1993 Palestine joined Business Net, a computer network linking European and Middle Eastern companies interested in exchanging information. EDG has been designated by EC as the intermediary in the Occupied Territories.

Only with a recent shift in strategy has EDG started to hire consultants in a systematic fashion to provide advice for the new medium-scale and larger-scale industrial projects.

The proposals for the "small" projects that were sponsored by EDG prior to 1993 were mostly simple and not based on market surveys. EDG did not set standards for market studies submitted by proposed projects. It does not help in preparing a business plan, nor has it given courses in preparing a business plan (a business plan in the form known in the US is rare in the Arab World).

It is interesting that BIRD and EDG, coming from two different cultures and business environments, both favor larger companies in their efforts of promoting economic development. This seems disturbing if the objectives were to minimize risk and mentoring of sponsored companies.

The credibility that EDG enjoys, both in the Palestinian society and with the EC, presents many challenges and opportunities for EDG. To be fair one should give credit to this private organization that has managed to get this far with limited resources and many environmental restrictions. However EDG is now facing a big managerial challenge: For a small private not-for-profit organization, EDG has been trying to fill too many gaps -- the social welfare gap, the financial gap, the managerial expertise gap, and the information gap. For example, their initial attempts to grant funds based on social need could explain much of the dissatisfaction with earlier projects, but this should not be mixed with the case of smaller projects with technical merit and market potential which might have performed poorly due to a shortage in mentoring, which again could be too demanding a responsibility for an organization like EDG.

Meanwhile EDG should incorporate the requirement for a business plan in their training program. They must make it a pre-requisite for both small and larger project applications.



The experience of Israeli BIRD companies proves that the BIRD's assistance with the business plan has helped those companies tremendously in articulating and thinking their plans through. EDG must make more use of consulting services to smaller projects. One possibility that EDG might consider is to spin out a for-profit venturous kind of enterprise that would provide business incubation to small businesses.

Furthermore, EDG should, with proper management and vision, experiment with PACER-like forms of consortia between industry and universities/research institutions in order to help industry and to enable university staff and new graduates to generate ideas that could later be commercialized and sponsored by EDG. To encourage such cooperation, EDG could consider implementing something similar to the Pellucio Incentive Plan by which industrial firms would be provided with budgets, or vouchers, that can only be spent to support research in a research institution or university (Allen et al. 1983).

EDG should also capitalize on their special contacts with the EC and PTPO to facilitate experimentation with a BIRD-like model, with the aim of improving the technological base and the market access of EDG-sponsored companies.

The fact that there have been productive forms of cooperation between Israeli and Palestinian enterprises, especially in the shoe wear and textile industries, gives hope for the post-peace era. However, considering that many of the post-peace future opportunities for Palestinian goods will be in the Arab markets, it makes more sense that the future post-peace cooperation between Israeli and Palestinian firms be based partly on Israel's technology base. As such, EDG could perhaps start sponsoring marketing functions for some existing industries in the Occupied Territories to enable them to build their own marketing capabilities and to expand their downstream opportunities and profits.

**CHAPTER FOUR**  
**HIGH-TECH PLANNED ECONOMIC DEVELOPMENT**

**1. Introduction**

This chapter addresses the following questions: Can a high-tech entrepreneurial region be planned, and can such planning give such a region a competitive edge in a 21st-century technology?

Because national governments worldwide seek to emulate the Boston-area pattern of technological entrepreneurship and Route 128 ("America's Technology Highway"), this chapter will start by presenting Bygrave & Timmons' model for high-tech economic development or the Bygrave-Timmons "genetic code" for a high-tech entrepreneurial region, which they based primarily on how the Route 128 area (the high-tech industrial region surrounding Boston) and its twin Silicon Valley (the high-tech region in California) have evolved. Because MIT played a key role as a spawning ground for innovation and entrepreneurship in the region, this chapter will discuss MIT, highlighting how environmental factors can and should redefine the role of a university and its relation to industry.

Although Route 128 was not deliberately planned by the government, there have been deliberate recent attempts to

design and develop high-tech entrepreneurial regions. Bygrave & Timmons define a genetic code for high-tech economic development which can be consciously replicated. An example of planned development will be presented, illustrating the cross-fertilization and cooperation of clusters of industry, academic, and government efforts. The example of planned development is chosen in this chapter from biotechnology, for a number of reasons:

First, biotechnology is a 21st-century industry. It is a brainpower industry, powerful enough to transform a society and create a national comparative advantage. It can be located anywhere. Where it will be located depends on who can organize the brainpower to capture it (Thurow 1992).

Second, the university was the birthplace of the biotechnology industry. The relationship of, and technology transfer from, university to industry remains the lifeblood of biotechnology which breeds many managerial, political, and cultural challenges that need to be considered.

Third, the commercial opportunities created by the critical discoveries of universities were developed by small entrepreneurial companies that owe their existence to financial backing from venture capital. Both the

entrepreneurial spirit and venture capital are behind the United States lead in biotechnology (Bygrave & Timmons 1992).

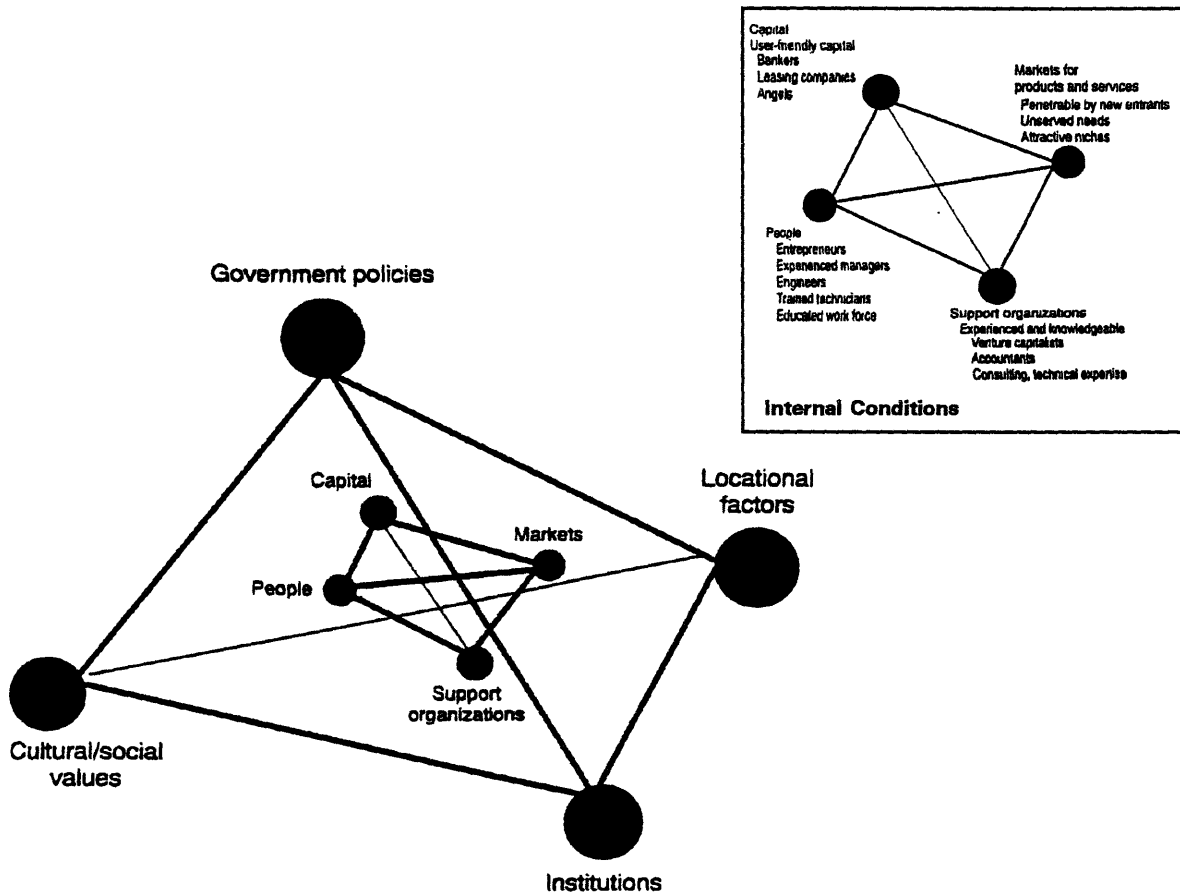
The example that will be considered is the Worcester-Massachusetts-based "First Biotechnology Super-Incubator," an outgrowth of the same environment that created Route 128.

To illustrate how an environment with the "genetic code" can empower an entrepreneur with determination and brilliance, the chapter will conclude with the case of Amira, a biotech company which spun off from MIT and was initially based in the so-called America's "First Biotechnology Super-incubator." The case will illustrate some building blocks that make entrepreneurship and technology venturing possible.

This chapter will conclude with strategic implications for the Arab World of which Palestine is an integral part. The implications will incorporate the role of rich Arab countries.

**2. Bygrave & Timmons' Model for High-Tech Economic Development**

Figure 5 illustrates the key precipitating and sustaining conditions that Bygrave & Timmons see fueling the engines of economic development. They divide these conditions into external and internal; the external refer to the environmental factors which are subcategorized into societal/cultural values, government policies, research and educational institutions, and locational factors.



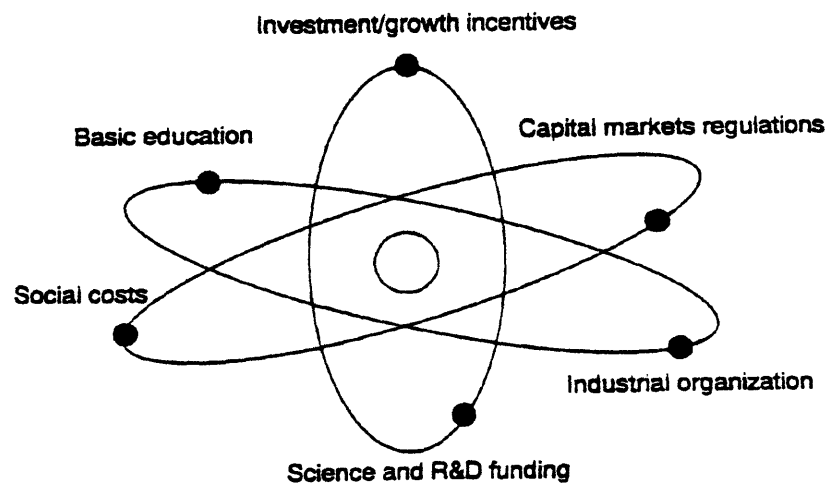
**Figure 5 Precipitating and Sustaining Conditions for Economic Development**

The model shown in Figure 5 illustrates the external factors revolving around people, capital, product/service markets, and support organizations from which new ventures are ultimately created and developed.

### External Factors in the Bygrave-Timmons Model

#### i. Government Policies

Bygrave & Timmons show the several fronts on which government policies influence economic development (Figure 6).



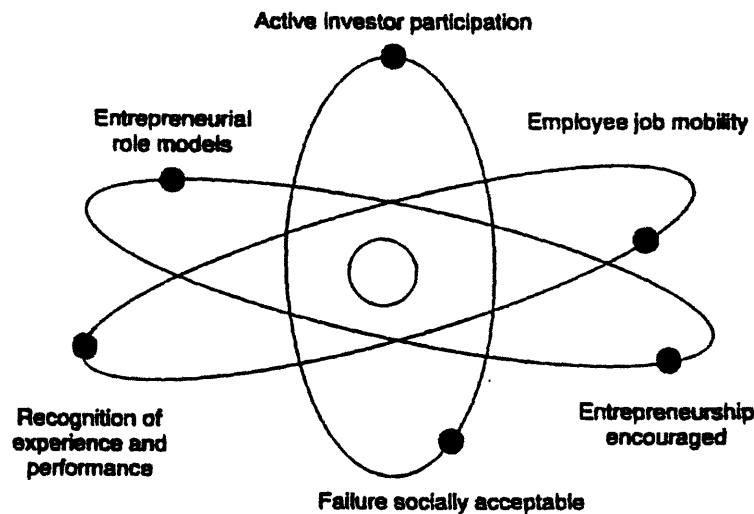
**Figure 6 Government Policies**

Bygrave & Timmons agree with Porter (1990) in that there is "legitimate role for government in shaping the context and institutional structure surrounding companies and in creating an environment that stimulates companies to gain competitive

advantage." However, they see the purpose of government initiative in encouraging entrepreneurship.

## ii. Societal Values

The elements that embody the determinant cultural/societal values in high-tech entrepreneurship are illustrated in Figure 7.



**Figure 7 Cultural/Societal Values**

A key determinant of the economic development process is the degree to which a society has a culture that encourages entrepreneurs, prizes their success, and tolerates their failure. Bygrave & Timmons believe that successful entrepreneurs must be visible so they can be role models in the society, not only to inspire those who seek to emulate them but also to set a positive tone in the local business culture for entrepreneurial activities. In addition, active



investor participation is a societal attribute that is highly important and reflects a sense of social responsibility and awareness.

### iii. Locational Factors

The proximity to resources such as education and research institutions, a well educated work force, capital, suppliers and customers are crucial to high-technology entrepreneurs (Figure 8).

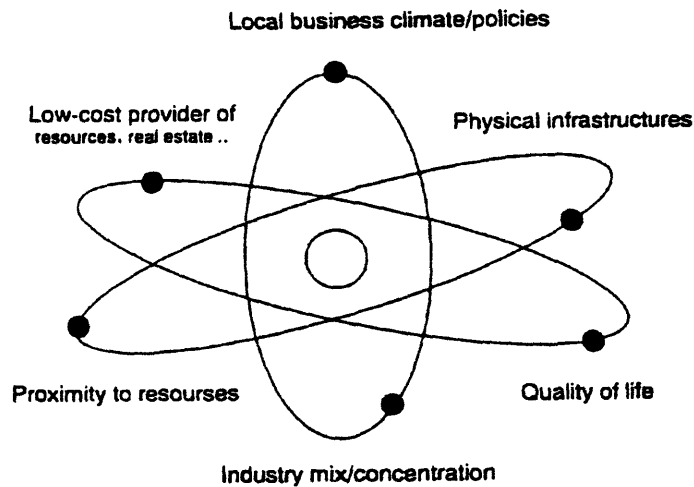


Figure 8 Locational Factors

#### iv. Institutions

The group referred to here include universities, research institutions (both public and private), and large enterprises. The example of MIT which follows will illustrate how a supportive value system in a university, combined with university-industry cooperation, can encourage entrepreneurship among faculty and staff members (Figure 9).

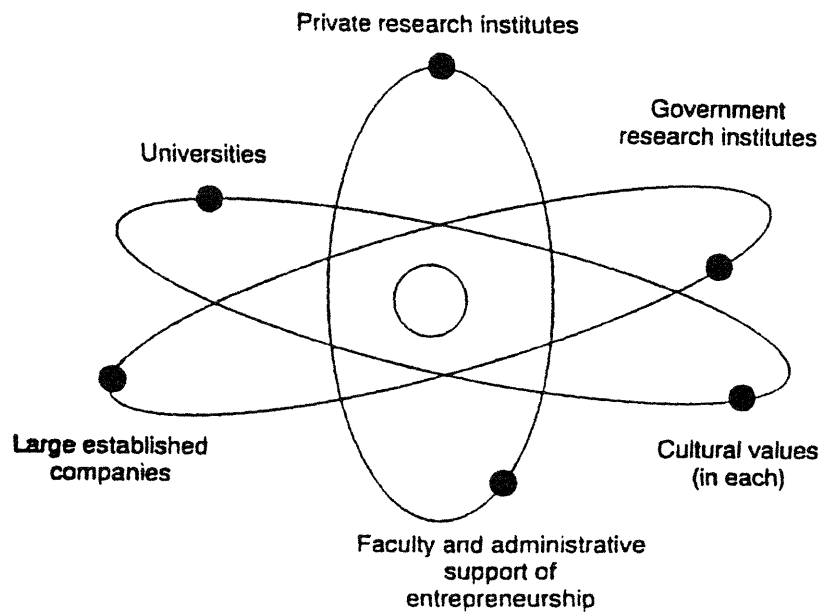


Figure 9 Institutions

### 3. Massachusetts Institute of Technology (MIT)

MIT was founded in 1861 by William Barton Rogers. The MIT slogan "Mens et Manus," the Latin for "Mind and Hands," explains why its logo shows the scholar and the craftsman in

parallel positions. This logo is symbolic of a culture that still prevails at MIT.

Roberts (1991) argues that the general environment of Greater Boston that began during the postwar period, and in particular the atmosphere at MIT, have played a strong role in creating "would be" local entrepreneurs. Specifically, he sees that two environmental factors were at play: first, the redirection of the university efforts from pure scientific inquiry to solving of critical problems. Second, the birth and continuing growth of venture capital which provided funding for new creative technology-based enterprises.

Roberts explains that World War II defined technology as the critical element upon which the survival of the nation rested. This element made universities, especially MIT, redirect their efforts from pure scientific inquiry to the solving of critical problems: "the science and its offspring technology had become the property of the whole nation with an immediate relevance for all people."

To maintain the relevance of university activities to the world outside the campus, MIT kept strong ties with industry. The MIT Industrial Liaison Program, which is the largest university-industry collaboration in the US, is a manifestation of this sustained tradition at MIT. The roots of

this program go back to the 1930s when MIT generated The Technology Plan, the first effort in the US to link a university to industry.

With respect to the venture capital industry, the landmark event in venture capital occurred in 1946 with the formation of American Research and Development (ARD), the first firm, as opposed to a private individual, to provide risk capital to new and rapidly growing firms, most of which were manufacturing and technology oriented. ARD was in part the brain-child of Compton, then-President of MIT, a man who brought MIT into intimacy with the war efforts just as he himself headed up all national R&D coordination in Washington (Roberts 1991).

The history and tradition at MIT of involvement with industry has long legitimized active consulting by faculty of about one day per week, and approves faculty part-time efforts in forming and building their own companies. This was extended to research staff as well. As a result, approximately half of MIT spin-off enterprises, including faculty-initiated companies and many staff-founded firms were started on a part-time basis that allowed the entrepreneurs to first test the water. Most of the faculty founders remain at MIT. New policies instituted at MIT, such as those instituted by John Preston when he was the Director of MIT's Technology Licensing Office, further

encourage entrepreneurship: While MIT technology transfer portfolio has been dominated by licensing MIT-originated technology to large corporations for fees, John Preston pioneered the practice of licensing MIT technology in exchange for founder stock in a new enterprise.

Lita Nelson, the current Director of MIT Technology Licensing Office, attributes the fact that universities have recently been turning to venture capital sources to form new companies to the increasing difficulty in finding licensees among established companies. This is either because of the well-known tendency for many large American companies not to invest in early, high-risk technology that would take many years to come to the market, or because very few companies are ready to re-direct already committed and scarce R&D resources inside the company to work on a university invention that might not be directly related to their ongoing projects.

In terms of job creation, the impact of MIT has been staggering. A study done by the Bank of Boston identified 636 MIT alumni-founded companies in Massachusetts alone, with 1988 revenues of approximately \$40 billion (approximately a third of the Massachusetts economy if one includes the secondary job creation caused by these high-tech manufacturing companies). Another study, conducted by Chase Manhattan Bank, identifies

225 MIT spin-off companies in Northern California, with 1989 revenues of \$22.5 billion.

John Preston, now the MIT Director of Technology Development, recently testified before the US House of Representatives Committee on the Small Business Technology Transfer program (STTR). The STTR is a three-year pilot program intended to foster technology transfer from universities, federally-funded research and development centers (FFRDCs), and other non-profit research institutions to the private sector through work with small businesses. Preston (1991) supported STTR on the following grounds:

First, the usefulness to the American society of any research is proportional to the interaction between the generators of the technology (e.g. university researchers) and the adopters of that technology (e.g. industry). Second, in America there is a funding gap in the riskiest stage in a technology cycle in which small companies are often the only [participants].

Preston believes that the key to willingness to invest for the long run is the tie between ownership and management, which is mostly seen in smaller firms. He calls those owners who manage "creators of wealth," and those speculators in the stock market "shifTERS of wealth." Preston's notion of creators versus shifTERS of wealth, and his association with owners who manage, is another manifestation of an MIT tradition that values the brainpower creation of comparative advantage.

Porter makes similar observations to those voiced by Preston. Speaking at the Conference on the Economy held last December by then president-elect Bill Clinton, Porter said:

We don't have real owners of companies in the United States. Our average share of stock in the United States is held for two years only, two years. Our investors are too concerned with guessing what stock is going to appreciate in the next six months or a year, rather than in understanding the fundamental health of the company.... We're going to need to rethink our system for investment in the United States. We're going to have to better align the goals of owners and managers and employees.

#### **4. The US "First Biotech Super-Incubator" in Worcester**

##### **A. Background**

Worcester Business Development Corporation's mission is to promote the common good and general welfare of the Worcester region; to improve the quality of life for our citizens by fostering the improvement of their employment skills and employment opportunities, and to plan, assist and advocate for the development and expansion of business activity in our region.

This was the mission statement of the Worcester Business Development Corporation (WBDC), the development arm of the city of Worcester, Massachusetts, fifty miles west of Boston. A few years ago Worcester was noted as a tool-and-dye town with unemployment rates above 11 percent. Today nearly twenty percent of the Massachusetts biotech companies and jobs are in the Worcester area, and the numbers are rising. This is a result of planned development which started in the 1980s.

In 1981 the concept of a "medical and related technologies" research park adjacent to the University of Massachusetts Medical Center was proposed by the Worcester Area Chamber of Commerce and the University of Massachusetts Medical School. In 1982 the state Division of Capital Planning and Operations (DCPO) began a selection process for a developer for the research park. In 1983 DCPO designated Worcester Business Development Corporation (WBDC), an independent not-for-profit corporation, as the developer of the research park. WBDC is the primary economic development arm of the city of Worcester. A land disposition agreement between DCPO and WBDC was completed in 1984. In this same year the Massachusetts Biotechnology Research Institute (MBRI) was created by Worcester business and academic leaders as a non-profit organization with the goal of establishing an efficient system to provide biotechnology transfer between academic/research institutions and the commercial sector. In 1985 Governor Michael Dukakis, with the support of the state legislature, created the Massachusetts Centers of Excellence Corporation (MCEC), a quasi-public agency that was founded to facilitate technology transfer and commercialization of emerging technologies through university-industry collaboration. In 1986, MCEC, through its Biotechnology Center of Excellence program, awarded the initial fund to MBRI to develop an "innovation center" that would have both a for-profit and a not-for-profit component. Commonwealth Bioventure Inc. (CBI)



is the for-profit entity. CBI is referred to as the first "Super-incubator" in biotechnology which combines business incubation and seed financing for start-up companies. CBI is located in the Research Park which is known now as Massachusetts Biotechnology Research Park (MBRP). MBRI is a limited partner of CBI. A portion of the return on investments made by CBI forms one of two longer term sources of funding available to MBRI. The second source is the profit from the Massachusetts Biotechnology Research Park, which collaborate with CBI to provide low-cost incubator lab space for CBI-backed companies. MBRI is governed by a board of Trustees which includes CEOs from Worcester's universities, colleges, research institutions, and major corporations, as well as the chairman of WBDC and the president of the Chamber of Commerce.

## **B. Massachusetts Biotechnology Research Institute (MBRI)**

### **i. MBRI Mission Statement**

The mission statement of MBRI is:

The Massachusetts Biotechnology Research Institute (MBRI) is an independent, tax exempt corporation devoted to supporting the growth of biotechnology in Massachusetts. Its Goal is to accelerate the application of modern biology to socially and economically valuable enterprises through the creation of new biotechnology-based companies. Utilizing a unique collaboration of public and private ventures, MBRI is able to use income generated by its commercial success to fuel a continuing program of identifying and supporting new technology as well as education initiatives.

## ii. The Evolution of a System Model in Planned Development

After eight years of involvement in biotech-based planned development during which MBRI tried to fill needs in biotechnology transfer and to build on opportunities in the process of commercialization, MBRI is now trying to evolve into an integrated self-supporting system. To have an integrated, self-supporting system, MBRI has the intent to operate in four interconnected functional areas:

1. Technology evaluation and transfer
2. Company formation/investment
3. Education and training
4. Reinvestment in basic research

The first functional area would be implemented by The Unified Office of Technology Transfer, which MBRI managed in 1992 to form as a consortium of seven academic and research institutions. The office will function as the internal technology transfer operation of each participating institution. In a way this office is trying to emulate the functions of the MIT Technology Licensing Office. When the Unified Office of Technology Transfer identifies a research with a potential to form the basis of a new company, this research supposedly gets incubated in the new Innovation Center which deploys its resources to shape the promising

research into a business entity and works on launching it as an independent enterprise. This Innovation center was opened by MBRI last year in the Research Park. It consists of molecular biology laboratories, biochemistry laboratories, and shared offices. MBRI has just completed the design for a Resource Center which will provide information services for the Unified Office of Technology Transfer and entrepreneurs at the innovation center. This includes an on-line computer information system, access to data-banks, technical expertise, and business counsel. In return for these support services and the use of facilities, MBRI acquires an ownership stake in the enterprise. The first tenant, Plant Pharmaceuticals, entered the Innovation Center just two months ago. MBRI has not yet hired new staff for the innovation center. According to Marc Goldberg, MBRI president and Chief Executive Officer, MBRI is relying on CBI to help with the new Innovation Center.

According to MBRI, in the capital funding stage which follows, MBRI plans to help tenants in the Innovation Center with their seed-money funding, which MBRI anticipates from CBI in many cases.

At the point when a new company goes public or gets acquired, MBRI expects to get its return on investment from the new company according to the pre-start-up equity agreement in addition to a share of CBI profit if CBI had invested in the

new company. MBRI plans to close the loop by reinvesting these funds in supporting the activities of the MBRI Innovation Center and in research, training, and education.

In line with its mission, MBRI has the ambition of centralizing under one umbrella, maintained by MBRI, those educational and training programs in Massachusetts that are needed to support the biotech industry. MBRI plans to establish an MBRI Educational and Training Resource Center that would function as a vehicle to fill needs and to build on opportunities in the three areas of K-12 bioscience education support, work force training, and community awareness in biotechnology. MBRI is already engaged in an educational program which aims at familiarizing teachers and students with biotechnology.

Reflecting on similar organizational arrangements, Lita Nelson (1991), the new Director of MIT Technology Licensing Office, wrote:

While some universities have set up separate foundations staffed by professionals who identify promising technologies, conduct market research, write business plans, seek venture capital, and may even act as an interim management team for the new start-up, MIT finds this approach expensive, relatively high risk, and limited in the number of ventures it can handle, but offers the advantage that the university may be able to command a higher percentage of the company's equity because the presenting package is more complete.

Unlike MIT, many academic institutions may have neither the expansive research base nor the experienced technology transfer capability necessary for assisting entrepreneurs and attracting industry or the private financial community; therefore the attempt to create a critical mass of deal flow through a consortium of universities and the provision of a system of support for entrepreneurs in the formation stage may prove rewarding.

MBRI's self-supporting cycle presents an interesting model, and is worth considering in similar settings of technology-based economic development. The implementation however, would not be straightforward.

### **C. Commonwealth BioVenture Inc. (CBI)**

The mission statement of CBI is:

The mission of Commonwealth BioVenture Inc. is to identify for seed investment the highest quality biotechnology start-ups and then to nurture and guide these investments through milestones to create company value and insure future financing.

CBI sees its core competence in:

1. Entrepreneurial experience in the approach to deal selection and structure.
2. Biotechnology focus with strong emphasis on products and early revenue streams.

3. Unique deal flow through the Massachusetts Centers of Excellence Program, the Boston venture capital community, and university and hospital affiliations.
4. Effective participation in organizational structuring and strategic planning of CBI backed companies.
5. Access to immediate space availability and rent subsidy at the MBRP.

Since its inception in 1987, CBI has reviewed over 600 business and technical proposals. From these, CBI has selected fourteen for investment. Amira was one of them. CBI thinks three to four new deals a year are all they can handle. The general partnership management team of CBI is: Robert Foster, president and chief executive officer; Gloria Doubleday, vice president of operations; and Gustav Christensen, who recently joined the organization as executive vice president.

CBI identifies five phases in the life of a growing biotech company: the embryonic phase, the start-up phase, the development phase, the sales-growth phase, and finally, the mature phase. Accordingly, they define their roles in each phase of growth as follows.

### The Embryonic Phase

In the Embryonic phase, the parties involved are at universities speaking to the technology transfer officer and faculty members in order to establish the value of the technology that might be transferred to commercialization. Their approach here varies from arbitrary to lengthy negotiation. During the negotiation, they try to establish a low initial valuation for a potential start-up because they believe that the lower the initial valuation, the greater the multiples available for attracting later rounds of capital investment.

### The Start-up Phase

CBI defines this phase as the period when the company is making a transition from having been a research project at a university to a start-up company with R&D capability. The transition takes about a year, during which they help a start-up company with the mechanical items that make it look like a company. More importantly, they try to achieve what is in their opinion the most crucial element for the success of this phase -- the identification and recruitment of a president and CEO for the start-up company. By the end of the phase CBI expects, besides a CEO, a company that:

1. became legally organized and incorporated;
2. established its legal counsel and selected its auditor;

3. has patents licensed from the university or is filing its own;
4. has retained a patent counsel and has begun to develop its own patent strategy;
5. has begun to hammer out its three-year business plan, and from this plan a short-term operating plan is being developed and adopted;
4. is establishing its own board of directors and a scientific advisory board; and
5. is setting up operations, offices, and laboratory facilities.

#### The Development Phase

In this phase, which lasts for two to three years, CBI sees achieving of an initial product sale key to maximizing a company's value. CBI sees a potential for several major milestones allowed for by an initial product sale, among them are capabilities that a company may build in manufacturing processes, process control procedures and quality assurance procedures. CBI believes that a strategic alliance, made possible after an initial product sale, is a milestone that leads to increasing the value of a biotech company "by virtue of the quality of the strategic partner."



## 5. Amira

Amira is an interesting entrepreneurial experience in the field of biotechnology. It is a story of commercializing the discovery of Rima Kaddurah-Daouk which originated at MIT. Following her critical discovery, Kaddurah-Daouk, Ph.D., together with Paul Schimmel, Sedgwick Professor of Biophysics at MIT, co-founded Amira in October 1989.

Rima Kaddurah-Daouk, a Palestinian originally from Safad, received her Ph.D. in Biochemistry in 1983 from the American University in Beirut. She did research as a Postdoctoral Fellow in the Molecular Biology Department of Johns Hopkins for two years, following which she became a Postdoctoral Fellow at the Molecular Biology & Genetics Department of Harvard. In 1988 she did additional postdoctoral work in Paul Schimmel's lab at MIT for a year-and-a-half.

The following description by Lita Nelson, the Director of the MIT Technology Licensing Office, describes the role of MIT in the birth of Amira:

Amira is the story of a brilliant and dedicated scientist who was unusually active in conveying her enthusiasm of the importance of technology. Initially I was facing a puzzle: all I had was a brilliant science, yet too early, a Post Doc, who believed in her science, and her patent. I knew Paul Schimmel is well known and had himself co-founded two well known companies. RepliGen was one of those two. I asked him if he would be willing to participate in or sit on the advisory board of a start-up

company built around Rima's discovery. Paul had a lot of faith in Rima, when he said yes I had a go. Name and credibility is highly important in this risky business.

In Kaddurah-Daouk's recollection of her early experience with MIT Technology Licensing Office she said: "They were excellent. They knew the whole process. They helped me and enlightened me of the different opportunities I had. I chose to start-up Amira."

When Lita Nelson contacted Bob Foster, President and CEO of CBI, known for his exceptional experience with biotechnology start-ups, he responded immediately, trusting the quality of deals that come out of MIT. In addition to the competence of Foster and access to CBI seed money, Lita knew that CBI could provide the attraction of low to minimal space rent for Amira at the Massachusetts Biotechnology Research Park. Lita Nelson believes that Amira is part of the articulation process which evolved for the biotechnology incubator in Worcester. Perhaps as start-up companies grow, CBI grows with them and keeps learning.

By superimposing Amira's growth pattern on the five-phase model, which CBI conceptualized in order to define CBI's targeted milestones and CBI's nurturing roles across time, in addition to applying strategic analysis to Amira's acquisition by RepliGen which took place in November 1991, this section will analyze the ability of a nurturing venture capital to

provide guidance and hands-on management to a start-up biotech company.

Kaddurah-Daouk's sole concern in the first year was to get a lead product and advance her science. A CEO was never recruited for Amira although this is stated by CBI as top priority for the first year. Although CBI claims to take a back seat only after a CEO is recruited, Amira remained science-driven and lacked management support. A strategic analysis of Amira's acquisition using Roberts and Berry's Familiarity Matrix supports this claim.

The history of the working relationship between Amira's founders explains the familiarity of RepliGen with the technological base of Amira prior to acquisition. As such, one can easily use the framework proposed by Roberts & Berry for the creation of the Familiarity Matrix to place RepliGen (prior to acquisition) with respect to the new business opportunity, which Amira represented, in the new familiar technology-base market, and consequently one can predict acquisition as RepliGen's optimal entry strategy. For RepliGen, this acquisition added potential products that introduce small molecules as chemical therapeutics. This addition is of high strategic importance to RepliGen in light of an ongoing shift in the biotech therapeutics industry from a biologic to a chemical base. Amira, on the other hand, can

be placed (prior to acquisition) in the base technology-new unfamiliar market on the Familiarity Matrix, which suggests that a strategic alliance would have been the ideal strategy for Amira at that time. The prevailing market conditions in biotechnology support this strategy. According to a study by McKinsey & Co. and Harvard University, pharmaceutical research productivity was more than four times higher at small biotech companies than at leading industrial companies (Blakely & Nishikawa 1991).

Three pharmaceutical companies were interested in negotiating a strategic alliance deal with Amira before acquisition and before Amira had a product -- Hoffman La Roche, BASF, and Burroughs Wellcome -- but these negotiations never took place. The option of strategic alliance with these companies was presented to Kaddurah-Daouk by Craig Jones from Dillon Reed. In an interview, Jones said:

Rima had an extraordinary mix between molecular biology and biochemistry. Her knowledge spanned many areas with both depth and breadth. She was a pioneer and I knew she was on something very big. I told her she was crazy to sell, that she can sell the company for five times more by waiting. I tried to explain to her that pharmaceutical companies are less interested in ROI than they are interested in growth. All she seemed to care about was seeing her science advance. Perhaps, she did not know me enough at that time to trust me.

CBI does not try to initiate contact with pharmaceutical companies for the purpose of negotiating a potential strategic alliance, as they believe that the biotechnology market is

efficient in disseminating information. Furthermore, CBI believes that closing a strategic alliance deal would take six to twelve months or more. CBI acknowledges that strategic alliances are very involving. These three points were expressed in an interview with Gloria Doubleday, CBI vice president of operations.

Kaddurah-Daouk needed a business infrastructure in place, needed R&D funds instantly, and like CBI she believed that negotiating a strategic alliance would take six to twelve months which was way too long for her science. For Amira acquisition was more of an operational tactic than a strategic move.

To complete this story, the continued scientific achievements of Amira after acquisition show how far-sighted RepliGen was in its decision to acquire Amira. Amira's success since acquisition can be summarized as follows:

1. Amira's first lead product is now ready for clinical trials in cancer therapy.
2. Amira was able to introduce major applications for the first lead product in cardiac applications.
3. Amira was able to generate second and third lead compounds that promise breakthroughs in cancer treatment.

4. It took Amira approximately three years to get from the initial discovery to the filing of an IND and potential initiation of clinical trials. This is a phenomenal speed in the biotechnology and pharmaceutical industry where such a phase would normally extend for four to five years.
5. Amira established strong contacts with key clinical centers who are adopting Amira's products for clinical trials, such as Harvard Medical School and M.D. Anderson Medical Center.

For RepliGen, Amira's acquisition was a smart entry strategy that cost them only \$5.5 million, paid in shares from RepliGen. To this date, the acquisition has been successful. So far, RepliGen and Amira lost only James Lillie, a highly competent scientist and an old colleague of Kaddurah-Daouk from Harvard university. James Lillie was with Amira when it started. In the acquisition deal, RepliGen tried to hedge and manage its risk. RepliGen was apparently aware of the general potential negative outcomes of acquisitions -- the potential loss of the entrepreneur, the strength upon which Amira was established, and the emergence of potential competitors if such an entrepreneur should leave; RepliGen therefore took the following measures to avoid such outcomes:

- a. RepliGen, at the insistence of Kaddurah-Daouk, agreed to keeping Amira operating its scientific operations

independently as it was before acquisition and they kept Amira located separately from RepliGen.

- b. In addition to the \$5.5 million paid in shares from RepliGen, RepliGen made the payment of an additional \$5 million contingent on the initiation of phase two and three of clinical trials (milestone payments).
- c. RepliGen made the payment of \$5 million contingent on Kaddurah-Daouk's presence in the company, which means that should her desire for entrepreneurial independence motivate her to leave Amira, and to waive her rights for the remainder of the money, she would still be morally committed to stay for the sake of the small investors who had believed in her from the start.
- d. Kaddurah-Daouk signed a confidentiality and a "no-competition" agreement with RepliGen.

Although the case is partly a critique of the level of venture nurturing that CBI provided, the fact remains that Amira was not only a brainchild of a brilliant scientist and MIT, but was also an outgrowth of an infrastructure blessed with entrepreneurial fever. CBI venture capital money was courageous seed funding that few venture capitalists are willing to make. Two concerns rise from this case:

1. CBI is looking forward to a future market with many consolidations/acquisitions which might imply bypassing

opportunities of strategic alliances that are of broader strategic value to their backed-companies. This could be in part a result of the demanding nature of strategic alliance deals, especially that CBI targets three to four start-up companies each year to keep CBI financially viable.

2. CBI might shift to later-stage funding in order to minimize their risks and to capitalize on their increasing expertise in biotechnology. This means that there might be a widening funding gap in the US for pioneer technologies such as that of Amira.

## **6. Some Strategic Implications for the Arab World**

Strategies for high-technology economic development which are discussed in this chapter are relevant not only to a state in the Middle East such as future Palestine, which has no natural resources and is trying to build man-made comparative advantages for the 21st century. These strategies are also relevant to a rich country like Kuwait, still considered almost the wealthiest nation according to its per-capita assets. Kuwait has a risky and illiquid position due to the concentration of its wealth in oil and because of the limiting oil extraction policies which are conducted in the framework of a delicate web of regional and international political and



economic realities. A viable investment strategy for Kuwait is "corporate state" venture capital strategy combined with other proactive long-term strategies that include but are not limited to strategic alliances in areas of R&D, manufacturing, and marketing.

The "corporate state" venture capital strategy could serve as a window on technology and could result in identifying, within certain niches, opportunities to develop certain technological capabilities and related skills in Kuwait. While adopting developmental perspectives in its investment decisions, Kuwait could also incorporate financial objectives. Such incorporation is particularly feasible when investing in small companies that are leading emerging technologies of the 21st century. One option for venture capital deal flow may lie in the existing funding gap in the US, which was referred to by Preston and is illustrated by the case of Amira's pioneer technology. As part of a biotechnology-based development plan, for example, Kuwait might have provided venture capital seed funding for a company like Amira provided that such a company would locate within a reasonable time-frame some activities along the value chain in Kuwait or other parts of the Arab world like future Palestine. From following such a strategy, Kuwait could emerge into a high value-added economy based on man-made comparative advantages, and would transform its role into a brain nerve in the Middle East. Such a win-win scenario

would integrate Kuwait into the future world economy while functioning as a stabilizing economic and political force in the Middle East.

A natural place for creating a "corporate state" venture capital activity is within the Kuwait Investment Office, the government's investment arm and the builder of Kuwait's financial empire. This office operates as a national pension fund taking stakes in the world equity and real estate markets. The adoption of such a "corporate state" business investment strategy cannot be productive unless linked specifically to four other strategies: (1) in-house technology development, through the promotion of local university-industry collaboration and encouraging research through appropriate support and incentives; (2) manpower training and development; (3) infrastructure development; and finally (4); national awareness.

Taking Singapore as an example, a strategic business unit for a National Biotechnology Program (NBP) was established in 1988 within the Economic Development Board (EDB) to coordinate national efforts in the development of biotechnology. In 1990 NBP launched a master plan which spanned the five strategies listed above. To encourage commercial biotechnology activities in Singapore, Singapore BioInnovations Pte (SBI) was incorporated in 1990 to pursue two tracks in parallel: first,

investing in commercializing indigenous biotechnology inventions and innovations, and second, investing in viable biotechnology companies overseas with the hope that overseas investments would lead to strategic alliances and collaborations in Singapore. This investment strategy is not being adopted independent of other national strategies; for example industry is being encouraged to tap the expertise at the university through joint research projects or consultancy. A good example of university-industry collaboration in Singapore is the Glaxo-IMCB (Institute of Molecular and Cell Biology) joint research venture on degenerative brain diseases which Glaxo has provided a \$ 50 million trust fund to support over 15 years.

The Singapore NBP can serve as a model for a country like Kuwait which has the financial power yet needs to link its overseas financial investment strategies with local research institutes and local commercial activities. The following personal experience at Kuwait University Nuclear Medicine Department illustrates the lack of technology-based development policies that would facilitate university-industry collaboration and commercialization of university research.

Prior to the Iraqi invasion of Kuwait, nuclear medicine at all hospitals in Kuwait was managed by the Nuclear Medicine Department of Kuwait University. In terms of equipment, Kuwait

had one diagnostic gamma camera per 100,000 people which met with the US standards. Kuwait University Nuclear Medicine Department had fifty publications per year on average, out of which ten were accepted at the annual meeting of the Society of Nuclear Medicine (SNM) in the US. Outstanding departments of nuclear medicine in the States who were happy to have two or three papers accepted at the SNM used to wonder how a group in the desert could have generated such research. The Nuclear Medicine Department at Kuwait University won the Gold Prize at the SNM meeting in 1986, followed by the Bronze two years later. The chairman of the Nuclear Medicine Department at Kuwait University was on an advisory board of DuPont. Two years before the Iraqi invasion, General Electric (GE) proposed to Kuwait University that GE sponsor a research program at the Nuclear Medicine Department to develop software that would enable GE Nuclear Medicine Data to escape restrictions of GE computer processors to other vendors' computing facilities. Although Nuclear Medicine at Kuwait University was willing to undertake the project, the proposal was rejected by the University. The software was later developed by a company in the Denmark -- PC Medical -- and it is now being marketed worldwide.

Unfortunately, following the Iraqi invasion, the Nuclear Medicine Department at Kuwait University lost its edge. The losses of nuclear medicine equipment during the Iraqi

occupation were minimal: two computers, and a gamma camera from the military hospital which was strapped to a helicopter, yanked out of place, and transferred to Iraq. The real losses are in human resources: except for expertise in chemistry, the Department had lost the personnel upon which its competitive edge had rested.

What is needed all over the Arab world is leadership, may be in new institutions that would be capable of rising above political disputes, to nurture and embrace Arab intellectual property at socially optimal levels; leadership that would foster strategic alliances among organizations in the Arab World and abroad to enable all to work together, to gain access to technology and markets, and to accomplish objectives of mutual benefit. The potential in the Arab World is tremendous; the challenges to management are many.

## References

- Allen, Thomas, Diane Hyman, & David Pinckney. "Transferring Technology to the Small Manufacturing Firm: A Study of Technology Transfer in Three Countries." Research Policy 12:119-211, 1983. North Holland.
- Austin, James. Managing in Developing Countries: Strategic Analysis and Operating Techniques. New York: Free Press, 1990.
- Austin, James & Tomas Kohn. Managing in Developing Countries: Case Studies. New York: Free Press, 1990.
- Blakely, Edward & Nancy Nishikawa. "Reformulating the Incubator Model: Applications to Commercial Biotechnology." Working Paper 528. Institute of Urban and Regional Development, University of California at Berkeley, January 1991.
- Bygrave, William & Jeffery Timmons. Venture Capital at the Crossroads. Boston: Harvard Business School Press, 1992.
- Foster, Richard. Innovation: The Attacker's Advantage. McKinsey & Co., Inc. New York: Fireside, 1986.
- Greenthal, Richard & John Larson. "Venturing into Venture Capital." The McKinsey Quarterly 70-79, 1983.
- Hamed, Osama & Radwan Shaban. "One-Sided Customs and Monetary Union: The Case of the West Bank and Gaza Strip under Israeli Occupation." A revised version of a paper presented at the Conference on The Economics of the Middle East Peace organized by the Institute for Social and Economic Policy in the Middle East, John F. Kennedy School of Government, Harvard University, January 1992.
- Hamed, Osama & Radwan Shaban. "Economic Integration and Israeli Occupation of the West Bank and Gaza." Presented at the Conference on The Economics of the Middle East Peace organized by the Institute for Social and Economic Policy in the Middle East, John F. Kennedy School of Government, Harvard University, November 1991.
- Harrigan, Kathryn. "Strategic Alliances and Partner Asymmetries," in F. Contractor & P. Lorange (Eds.), Cooperative Strategies in International Business. Lexington, MA: Lexington Books, 1987.

- Kogut, Bruce. Joint Ventures: "The Theoretical and Empirical Perspectives." Strategic Management Journal 9:319-332, 1988.
- Nelson, Lita. "The Lifeblood of Biotechnology: University-Industry Technology Transfer," in R. Dana Ono (Ed.), The Business of Biotechnology. Boston: Butterworth-Heinemann, 1991.
- Palestinian Academic Society for the Study of International Affairs (PASSIA). The West Bank and Gaza Strip. East Jerusalem, December 1990.
- Palestine Delegation for the Middle East Peace Negotiations. Position Paper Presented to the Working Group on Water in Washington, 1992.
- Porter, Michael. Competitive Advantage: Creating and Sustaining Superior Performance. New York: Free Press, 1985.
- Porter, Michael. The Competitive Advantage of Nations. New York: Free Press, 1990.
- Preston, John. Testimony Presented Before the US House of Representatives Committee on Small Business, April 1991.
- Roberts, Edward. "New Ventures for Corporate Growth." Harvard Business Review 130-144, July 1980.
- Roberts, Edward. "Strategic Alliances: New Competitive Muscle." Presented at the Business Week Ninth Annual Strategic Planning Conference, October 1986.
- Roberts, Edward. Entrepreneurs in High Technology. New York: Oxford University Press, 1991.
- Roberts, Edward & Charles Berry. "Entering New Business: Selecting Strategies for Success." Sloan Management Review 3-17, Spring 1985.
- Roberts, Edward & Ian Yates. "Initiating Successful Corporative Venture Capital Investments." Sloan Working Paper No. 3308-91-BPS, June 1991.
- Roussel, Philip, Kamal Saad, & Tamara Erickson. Third Generation R&D. Boston: Harvard Business School Press, 1991.

- Shaban, Radwan. "Labor Mobility of the Palestinians of the West Bank and Gaza Strip." A revised paper presented at the Conference on The Economics of Labor Mobility in the Middle East which was organized by the Institute of Social and Economic Policy in the Middle East, John F. Kennedy School of Government, Harvard University, February 1992.
- Thurow, Lester. Head to Head. New York: William Morrow and Company, Inc., 1992.
- UNCTAD Secretariat. "Prospects for Sustained Development of the Palestinian Economy in the West Bank and Gaza Strip, 1990-2010: A Quantitative Framework," April 1992.
- Urban, Glen & Steven Star. Advanced Marketing Strategy. New Jersey: Prentice Hall, 1991.
- Yahalomi, Lior. "Promoting International Cooperation as a Strategy for Economic Development, 1991: A Case Analysis of Israeli and US High-Technology Partnerships." Ph.D. Dissertation in Social Systems Sciences for the Graduate Group in Managerial Sciences and Applied Economics, University of Pennsylvania.
- Zahlan, Antoine. Acquiring Technological Capacity. England: Macmillan 1991.
- Zahlan, Antoine. "Science and Technology: Their Role and Function in the National Palestinian Economy." Chapter 8 in Part II of The Program for Development of the Palestinian National Economy for the Years 1994-2000. Prepared by The Department of Economic Affairs and Planning of the Palestine Liberation Organization. Tunis, 1993.