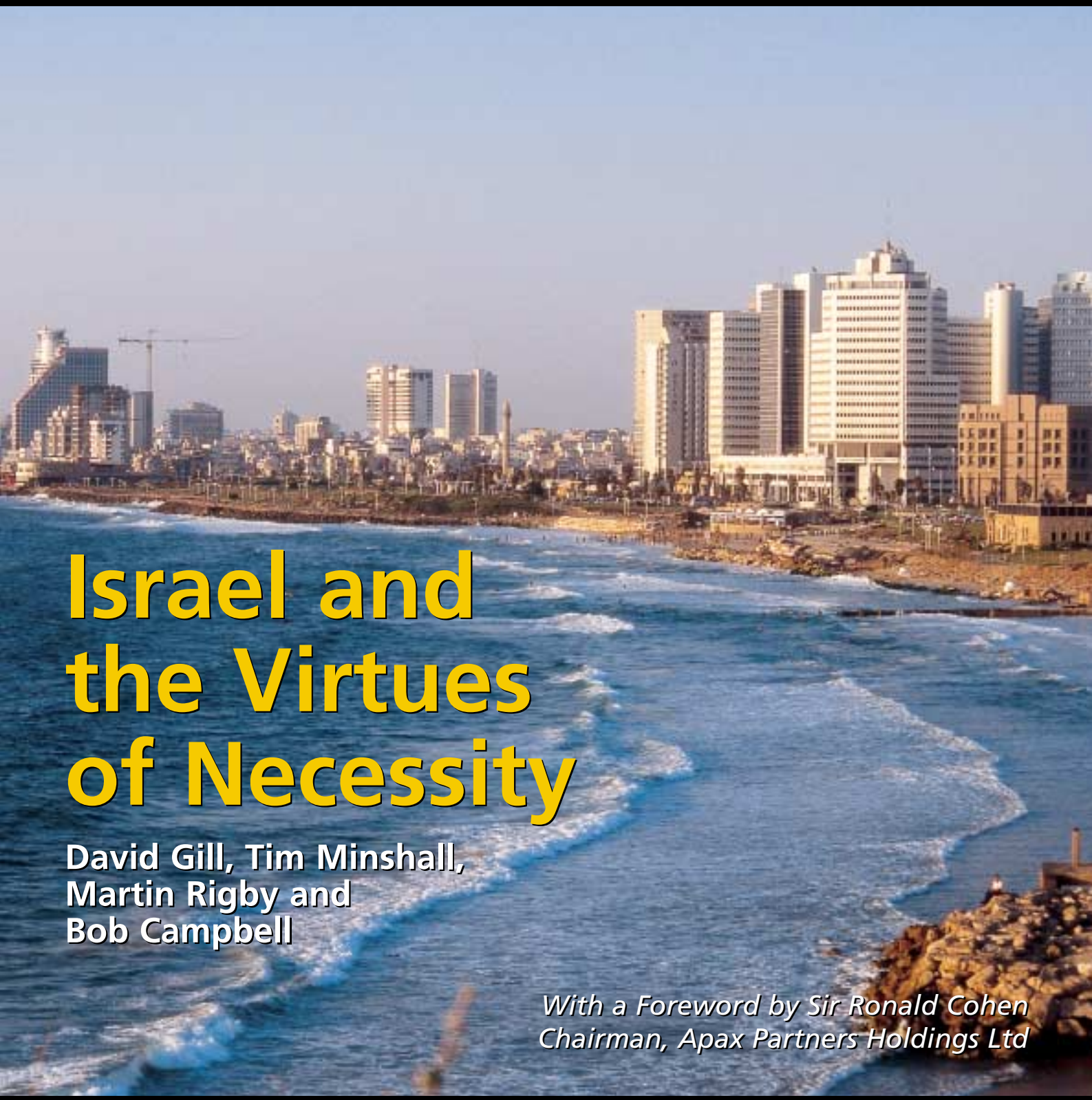
Funding TECHNOLOGY



Israel and the Virtues of Necessity

David Gill, Tim Minshall,
Martin Rigby and
Bob Campbell

With a Foreword by Sir Ronald Cohen
Chairman, Apax Partners Holdings Ltd

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Abstract

"Isaiah loved 'Reb Yitzhak's' enthusiasm for the new Israel but did not share it himself. As he wrote to Felix Frankfurter, 'the trouble about the Israelis is not only their partly unconscious conviction born of experience that virtue always loses and only toughness pays, but a great provincialism and blindness to outside opinion.'…. In a lecture on Israel to the Anglo-Israel Association in 1953, Berlin praised the country because it allowed Jews to escape their stereotypes and escape their history. They no longer had to be 'sophisticated, chess-playing, café intellectuals'. After a history of martyrdom, they had earned the right to 'normality', 'wholesomeness', even 'dullness.'"

Michael Ignatieff, *Isaiah Berlin – A Life* (1998) p182[1]

Far from being provincial or dull, Israel over the past decade has been a remarkable case study in the transfer of technology from the research base to commercial exploitation internationally. On the face of it, Israel has many disadvantages in attempting to become a world-leading, knowledge-based economy: its own population is limited (c.6m), it is geographically isolated, surrounded by countries with whom its political relations are fraught and which, in any event, have low GDP both in absolute and per capita terms; defence takes up a high proportion of the national budget; the land has limited natural resources and has had to accommodate significant immigration in a short space of time.

However, over the course of the 1990s, Israel turned these disadvantages to good effect. In integrating nearly one million immigrants from the former Soviet Union through programmes such as state-sponsored incubators, it took advantage of the high proportion (c.40%) of new arrivals with science and technology backgrounds. Subject to national security, much of the research undertaken within the defence arena has been encouraged to move into the commercial sphere. Its limited national and regional markets have obliged it to look overseas for sales – first to the US, but also to Europe and the Far East. Many of these initiatives worked with the grain of Israeli society, including a familiarity with entrepreneurship and research (some of Israel's leading education institutions, such as the Technion and the Weizmann Institute, pre-date the modern State of Israel), and broad international cultural links.

At the same time, other government initiatives (notably the Yozma venture fund) have complemented the private sector to such an extent that in the case of the venture capital industry, Israel now benefits from one of the most developed risk-capital markets in the world, paradoxically as a result of state intervention. However, the market is currently experiencing a downturn and the outlook is uncertain. Israel may have been over-reliant in recent years on the US – for investment in Israeli-based research companies and venture funds, for export markets, and for NASDAQ-listings. Many successful Israeli technology firms of the 1990s had the look and feel of a US corporation and may well have been registered in Delaware or headquartered in California. The current state of the US economy and NASDAQ's slide over the course of 2001 are testing the robustness of the transformation of Israel's economy and society from being reliant on agriculture to being led by technology investment. These setbacks are also taking place against the breakdown of the peace process.

To what extent can Israel maintain the momentum of the 1990s in the knowledge economy? The answer may depend in part on its ability to broaden its international markets and limit its over-dependence on the US. Its science base is above average in terms of investment and research by the standards of the developed world and pro rata to its economy, but Israel will need to accelerate technology transfer at the same time as maintaining its ability to "make a noise out of all proportion to its size". Although many commentators on the ground believe that

1 'Reb Yitzhak" refers to Yitzhak Sadeh, formerly Isaac Landoberg, Berlin's uncle by marriage and one of the founders of the elite underground army, Palmach. Felix Frankfurter was a Justice of the US Supreme Court

Abstract

NASDAQ has more influence on the economy than does the stalling of the peace process, the political situation is impacting increasingly on the economy as higher military spending is required, government deficits increase and inflation (0% in 2000) resumes.

What lessons does Israel provide other countries seeking to expedite their entry into knowledge-driven markets? In a number of ways, Israel is a case apart, given its political, historical and geographical circumstances. It does, however, demonstrate the ability for targeted government intervention to remedy market weaknesses, to work with the grain of the market and to be withdrawn once its objectives have been accomplished. It also demonstrates that, as in the US and other advanced economies, technology transfer and the exploitation of innovation do not take place in isolation but require all key components to be present and work together: basic research, seed capital, entrepreneurship, incubation, professional service firms, capital and export markets. For policy-makers and entrepreneurs alike, the key lessons of the Israeli experience will be in the detail. Successful technology transfer is inherently dependent on "tacit knowledge"; the interview methodology behind this report seeks to convey some of the texture of the Israeli approach alongside more conventional analysis.

They say Israeli high tech businesses are successful because…

Some often-expressed views on Israeli high tech, and some "buts":

High level of military spending – other Middle East states spend a high proportion of GDP on defence: compare Israel at 9.4% with Jordan 7.8%, Syria 5.9%, Saudi Arabia 13%, Oman 13%, Kuwait 8.7%. (By way of comparison: US 3.2%; UK 2.7%). *Source: CIA Handbook 2001*

National service – but only certain regiments provide access to leading technologies that can be applied in the commercial world. Other than that, the skills acquired in national service are teamwork and management skills.

Relationship with US – although both civil and military subventions have been provided since 1985, it is far from clear that US Middle East policy was unduly favourable to Israel even before 11 September 2001 (Egypt was another significant beneficiary of US funding). And as the US economy turns down, will Israel be over reliant on US money and markets?

Success through the growing network of Israeli entrepreneurs – but as Israeli start-ups move to markets other than the US, will this network continue to be sufficient and effective?

Natural entrepreneurs – although dirigiste government policy until the mid-1980s showed the extent to which environment can hamper heredity and culture.

Geopolitical situation – Israel is a developed country "in the wrong place". Because of its location Israel has been forced to be successful simply to survive. Without neighbours with whom to trade, Israel has been forced to find trading partners further afield. But does this provide a sufficient variety of trading partners able to weather downturns?

Russian immigrants – this group is held up as a driving force behind the recent high tech boom in Israel. But not all our interviewees saw them as the critical factor: "Not every Russian working as a janitor had a Nobel prize for physics," one said. And many immigrants from the former Soviet Union still do not feel welcome on account of the reluctance of the Orthodox authorities to accept them as Jewish. This in turn may accelerate the secularisation and fragmentation of Israeli society.

Foreword

"Palestine has a strange psychological effect on people. Everyone who gets involved in it either has – or acquires – a sense of mission, a feeling that they have become protagonists in its history, promoting a view that must be borne like a battle standard, and which is in contention with other points of view that are wrong. Palestine is no place for the urbane or the ironic."

Edward Fox, *Palestine Twilight* (2001) p81

Funding Technology – Israel and the Virtues of Necessity is a timely contribution to the continuing evaluation of how the science base can be turned to advantage both commercially and for the benefit of individuals and society at large. It appears at a point when the downturn in technology stocks, especially US quoted companies, has risked affecting confidence and the ability to perform along the entire technology transfer train, from university spin-outs through to established trading companies. The authors demonstrate that the economic revolution brought about by the shift to the knowledge-based economy in Israel has been so profound that current market conditions cannot reverse this transformation, only slow it down.

The authors are careful not to single out specific policies or practices to be translated directly to the UK or other countries. Their approach is to present both the detail of Israel's recent experience – government sponsored incubators, the creation of a significant venture capital industry through state intervention, the patterns of exports and the wealth of the research base – and the broad historical and cultural canvas on which it appears. Whilst the learning points are sign-posted, *Israel and the Virtues of Necessity* leaves readers coming from a range of different professional interests to draw their own conclusions.

At a formal level, Britain has in recent years forged specific links with Israel through the establishment of BRITECH, the British-Israeli Industrial R&D Fund, which promotes joint industrial R&D collaboration between firms in the two countries. A number of recent projects have been funded, with some notable early successes. BRITECH, which is government-funded, demonstrates that there is considerable scope for further co-operation between R&D companies in the two countries in the private sector.

Sir Ronald Cohen
Chairman, Apax Partners Holdings Ltd

Preface

"Israel has become a global center of high-tech development, pioneering more new start-ups than any country outside the US. During the year 2000, Israeli start-up companies attracted 3.2 billion dollars, constituting a growth of approximately 300% over 1999. In the fourth quarter of 2000, 845 million dollars were invested in 193 Israeli start-up companies."

Israeli Export Institute brochure, *Investment in Israel Technology II – Preview of Sizzling Start-Ups* (March 2001)

"If I am proved right, the Germans will hail me as a German and the French as a citizen of the world. If I am proved wrong, the French will call me a German and the Germans will call me a Jew."

Albert Einstein, speaking at the Sorbonne (1920s)

This report is based on a series of some 40 interviews conducted in the spring and summer of 2001 in a number of locations in Israel with leading players in the field of technology transfer and the commercialisation of Israel's science base. It is a portrait rather than a snapshot, although it is necessarily heavily influenced by the time when it was compiled, the autumn of 2001. In adopting a broad range of detailed interviews as our research methodology rather than using the survey approach we have sought to bring a rich body of contextual evidence to bear: in Israel "culture" is the starting point, rather than a "residual" as it usually is in economic theory.

Drawing on the aggregate wisdom of our numerous interviewees, we have sought to complement traditional data sources, information in the public domain and a growing knowledge base of detailed studies of individual aspects of the Israeli phenomenon. We have attempted to synthesise the many opinions given to us, but without forcing a consensus where none exists; as we were told more than once, "In Israel, where there are three rabbis there are four opinions."

The authors of this report are active in the development of technology-based firms in the UK and previously undertook a similar research exercise in the US (published in March 2000 as *Funding Technology – Lessons from America)*. During the course of the US research, a high proportion of our interviewees suggested Israel as a role-model of how the numerous economic actors (from government to investors, the army and universities) can work together to create a system capable of rapid internationalisation and, hence, punching significantly above the weight expected of a population of some 6 million. This report attempts to tease out in detail the Israeli achievement, as well as suggesting both its lessons and limitations for other economies.

The authors are grateful to the many Israeli executives who took considerable pains to explain the complex interlocking of factors behind the phenomenon of science-based innovation and entrepreneurship in their country. Despite the recent reverses of international markets (notably the US economy and with it NASDAQ, the main stock market for technology businesses) most of our interviewees evinced an underlining confidence in the robustness of Israel's technology sector and a desire to ensure that it continues to reach new markets and form new partnerships overseas. In the context of the world after the major terrorist attacks in the US on September 11 2001 it remains to be seen whether this confidence will become hope deferred.

The research behind this report was undertaken thanks to generous support from The Gatsby Charitable Foundation. BRITECH (the Britain Israel Technology Foundation) and HSBC in Tel Aviv were both most helpful in enabling us to meet key individuals in technology commercialisation in Israel. We are also grateful

Preface

to the numerous people in the UK who have assisted us with detailed statistical research and in clarifying a range of technical and regulatory issues. All remaining errors are the authors' own.

Finally, although all the authors are actively involved in the technology finance sector in the UK, the opinions expressed in this report are those of the authors alone and do not necessarily reflect those of the organisations for which they work or those which have provided support, guidance and advice in its preparation.

This report incorporates data up to early November 2001.

18 Kislev 5762
3 December 2001

Overview – the Virtues of Necessity

"You have to understand that the noise we make is inversely proportionate to our size"

Senior Israeli Civil Servant in conversation with the authors, spring 2001

"Who doomed to go in company with pain,
And fear, and bloodshed, miserable train!
Turns his necessity to glorious gain."

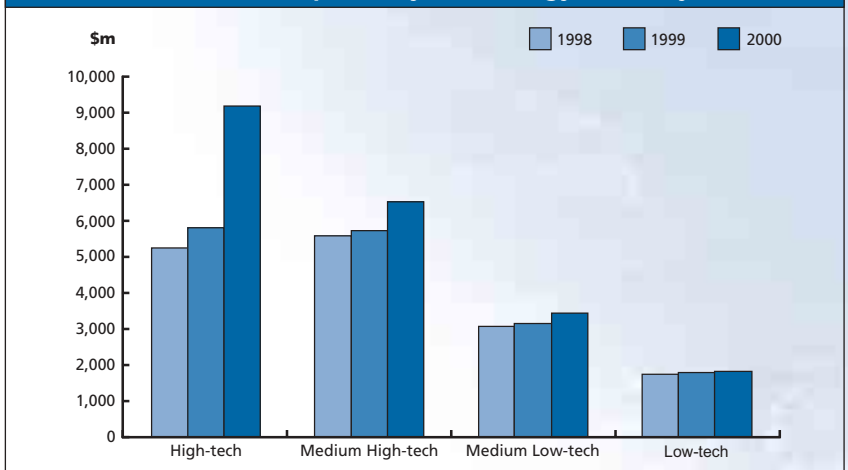
Wordsworth – *Character of the Happy Warrior*

ISRAEL AND THE KNOWLEDGE ECONOMY

1.1 This paper summarises the findings of a research team[2] investigating the phenomenon of technology commercialisation in Israel over the past decade. Some 40 interviews were carried out in Israel between March and September 2001. The authors are grateful to the numerous individuals who gave generously of their time and expertise, especially during a period when the Israeli technology sector was feeling the ill effects of a downturn in the US economy and NASDAQ. The willingness to continue to seek international co-operation and understanding is an enduring feature of Israel's technology success. It is notable, for instance, that we were given ready access to the current Chief Scientist and his two predecessors.

1.2 As with the US, the importance of the high-tech sectors in Israel for overall economic growth is now widely accepted. The 1990s witnessed a structural change in the composition of Israel's industrial exports. Taking the five years 1996 to 2000 alone, low-tech goods declined from 13% of industrial exports to 9%, whilst over the same period high-tech goods rose from 30% to 44%[3]. Agriculture now accounts for under 3% of GDP[4].

Industrial Exports, by Technology Intensity



Source: Israel Export Institute

1.3 Experience in other countries has shown that "international activity is the norm for a majority of young technology-based firms […] One in five firms in our sample had started to sell abroad within the first year after start-up."[5] However, Israel still maintains a balance of payments deficit, which has been exacerbated by recent difficulties in the high-tech sector. One

2 Biographical details are set out in Appendix 2

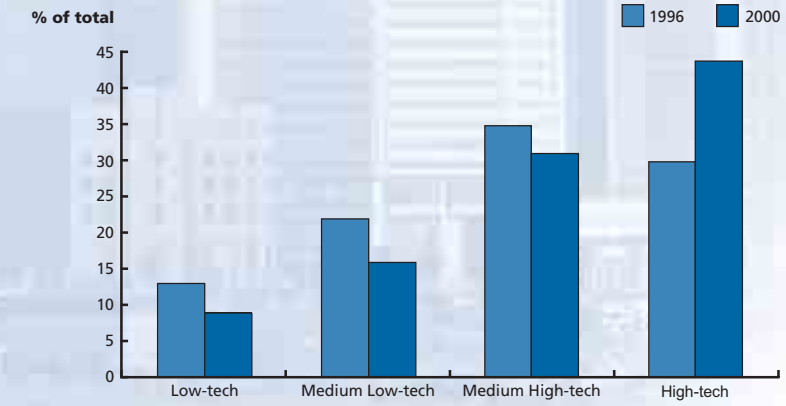
3 Source: Israel Export Institute, Economics Department

4 Meseri O & Maital S (2000) p3. See also HSBC Securities (1998) p45: "Agriculture... was [a] key sector in the early stages of Israel's development, but is currently contributing less than 5% to the business sector product."

5 Burgel O, Murray G, Fier A & Licht G (2000) p25, referring to German and UK experience

1 Overview – the Virtues of Necessity

Structural Change in Industrial Exports



Source: Israel Export Institute

recent study of the commercial impact of technology transfer noted that:

"[…] Israel's efficiency in generating research is relatively high, but declines rapidly as the fruits of that research are moved towards commercialization. The persistence of Israel's trade deficit, averaging 10 per cent of GDP in recent years, suggests that Israel's 'brains' are not being turned into export-related 'bucks'. The question is: Why?"[6]

1.4 How fundamental is the change in Israel's economy wrought by the rapid growth of high-tech sectors? How important is basic academic research and commercial R&D in giving Israel sustainable differentiation in the world market? Has Israel relied too heavily on external funding and US commercial expertise? This paper tracks Israel's experience and examines how far it is unique (given its unusual political and geographical circumstances) and how far it holds lessons of wider application. We believe that using primarily the interview and case study approach provides rich contextual evidence to support the development of new knowledge, but we are mindful that:

"[…] case studies should be evaluated in terms of the adequacy of the theoretical inferences that can be generated. The aim is not to infer the findings from a sample to a population, but to engender patterns and linkages of theoretical importance."[7]

ISRAEL'S LIMITED RESOURCES

1.5 At first glance, Israel may not seem an obvious home for one of the leading knowledge-based economies in the world:

- It has a small population (c.6.1m) and is thus unable to benefit from the domestic economies of scale open even to individual US states such as California or Texas. Significant domestic markets often act as the platform for international scalability, essential in technology sectors.
- Politically and economically its own region offers limited export opportunity, with the combined gross domestic product of Jordan, Egypt and Syria being little more significant than that of Israel – see Table A
- By the standards of other relatively developed economies, Israel maintains high defence spending (some 16% of current government budgets[8]), with government taking a significant proportion of total national income.
- As recently as the early 1990s, Israel had hardly any venture or other risk capital.
- Israel has taken relatively high numbers of immigrants over the past generation, many of whom did not speak Hebrew.[9]

TURNING OBSTACLES TO ADVANTAGE

1.6 However, notably in the high-tech field, Israel has transformed the obstacles and necessities of its circumstances into advantages:

- Its small size and inability to trade significantly at regional level have induced an internationalist attitude in the Israeli business community, with numerous Israeli firms (including some of the biggest) not only having operations in the US but operating legally and commercially with the look and

6 Meseri O & Maital S (2000) p3

7 Bryman A (1989) p173

8 Taking 1999 data from the Economist Intelligence Unit, Israel's GDP was NIS410.1bn; government revenue was NIS213.9bn (52.16%), of which Defence expenditure amounted to NIS34.3bn, or 8.4% of GDP and 16% of government revenue. Following reforms to the tax system, the overall tax burden represented 43% of GDP in 2000-2001. Military spending is to some extent supported by the US, which has made an annual grant of $3bn since 1985, $1.8bn of which is military aid to be spent primarily on US equipment. Civil aid is being phased out. See Economist Intelligence Unit (2000) p13. Egypt also receives US aid

9 Hence the saying, "Israel is the country where the mother tongue is taught to the mother by the children."

TABLE A – Israel & its Neighbours: Relative Economic Performance
GDP US$ at market prices

	1995	1996	1997	1998	1999
Israel	88,234,598,400	97,261,297,664	101,475,000,320	100,733,001,728	100,839,997,440
per capita	*14,960*	*16,160*	*16,710*	*16,470*	*16,310*
annual change (%)	*7*	*5*	*3*	*3*	*2*
population (m)	*5.545*	*5.692*	*5.836*	*5.963*	*6.105*
Egypt	60,159,201,280	67,651,198,976	75,604,697,088	82,709,602,304	89,147,703,296
per capita	*990*	*1,100*	*1,200*	*1,280*	*1,380*
annual change (%)	*5*	*5*	*5*	*6*	*6*
population (m)	*58.180*	*59.272*	*60.396*	*61.524*	*62.655*
Jordan	6,811,550,208	7,027,489,792	7,323,870,208	7,963,610,112	8,072,779,776
per capita	*1,600*	*1,620*	*1,620*	*1,630*	*1,630*
annual change (%)	*6*	*2*	*3*	*3*	*3*
population (m)	*4.195*	*4.325*	*4.459*	*4.597*	*4.740*
Syria	16,548,299,776	16,712,299,520	16,464,199,680	17,411,700,736	19,379,599,360
per capita	*1,210*	*1,180*	*1,050*	*1,030*	*970*
annual change (%)	*7*	*2*	*4*	*5*	*5*
population (m)	*14.112*	*14.511*	*14.911*	*15.312*	*15.711*

By way of comparison, in 1999 US GNP was $8,350.1bn, its population 272.9m and GNP per capita $30,600. In the same year, UK GNP was $1,338.3bn, its population 59.1m and GNP per capita $22,640.

Source World Bank Development Data (www.worldbank.org). Figures differ marginally from those provided by the Israel Export Institute.

feel of a US company.

- Since inception Israel has needed to compensate for its relative size (including limited military manpower) through innovation and technical resourcefulness. Remotely-controlled irrigation was an early example of technology introduced to protect growers from the dangers of physical attack. More recently, the Israeli armed forces have invested heavily in leading-edge technology (e.g. in secure telecommunications).
- Many of the most able individuals are specifically recruited into a limited number of elite units (such as Intelligence or the Air Force) whose cohesiveness fosters team-work. Significantly, the military has not stood in the way of researchers seeking to apply new technologies commercially, subject to security considerations.
- Israel recognised that many new immigrants had useful skills, provided that the right environment could be created to allow their skills to flourish. Some 900,000 immigrants from the former Soviet Union arrived in a period of two years or so at the beginning of the 1990s immediately after the fall of the Berlin Wall. Since Israel's population at the time was only about 5.1m, absorption could have posed serious strains on Israeli society. However, Israel turned to its advantage the fact that perhaps as many as 40% of the new arrivals had a technical background, with some 25% having higher degrees and experience in government-sponsored research.
- Given the extent to which the Israeli technology sector has been financed by US sources and its successful companies transposed to the US, the collapse of the Soviet Union has represented (ironically) an invaluable one-off transfer of know-how to Israel and its western partners, notably the US.
- Israel has exploited its status as a

Israel's International Trade & Economic Agreements

European Union (1975; renegotiated 1995)	*Free Trade Agreement*
USA (1985)	*Free Trade Agreement*
EFTA (1992)	*Free Trade Agreement*
Jordan (1995)	*Bilateral Trade Agreement*
Turkey (1997)	*Free Trade Agreement*
Canada (1997)	*Free Trade Agreement*
Slovak Republic (1997)	*Free Trade Agreement*
Czech Republic (1997)	*Free Trade Agreement*
Poland (1997	*Free Trade Agreement*
Hungary (1997)	*Free Trade Agreement*
Slovenia (1998)	*Free Trade Agreement*
Mexico (1999)	*Free Trade Agreement*
Romania (2000)	*Free Trade Agreement*

1 Overview – the Virtues of Necessity

Exports, Imports and Trade Balance by Region 2000

Source: Israel Export Institute

geographical and cultural "mid-point" by negotiating international trade and economic agreements with the EU, the US and a wide variety of other countries.

RELIANCE ON US CAPITAL & MARKETS

1.7 Despite these many achievements, Israel is currently facing numerous critical challenges, partly as a consequence of the economic and social transformation of the past decade:

- Israel has become dependent on the US both for sources of capital (some 70% of investment in venture funds at the end of the 1990s came from the US) and for markets for its goods. In consolidating its position as a robust knowledge-based economy in the near term a major challenge will be to broaden and deepen the range of its trading partners and sources of funding.
- Further, the main aspiration of most early-stage companies in the initial phases of building up the tech sectors was to obtain a NASDAQ listing as soon as possible. The downturn in quoted technology, media and telecoms sectors since the Spring 2000 has left numerous Israeli market leaders trading significantly below 2000 highs and under intense investor scrutiny.

1.8 The Israeli business website Globes[10] tracks the share price movement of leading quoted technology stocks. The trend over the year has been downwards for nearly all of these shares; the position as at 7 September 2001 is set out in Table B. Worse, it appears that overall (with some exceptions) Israeli quoted tech stocks have underperformed the market as a whole in 2001, as demonstrated in Table C comparing the top 50 US-traded Israeli companies in the sector with the technology-biased NASDAQ index as at 6/7 September, being the latest practicable date before the terrorist attacks of 11 September 2001.

TABLE B – Quoted Israeli Tech Stocks Price Movements 2001
Israeli Companies Quoted Overseas: Top Five by Market Capitalisation

	Closing price 7 Sept 2001 US$	*Closing price 31 Aug 2001 US$*	*Weekly change %*	*1 month change %*	*YTD change %*
Amdocs	30.84	38.30	-19.48	-32.32	-53.45
Checkpoint	30.57	31.99	-4.44	-28.51	-77.11
Comverse	21.77	25.14	-13.40	-26.65	-79.96
Mercury	24.09	27.01	-10.81	-35.61	-73.31
Taro	37.56	42.50	-11.62	-2.82	141.84

TABLE C – Performance of Isratech 50 vs. NASDAQ: 6 September 2001
The Globes-Nessuah Zannex Isratech 50 Index comprises the 50 leading Israeli stocks traded in New York

	Weekly change %	*1 month change %*	*YTD change %*
Isratech 50 index	-10.1	-20.8	-48.1
NASDAQ	-6.5	-16.8	-31.7

10 www.globes.co.il

ENTREPRENEURSHIP AND GOVERNMENT POLICY

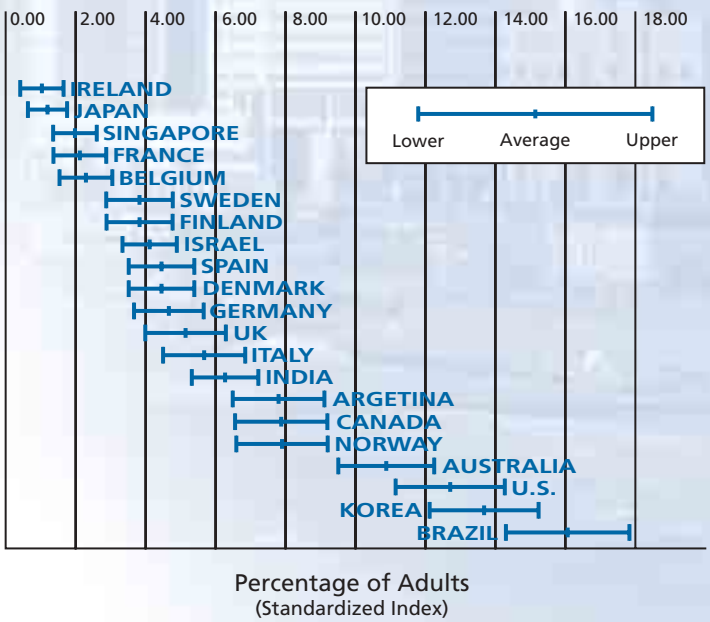
1.9 With a revival of entrepreneurship, Israel is estimated to have had between 2,000 and 3,000 start-ups in recent years[11]. One of our interviewees specialising in technology transfer summarised recent events thus:

"Ten years ago there was the beginning of a new atmosphere, something that went beyond entrepreneurship. People broke all normative society rules, including neglecting their families - with their spouse's support; it was a form of self-slavery. One success story led to another, to the point where it has challenged existing ways of life. Easy money became the rule of the game. Salaries were pushed up, work conditions and benefits were unbelievably high, youngsters became millionaires overnight – or lost everything."

1.10 This embrace of the free market should be seen against the dirigiste nature of Israeli society in the first 30 years of the state. Now, following a shift to the market economy, the introduction of incubators, and the growth of venture capital, many Israelis are able to enter into business on their own account. The growth of the stock market is one measure of the increase in the free-market approach in Israel. After a slow start, the stock exchange is now an integral feature of Israeli commercial life, as the Tel Aviv Stock Exchange's own history[12] explains:

"Securities trading in Israel dates back to 1935, when the Anglo-Palestine Bank Ltd, together with pre-state Israel's leading banks and brokerage firms, founded the Exchange Bureau for Securities, which acted as an unofficial stock exchange […] The Tel Aviv Stock Exchange was incorporated and began operations in 1953. A decade later, a group of bourse members established the TASE Clearing House Ltd […] The TASE derivatives market opened in 1993 […] since the end of 1999, all listed securities as well as derivative products are traded on the new integrated trading platform."

Total entrepreneurial activity prevalence rates
(GEM TEA Index by country)



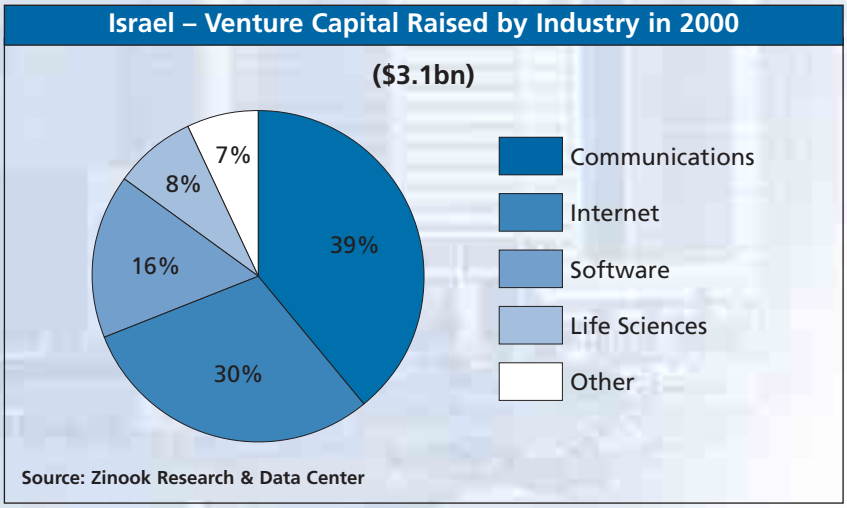
Source: Global Entrepreneurship Survey 2000 Executive Report p10

1.11 Our experience of the fundamentally entrepreneurial nature of Israeli society should also be set against the survey data summarised in the Global Entrepreneurship Monitor 2000. In analysing levels of entrepreneurial activity, the GEM report considers such factors as the proportion of the adult population in each country currently engaged in the process of creating a nascent business, and the presence of new firms is measured by the proportion of adults in each country involved in operating a business under 42 months old. Nascent and new firm activity are combined to provide an index of total entrepreneurial activity (TEA). The GEM TEA Index counts only once those individuals involved in both activities. While it may be no surprise to find the US towards the top of the TEA index, empirical experience runs counter to a ranking of Israel (and indeed Ireland) significantly behind Germany and Norway.[13]

11 See, for instance, Khavul S (2001). Dr Khavul is now an Associate Professor of Entrepreneurship at London Business School and has issued a summary of her doctoral dissertation. See summary paper, p2

12 www.tase.co.il

13 Global Entrepreneurship Survey 2000 Executive Report pp9-10; figure 6



1.12 Entrepreneurship in Israel also benefited from a major shift in government policy away from the dirigisme of the founding period of the State of Israel. Once again, this policy shift began as a matter of necessity and later become a major virtue: following the energy crisis of 1973, successive Israeli governments initially attempted to cope through devaluation and inflation, rather than fiscal adjustment. This policy was thwarted by near universal indexation and excess demand. Inflation reached 400% in 1984, causing massive government and current account deficits. A stabilisation programme was launched in 1985, a turning point for economic policy. The Bank of Israel, the central bank, was given a key role in achieving price stability, promoting deregulation, reforming financial markets and forcing the government to move towards international fiscal standards. Inflation fell back to c.18% over the late 1980s as government budgets were cut back and balanced.[14]

1.13 By the late 1990s, Israel reached price stability, although government spending rose again in 1995-6, leading to a rapid deterioration in the balance of payments. The shekel (NIS) became fully convertible in 1998. Real GDP growth, which had averaged 5.9% in 1990 - 1994 and peaked at 6.8% in 1995, fell back to 2.2% in the late 1990s, partly as a result of a cyclical downturn in private consumption as the immigration wave of the early 1990s subsided. Nevertheless, structural reform had been achieved in Israel, with low inflation and relative restraint of the state sector, providing a stable background for increased private sector activity, including an increase in industrial exports (notably electronics and other high-tech goods) in 1999.

GOVERNMENT'S NEW ROLE

1.14 Recent developments in Israel have seen "a new point of balance" (as it was put to us) being achieved between government intervention and the free market. New policy initiatives were imperative in the light of the huge wave of Russian immigration. What could have presented an impossible burden of economic assimilation – especially given the limited resources the new arrivals brought with them – turned into a unique opportunity for Israel. This came to pass through government sponsorship of incubation and state intervention to create a thriving venture capital industry, with $2.3bn being raised in 2000. What is more, unlike the UK, Israel has seen a considerable proportion of its venture funding channelled into relative early stage investments and into a range of technology sectors.

1.15 However, as a general principle, government has sought to address market weaknesses and to withdraw once its policy has had the necessary effect. Its venture capital vehicle, Yozma, was later privatised and new policies to enable state-financed incubators to be income generating in partnership with the private sector are now being implemented.

SUMMARY

1.16 Following several years of free market reforms, Israel's economy has moved away from primary sectors such as agriculture and seen a resurgence of entrepreneurship. Israel has turned its apparent limitations, including limited natural resources and high defence spending, to competitive advantage. Long-standing investment in education and the one-off benefit of a wave of highly-trained immigrants were combined with targeted government programmes supplementing the private sector. However,

14 *Israel, The Occupied Territories,* Economist Intelligence Unit 2000, pp 21-25

Summary of Israeli Government Finances (NIS million at current prices)				
	1997	1998	1999	2000
Revenue	186,506	198,643	213,891	227,426
of which				
income tax	51,336	58,145	58,300	61,780
VAT	31,650	35,760	35,740	39,730
customs duties	1,160	1,310	1,180	9,790
purchase tax	7,889	8,850	8,610	860
excise & fuel tax	5,807	6,570	6,560	7,580
stamp tax	848	950	910	860
interest, dividends	7,553	8,481	12,640	12,770
transfer	18,296	17,276	15,020	16,467
Expenditure	186,506	217,242	224,685	227,426
of which				
defence	33,600	32,770	34,322	36,655
health	10,187	11,649	12,253	12,924
education	21,065	24,086	24,831	26,233
agriculture	979	1,056	1,075	1,114
commerce	106	154	161	165
housing	688	730	809	3,670
interest	22,226	23,800	23,836	26,339
social security	17,128	18,575	20,039	20,294
subsidies	1,798	2,074	2,044	2,375
Development budget	47,079	56,587	56,323	60,114
of which				
debt repayment	37,485	44,940	43,405	46,674
Payments to Bank of Israel	1,120	1,500	1,177	1,325

Sources: *Israel, The Occupied Territories* Economist Intelligence Unit 2000; Ministry of Finance, Israel.

the balance of payments deficit has continued, and even before the recently renewed political and economic uncertainties, Israel was faced with policy issues concerning the efficiency of its technology transfer and ability to penetrate more effectively export markets other than the US.

1 Overview – the Virtues of Necessity

Political and Economic Context

"We are one of eight second Silicon Valleys. Israelis are very innovative, they are individualist, undisciplined – and they improvise; improvisation does not have negative connotations in Hebrew. As in Silicon Valley there is a rare combination of technology and entrepreneurship. The military has played a key role as the father of high tech, and the peace process saw a wave of start-ups from the armed forces. Ninety to ninety-five percent are from Intelligence or the Air Force. What makes a difference here is that the individuals are used to working together as a team. And military service exposes Israelis to technology at a young age. It also instils maturity and responsibility."

Senior Civil Servant in conversation with the authors, spring 2001

"Afraid that Ishmael, as the elder son, might harm her Isaac after Abraham died, Sarah urged her husband to dismiss Hagar and her son. Seeing that Sarah's request was also sanctioned by God, Abraham yielded and sent them off. When their provisions ran out, an angel and some shepherds sustained the outcasts. Later Ishmael married an Egyptian woman, by whom he had twelve sons, and their descendants became the Arabian nation."

Josephus, *Jewish Antiquities* (1st Century)[15]

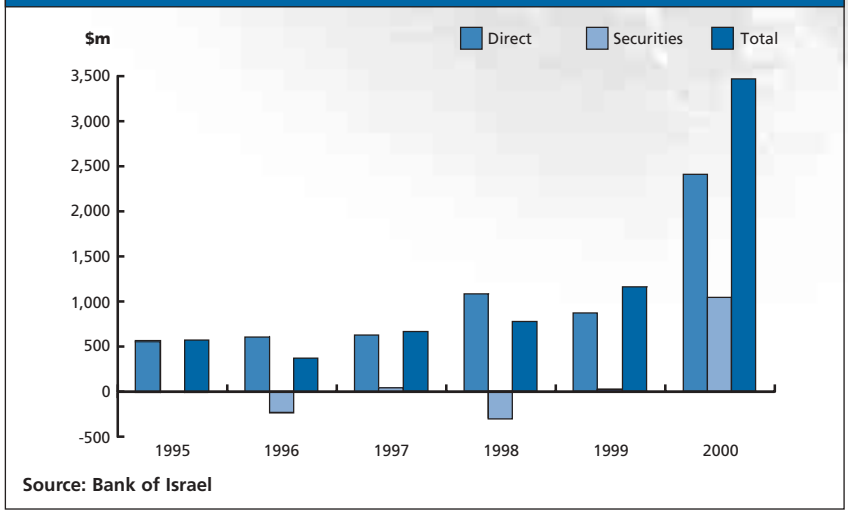
INTRODUCTION

2.1 Israel as a modern state only traces its history back to 14 May 1948. However, the broader story of Israel is of some 4000 years duration, which generates cultural and political barriers at every level and out of all proportion to the size of the territory. Even the name used – Israel, the Holy Land, Palestine – can have political overtones, and the interest taken in the area internationally is also out of proportion to its population or natural resources:

> "Since the beginning of the Christian era, Palestine has been the focus of […] what one might call negative cosmopolitanism. The usual sense of cosmopolitanism denotes an outlook in which a person from one location identifies with a wide variety of places. Negative cosmopolitanism means the opposite: the identification of people from a wide variety of locations with one place."[16]

2.2 Over its first 50 years of existence, Israel has transformed itself from being primarily an agriculturally-based economy to one based on industry (36% of business-sector GDP, of which manufacturing represented two thirds in 1998[17]) and services (64%), with high-tech sectors accounting for 44% of exports[18]. A considerable proportion of this transformation has been achieved in the past ten years, partly as a result of immigration from the former Soviet Union and partly as a result of government policy, as well as a

Israeli Investment Abroad



Source: Bank of Israel

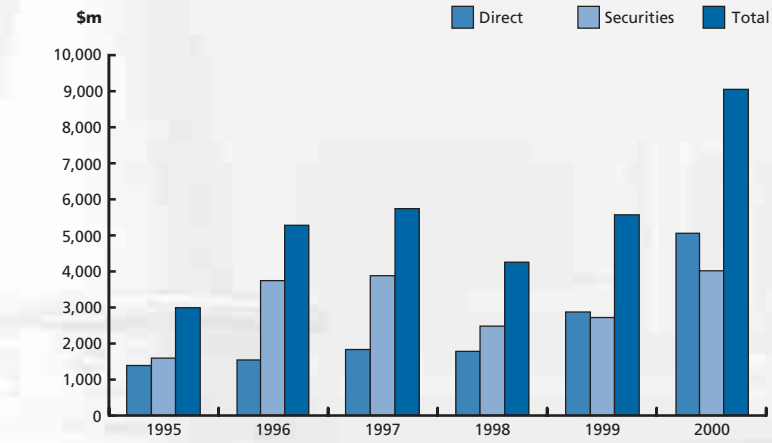
15 *Josephus – The Essential Writings,* ed Paul L Maier, Grand Rapids, Missouri 1988 p 28. Cf Genesis chapter 31

16 Edward Fox, *Palestine Twilight* (2001) p55

17 Economist Intelligence Unit (2000) pp19-20

18 Israeli Export Institute, Economics Department, 2001

Foreign Investment in Israel



Source: Bank of Israel

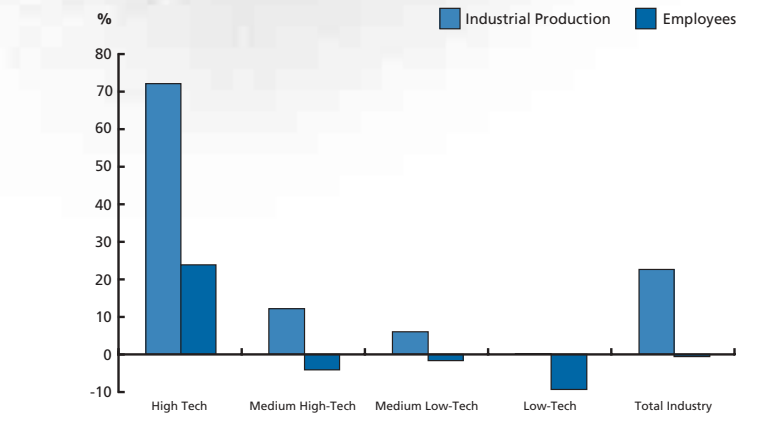
reaction to market forces. Economists generally treat cultural factors as a residual; however, in Israel they are a starting point. No visitor can ignore either the generally remarkably high standards of education (with many scientifically qualified entrepreneurs speaking Hebrew, English and perhaps another parental language) or the sense of purpose evinced by a relatively young society, almost all of whose members have undergone military training, learning discipline and teamwork.

ACCELERATED ECONOMIC TRANSITION

2.3 Many Israelis believe that their society has just passed through "the intersection of events for start-ups and entrepreneurship."[19] The impetus for the rush of talent and energy into technology-based start-ups arises from the following factors:

- The transition "from war to peace"; however fragile the peace process now, over the 1990s it spurred the conversion of much of the defence-based innovation in the military sector to market application.
- Related to this, some of the ablest individuals in every generation since 1948 were attracted into physics, mathematics and electronics and other sectors where they became an unusually strong cohort of idea generators for the military.
- In the early 1990s, Israel benefited from a one-off wave of immigration from the former Soviet Union. In two to three years, some 900,000 people arrived (Israel's population at the time was some 5.1 million); about 40% of the new arrivals had science or technology qualifications, many in subjects such as mathematics complementary to Israel's indigenous strengths and representing know-how of almost incalculable value. (There were also sufficient musicians "to form a symphony orchestra in every village")
- Modern communications and the widespread availability of information technology "makes the world shrink by orders of magnitude." Israel, isolated from its immediate neighbours and with a population whose roots reach round the world, was well able to exploit the internationalisation forced upon it.

Structural Change in Industrial Production and Employment 1995 to 2000 *(% change during period)*



Source: Israel Export Institute

CURRENT ECONOMIC OUTLOOK

2.4 Although when we began our research (March 2001) many of our interviewees insisted that the crumbling of the peace process is less significant for the economy than the performance of NASDAQ, one year after the resumption of the Intifada (the al-Aqsa Intifada began following the visit to the Dome of the Rock in September 2000 by the current Israeli Prime Minister, Ariel Sharon, then in opposition) the costs of stepping up defence activity are beginning to bite in an economy which is already seeing a resumption of inflation. We noted increasing pessimism in our interviewees between March and September

19 Leading university technology transfer official in conversation with the authors, spring 2001

2001. The change in mood has been influenced by a number of factors:

- Even before the terrorist attacks in America in September 2001, the coalition government agreed to increase defence spending.[20]
- In October 2001, the International Monetary Fund revised its 2002 growth forecast for Israel to 2.8%, down from 5.4% set out in the half year report published in September, although even that lower level is above the projected growth rate for most developed countries. The Ministry of Finance was forecasting 4%, a figure deemed unrealistic by the Bank of Israel.
- Some high profile failures (such as Chromatis) have dented confidence in the technology commercialisation model.
- In October 2001, the high-tech forum of the Israeli Center for Administration (composed of experienced CEOs in the sector) gave evidence to the Knesset (parliament) sub-committee on the high-tech crisis to the effect that without immediate government intervention many start-up companies would fail and the sector as a whole shrink considerably. The Forum envisaged a new government fund for start-up companies (in effect a new Yozma) to prevent them moving abroad.

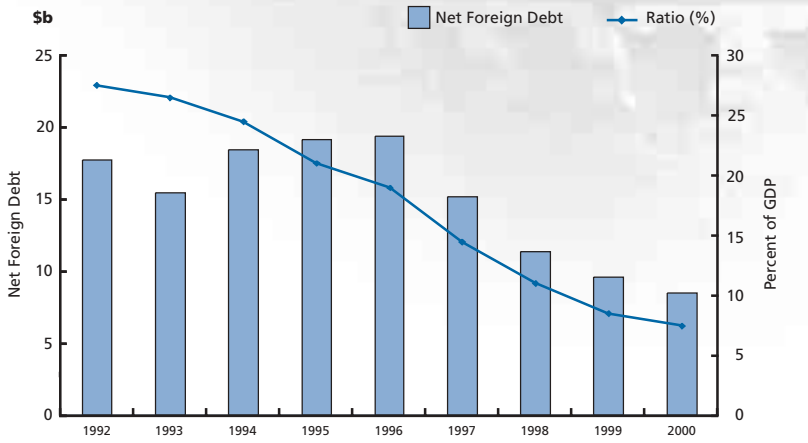
2.5 Some but not all of our interviewees were concerned that the explosion in wealth of the late 1990s (even following stock market revaluations) was leading to divisions in Israeli society after an extended period during which other differences (such as those between Ashkenazim and Sephardim) had been eroded through inter-marriage. As one recent review of the impact of government intervention in the industrial sector notes:

"Developments in the labor markets associated with High Tech have of course wider implications. In fact, one of the most striking trends in the Israeli economy of the past two decades has been the rapid rise in pre-tax income inequality. Attempts by the government to keep a lid on after-tax inequality have necessitated a dramatic increase in the share of the budget (and of GDP) going to welfare, a trend that seems unsustainable. The rapid rise in the relative wages of workers in the High Tech sector has undoubtedly contributed to the growing income gap in recent years."[21]

2.6 This trend is becoming self-correcting, given the major shifts in expectations, and hence in recruitment and remuneration policies evident in Israel's high tech markets in late 2001. According to a Manpower Information Technology survey (published in August 2001) of recruitment advertisements there was a decline in demand for high tech workers in July of 20.1% compared with June. This followed a 17% decline in May and a 20% decline in April. Demand has continued to decline precipitately, falling 80% between September 2000 and September 2001[22]. It appears, however, that IDF personnel, especially from Intelligence, continue to be recruited.

2.7 A small number of firms continue to recruit: for instance, in September 2001 Intel Israel launched a recruitment campaign for hardware and software engineers in Haifa and Yakum. But in general, the decline in demand in mid-2001 for hardware engineers

Ratio of Net Foreign Debt to GDP (end of period)



Source: Israel Export Institute

20 However, some Israeli companies are active in sectors more in demand since 11 September: Adyoron Intelligent Systems has won a New York Police Department tender for installing digital video recording systems in six central locations in New York City, to be connected to 2,500 cameras operated by the NYPD. The company was established in March 1999 and has 40 employees

21 Trajtenberg M (2000) p5

22 Manpower Information Technology survey published 15 October 2001

(38.8%), network managers and support personnel (33%) was particularly sharp. In previous months, programmers saw the steepest fall in demand for their services. As one technology professional put it to us, Israel being a less conspicuously consumer society than Silicon Valley:

"The keys to the Mazda 323s are being handed back."

2.8 Although some foreign firms continue to invest (in November 2001 IBM announced that it was investing $6m to found a global technology unit in Israel) foreign investments in Israel have been severely curtailed over the past 18 months. Total investments by foreign residents fell by $313m in August 2001 for the first time, and no issues by Israeli companies on foreign stock exchanges were recorded for the second consecutive month[23]. In the first quarter of 2001 venture capital investments by foreign VCs declined to 41.4% of Israeli VC investment, down from a peak of 88.4% for the same quarter in the previous year.

2.9 In early September 2001, the Israeli cabinet approved the 2002 budget. The new draft sets out an overall NIS2bn cut over 2001 and proposes a deficit of 2.4%, on the assumption that 4% growth is achievable in 2002, a forecast which the Bank of Israel believes unrealistic. The 2.4% deficit is already higher than the 1.5% stipulated in the Deficit Reduction Law under which Israel has worked in recent years to achieve economic stability. As at September 2001 inflation expectations for the next 12 months were 2.2% to 3.2%, and interest rates stood at 6.1% in November.

2.10 The draft budget also includes a number of reforms likely to impact on the development of technology, such as new rules expanding university eligibility to anyone with a matriculation certificate; psychometric exams will no longer be required. The committee on national infrastructure projects is to have new powers; the water and energy sectors are to be opened to competition and the real estate market is also to be opened up. Total investment in roads, railways and the Cross-Israel Highway will be increased by NIS2bn to over NIS6bn, including NIS3.5bn through "build, operate and transfer" and "private finance initiative" programmes. The plan envisages building 5,000 new classrooms, including some in the Arab sector. However, it is also envisaged that 12,000 fewer foreign workers a year will be employed.

RESEARCH & DEVELOPMENT

2.11 How well Israel fares in terms of R&D expenditure is hotly debated within the country. On the one hand, in recent years national expenditure on civilian R&D has compared favourably with competitors in the developed world, on a par with Japan at 2.9% of GDP in 1997 and only behind Sweden (3.6%). The UK (1.6%) has been behind its peers for a number of years, with arguably unsustainably low investment in R&D in all but a handful of sectors such as pharmaceuticals[24].

TABLE D – Israel Economic Indicators

	1997	1998	1999	2000
Population	5.9 m	6.041m	6.209m	6.4m
GDP	$101,475m	$100,730m	100,842m	$110,130m
GDP per capita	$17,409	$16,870	$16,470	$17,549
GDP growth	3.3%	2.4%	2.3%	5.9%
Inflation rate	7%	8.6%	1.3%	0.0%
Unemployment rate	7.7%	8.6%	8.9%	8.8%
Imports: goods/services	$42.2bn	$40.7bn	$45.7bn	$52.3bn
Exports: goods/services	$31.1bn	$32.1bn	$36.0bn	$43.9bn
Goods/services deficit	$11.1bn	$8.6bn	$9.7bn	$8.4bn

Source: Israel Export Institute Economics Department

23 www.globes.co.il 24 September 2001

24 For further details of the UK's competitive position, see the DTI's annual *R&D Scoreboard*

2.12 The UK provides a useful contrast with Israel. Despite its low investment record, the UK has generated a small number of successful specialist clusters, which in turn have given rise to internationally successful businesses. Cambridge, for instance, is home to a number of corporations which have either already achieved significant commercial success or are well on their way to doing so. Over 1,500 technology-based companies operating in the IT, telecommunications, life science and instrumentation sectors are now based in Cambridge. Many of these have University technology and people at their heart (in the IT sector alone: ARM, Apama, Autonomy, Cambridge Display Technologies, Zeus Technology). It should be noted that the population of Cambridge is only some 115,000, with the University accommodating 7,000 academics, 4,900 research students and 11,600 undergraduates.

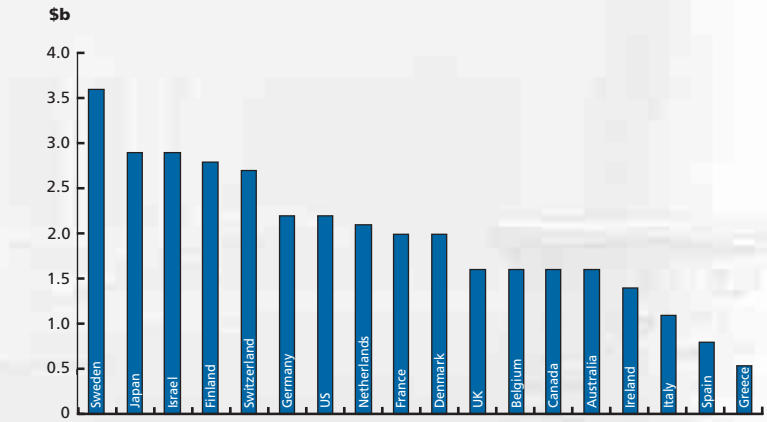
2.13 In this context relative and absolute size can be material. As one of the pioneering analyses of technology transfer in Israel put it:

"Thus, in 1997 the absolute amount of resources allocated to civilian R&D in Israel was $3,129m, of which $2,006m was business sector R&D. That same year eight of the leading industrial R&D performers in the US spent over $2bn in R&D, each of them more than Israel's industrial sector as a whole. To put it differently, all of Israel's business sector R&D amounted to the R&D done by Pfizer, and was slightly less than the R&D done by Johnson & Johnson."[25]

2.14 Tratjenberg points out that similar conclusions can be drawn from patent information:

"[…] Israeli inventors were granted in 1997 a total of 653 patents, of which slightly less than half went to Israeli corporations, i.e. about 320 patents. By contrast, that same year IBM was granted 1,758 patents, Motorola 1,151, Intel 407, Hewlett-Packard 537, General Electric 667, and so forth."[26]

National Expenditure on Civilian R&D as Percentage of GDP International Comparison 1997



Source: Israel Export Institute

RESEARCH & GOVERNMENT POLICY

2.15 In August 2001, the ministerial committee for science and technology reviewed making biotechnology a national priority. The team appointed by the Minister of Science, Culture & Sport made the following recommendations:

- On manpower training, plans should be drawn up for the last years of high school to include entrepreneurial and industrial elements. The committee also recommended providing post-doctorate scholarships in the industry.
- A need for a $5m fund for medical research and an $18m fund for innovative application research was identified. A further $7m should be allocated to establish and expand knowledge centres to serve the entire scientific community.
- It is recommended that establishing specialised incubators be reviewed and $2m be allocated for the purpose.
- The government's decision to set up a national bioethics committee in the Ministry of Science was welcomed, and manpower training in this subject in outlying districts recommended.
- A flagship project of $8m was recommended to step up activity in a well-defined sub-sector.

25 Tratjenberg M (2000) p49

26 Ibid. By way of comparison, in 1997 5325 patent applications were made in the UK, of which 293 were in Cambridgeshire

TABLE E – The 15 Leading Industrial R&D Companies in the USA and Israel – R&D Expenditures in 1997

1997 Rank	Company	R&D Expenditures Millions $	R&D / Sales %
1	General Motors	8,200	4.9
2	Ford Motor	6,327	4.1
3	IBM	4,307	5.5
Israel's Total Civilian R&D		**3,129**	
4	Lucent Technologies	3,100	11.8
5	Hewlett-Packard	3,078	7.2
6	Motorola	2,748	9.2
7	Intel	2,347	9.4
8	Johnson & Johnson	2,140	9.5
Israel's Business Sector R&D		**2,006**	
9	Pfizer	1,928	15.4
10	Microsoft	1,925	16.9
11	Boeing	1,924	4.2
12	Chrysler	1,700	2.9
13	Merck	1,684	7.1
14	American Home Products	1,558	11.0
15	General Electric	1,480	1.7

Source: NSF Science & Engineering Indicators – Top 500 Firms in R&D by Industry Category, 1999. Reproduced from Tratjenberg M (2000) p50

2.16 The team also reported that to influence the future of bio-technology in Israel, 5% of Israel's total civilian R&D will be required to be invested, equivalent to NIS3bn in 2000, and 20% of Israeli spending on life sciences – NIS1bn at 2000 values. Total annual investment of $50m a year in biotechnology infrastructure is required.

2.17 Putting this in the context of private sector spend, Ernst & Young Israel[27] reported that in the second quarter of 2001, venture capital funds and private investors made 12 investments totalling $52.14m in the Israeli life sciences sector, a 32% increase over the same period in 2000, during which nine investments worth $39.5m were made. The second quarter of 2001 was 22% below the first three months of the year (13 investments totalling $67m). Biotechnology accounted for $24.1m of the second quarter's total. The average size of investment was $4.7m, with most investments in existing companies and seed-stage investment declining rapidly.

2.18 In October 2001, Genzyme (the fifth biggest biotech company in the world by market capitalisation) announced significant investment plans to buy Israeli companies and to develop drugs jointly.

"POST-ZIONISM"

2.19 Economic issues cannot be considered without reference to the broader political and cultural context, most notably the accelerating transition towards secularism. In addition to the continuing conflict with the Palestinians recorded in the international news media, Israel is having to face up to the long-term implications of statehood in such issues as who is an Israeli and how does the Law of Return apply. In many instances, this is a tension between cultural or religious identity and the norms of democracy:

> "The secular nature of the state on the other hand prevented the adoption of strictly religious criteria in the bestowal of citizenship. The wording of the Law of Return is such that many individuals who are not Jews from a strictly religious point of view can still enjoy a right of return as Jews. But the existence of religious courts, and their virtual monopoly on personal matters, suggests that individuals considered as Jews by the state might not necessarily be so in a religious court."[28]

2.20 The conflict between secular and religious values, together with the rapid influx of new immigrants in recent years, led to the introduction of stricter religious tests for those reaching Israel after 1990:

> "[…] but the Orthodox and even Jewish hold over Israeli life has come under pressure from immigrants, who have been persuaded to come to Israel to offset the 'demographic time bomb' of rapid population growth among Arabs. More than 40 per cent of the one million new arrivals over the past decade, mostly from the former Soviet Union, are not Jews, according to government officials […]

27 www.ey.com/global/gcr.nsf/Israel/Israel_home

28 Emanuele Ottolenghi,"Religion and Democracy in Israel", in *Religion and Democracy* (ed David Marquand and Ronald L Nettler) Blackwell, Oxford 2000, p45. See also Yeshayahu Leibowitz, "Judaism, Human Values and the Jewish State", in Eliezer Godlam (ed.) Cambridge MA, Harvard University Press, 1992, pp226-7

One of the teenage victims of the last suicide bombing in Tel Aviv was buried in a Christian cemetery. Another, whose Judaism was in doubt, qualified for burial only on the edge of a Jewish area. Many recruits to the Israeli Army – some estimates say up to 20 per cent – now take their oath of allegiance with a hand on the New Testament."[29]

2.21 The tensions within Judaism and between Judaism and secular pluralism (and by implication acceptance of minorities) were not necessarily recognised when modern Israel was conceived. As David Ben-Gurion put it in 1918:

"Both the vision of social justice and the equality of all peoples that the Jewish people has cherished for three thousand years, and the vital interests of the Jewish people in the Diaspora and even more so in Palestine, require absolutely and unconditionally that the rights and interests of the non-Jewish inhabitants of the country be guarded and honoured punctiliously…. The non-Jewish interests are conservative; the Jewish interests are revolutionary. The former are designed to preserve that which exists, the latter – to create something new, to change values, to reform and to build."[30]

So, Who is a Jew?
from *The Times*, 27 June 2001[31]

Israeli State: Under the "Law of Return", immigrants must prove at least one Jewish grandparent.

Jewish Halacha rulings: Jewishness by descent through mother, who must have been born, or converted to, Judaism before child's birth.

Conversion: In Israel, only Orthodox conversions are recognised when conducted inside the country.

Belief: "It should not be what anyone else says, but how you define yourself. If you're Jewish, you can just say so" – Irit Rosenbaum, a lawyer for non-Jews seeking family rights.

Psycho-social: "My Judaism comes from ethical principles which demand that we are always on the side of the weak and the victim" – Dr Elza Greenbaum, pro-Palestinian psychoanalyst.

SUMMARY

2.22 Israel has seen a transformation of its economy over the 1990s, with considerable structural change in favour of high-tech sectors. Remarkable as this progress is, even before the current economic downturn and accelerating political uncertainties, it was not clear whether Israel was making the most of its research base. Economics are inseparable from politics and, in Israel, from cultural factors. Over the next generation further adjustment will be necessary to accommodate the tensions between the country's faith origins and growing secularism. However, where high-tech is concerned, firm foundations have been built with the pioneering work of the founders of the modern venture capital scene and structures for the commercialisation of research, the virtues of which are now the accepted norm in Israel.

29 *The Times,* London 27 June 2001. See also Ottolenghi, op cit, p47: "For in order to be both Jewish and democratic, the state must necessarily retain an overwhelming majority of Jews as its population, something that calls for both a territorial compromise and an identity compromise."

30 Cited Gilbert M (1998) p38

31 For a detailed and accessible discussion of definitions of Judaism, see Dan Cohn-Sherbrok *Messianic Judaism* London and New York 2000

The Godfathers

"The key factors are availability of opportunities, entrepreneur role models, colleagues who are willing to join the would-be entrepreneur in their new venture, and resources."

Prof Bill Bygrave[32]

Israel's high technology industries, and their success in attracting inward investment and internationalising technology businesses, owe much to the role of a handful of individuals in the late 1980s and early 1990s.

David Efrati originally trained as an engineer and worked for Bezek (the Israeli state telco) before qualifying as a lawyer. He founded Efrati, Galili & Co, the Tel Aviv law firm specialising in the technology industries, and was the first Chairman of the Israel Venture Association. Efrati's main achievement was in accelerating the successful series of flotations of Israeli technology companies on the US stock exchanges. Early flotations included Scitex[33] and InterPharm. More recent successes have included Checkpoint[34] (the internet security company). Efrati has also been central in the campaign to change Israel's tax and corporate governance law to make the country's high technology industries attractive to overseas investors.

Ygal Ehrlich read Chemistry for his first degree and has an MBA from the Hebrew University, Jerusalem. He was the Chief Scientist of Israel's Ministry of Industry and Trade between 1984 and 1992. During his tenure he initiated the Generic Technology Program, creating consortia between technology companies and research institutes and universities worldwide, as well as the Technology Incubator Program. He was also instrumental in setting up the bi-national industrial R&D co-operation agreements with Canada, France, the Netherlands, Singapore, Spain, the UK and the US. In late 1992, he persuaded the government to allocate $100m to set up Yozma, the cornerstone Israeli fund of funds, including Gemini, JVP, Nizanim (Concord), Polaris (Pitango), STAR and Walden Israel, which are the backbone of the current Israeli VC industry.

Ed Mlavsky, an Englishman by birth, has a first degree and a doctorate in Chemistry from Queen Mary College, London. After a career in the US, during which he rose to be CEO of Tyco International, Mlavsky moved to Israel in 1979. He was the founding director of BIRD, where he remained until 1993, pushing the hugely successful series of partnerships, alliances and acquisitions between Israeli and US companies which developed through the 1990s. Mlavsky is co-founder and chairman of Gemini Israel funds).

The Zisapel brothers, Yehuda and Zohar, are Technion-educated electrical engineers who founded the RAD group of companies in the early 1980s. RAD's focus has mainly been networking technologies - one of the pillars of the Israeli high-technology industries. Zohar Zisapel was Head of the Electronics Research Department in the Israeli Ministry of Defence before founding RAD with his brother. The RAD companies have spun-out a succession of successful businesses, such as Giganet, through their in-house incubator at Har Hotzvim and latterly raised a venture fund. The Zisapels' reputation took a battering during 2001 with the failure of Radguard, a company focused on Virtual Private Networks technology, but the brothers remain among the most active technology investors in Israel.

32 Quoted in Beveridge (2001) p3
33 NASDAQ - SCIX
34 NASDAQ - CHKP

Venture (and other) Funding

"Certain oddities about Israel: Because people think so hard here, and so much, and because of the length and depth of their history, this sliver of a country sometimes seems quite large. Some dimension of mind seems to extend into space."

Saul Bellow, *To Jerusalem and Back* (1976)

"Lui qui hait l'irrationnel et le fanatisme a toujours conçu le métier de banquier comme un moyen d'agrandir la sphère de la rationalité, et non de gagner de l'argent. Il a su d'avance le tragique de son destin: refaire fortune sans aimer l'argent, penser rationnellement dans un monde de folie, aspirer à la sagesse dans un siècle de barbarie. Décidément, pense-t-il, si lui, homme de haute finance, a eu si peu d'influence en ce siècle, c'est qu'il n'est pas le siècle de l'argent mais de la spéculation et du pouvoir."[35]

Jacques Attali, *Sir Siegmund G Warburg – Un Homme d' Influence* (1985) pp 513-4

INTRODUCTION

3.1 Unusually, Israel created its active and successful venture capital industry – that most capitalist of all sectors – through state intervention. Although very limited private funds were available for equity investment in the late 1980s, the VC industry mainly took off following the creation by the government of Yozma in 1992-93. Initially, Yozma provided matched funding to a range of VC companies typically providing some 40% of their capital. Now that the sector is established, Yozma has been privatised.

3.2 Today, Israel has a well-established VC sector, with significant investments in life sciences, software, communications and the internet. The industry has been characterised by strong links to the US, both as a source of capital for investment and as a ready market for realisations by IPO on, typically, NASDAQ or by trade sale. Over the past decade, a steady and accelerating stream of VC-backed Israeli companies have been floated in the USA, often as Delaware corporations with US domicile.

3.3 As a small and relatively geographically isolated country, Israel has a limited capacity to develop large technology companies within its own borders. The drastic downturn in quoted technology stocks over the past year has led to a drying up of both IPO and acquisition opportunities for Israeli

Yozma

Yozma ("project") effectively created the Israeli venture capital market in 1993 through the formation of its first venture fund, Yozma I. Originating from a government program aimed at prompting venture investments in Israel, Yozma I has transformed the domestic landscape of private equity investments. Over a period of three years, the Group established ten drop-down funds, each capitalized with more than $20 million. In parallel Yozma started making direct investments in start-up companies. This marked the beginning of a professionally managed venture capital market in Israel. Today, Yozma's drop down funds constitute the backbone of the Israeli venture market.

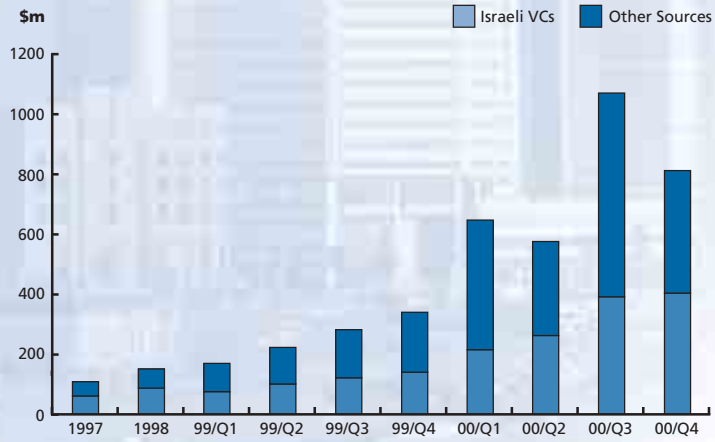
Since inception the Group has managed more than $170 million in its two funds, Yozma I and Yozma II, and has made direct investments in more than 40 portfolio companies. Many of Yozma's portfolio companies been floated on US and Europe stock exchanges while others have been acquired, or invested in, by corporates such as Agilent, America On Line, Cisco, Computer Associates, ECI Telecom, Enron, General Instruments, Johnson & Johnson, Medtronic, Microsoft and Terayon.[36]

35 "He who hated the irrational or fanatical had always seen the banking profession as a means of widening the sphere of rationality and not of earning money. He had known in advance the tragedy of his destiny: to make a fortune without loving money, and to think rationally in a world of madness, aspiring to wisdom in a century of savagery. He firmly believed that the reasons why he, a man of high finance, had had so little influence in this century was that this was not the century of money but that of speculation and power."

36 http://www.yozma.com/overview/default.asp

3 Venture (and other) Funding

Sources of Investment in Israel High-Tech Companies



Source: IVC Online High-Tech VC Survey

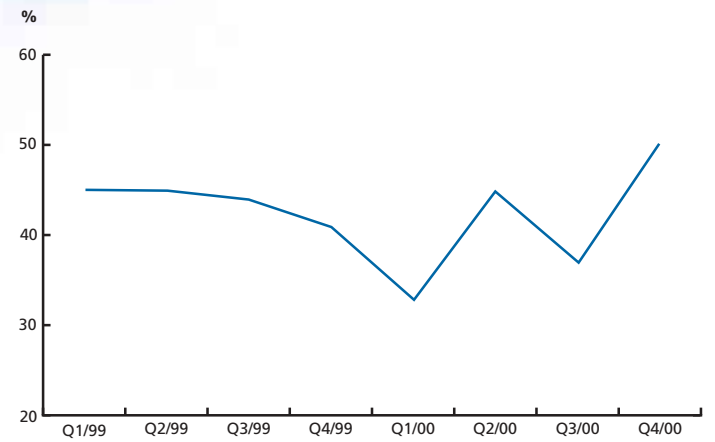
companies in the US. This has created uncertainty both about the ability of young technology companies to finance their growth by raising US investment capital and about their ultimate ability to offer exits to investors by flotation or sale.

3.4 Israel has, however, also benefited in recent years from significant developments in early-stage informal funding and from innovation in later stage "mezzanine" finance.

VENTURE CAPITAL – ORIGIN & EVOLUTION

3.5 Following the successful establishment and subsequent privatisation of the ground-breaking Yozma fund, Israel benefited from the rapid creation of a large and diverse venture capital sector. Given the focus of Israeli VC on technology sectors, necessary risk capital has been made available to the this key area of the economy in a way that has not been replicated in many other putative "second Silicon Valleys". However, particularly in the light of current testing market conditions, a number of issues arise concerning the structure of the Israeli venture capital market.

Share of Capital Raised from Israeli VCs



Source: IVC Online High-Tech VC Survey

3.6 First, in recent years venture or other risk capital has been much more widely available in technology sectors in Israel than in many other economies with a commercially-exploitable science base. In the ten years until 2000, the rate of growth in capital raised by VC funds in Israel was remarkable, rising from $58m in 1991 to $2,300m in 2000. In turn, significant investment was made in high-tech companies, with the recent peak being $1,085m in the third quarter of 2000. The current curtailment of investment in 2001 risks either running down the number of new investments made (i.e. in companies not previously in receipt of venture capital) or choking off capital to many potentially successful companies at a critical point in their R&D or commercialisation cycle – or both.

3.7 Much of this investment historically came from overseas investors rather than Israeli VCs (themselves often dependent on overseas, mainly US funding). One example of an established Israeli-managed but largely overseas-funded VC is the Catalyst Fund[37], which invests between $1m and $4m in portfolio companies, normally late-stage, pre-IPO. Its strategy is to focus on the mezzanine round on the basis that "bridge finance" is under-represented in the Israeli market. Its investors include leading international banks and investment houses, such as HSBC, ABN-AMRO, MM Warburg, Hornblower, Compartner and Quest Group. It does, however, include Union Bank of Israel among its investors.

3.8 The downturn in investment was confirmed by the publication of both the PricewaterhouseCoopers[38] MoneyTree

37 www.catalyst-fund.com
38 www.pwcglobal.com/il/eng
39 www.pwcmoneytree.com
40 www.ivc-online.com

survey[39] and the IVC[40] statistics in July 2001. The MoneyTree survey showed that investments by VCs in Israel had declined by 12% in the second quarter of 2001 when compared with the first three months of the year ($415m compared with $471m). This survey only covered financing rounds of high-tech companies by venture funds. The IVC survey, by contrast, also covered investments by non-fund investors and showed a 22% fall in investment, from $642m in the first quarter of 2001 to $500m in the second quarter.

3.9 The MoneyTree survey also showed that while numbers of investments were maintained the average size fell: 132 investments were made in Q1 compared with 133 in Q2, with the average falling from $3.57m to $3.12m. The number of start-ups backed declined from 33 to 30, and total invested in seed rounds fell from $47.8m (32 companies) to $24.8m (27 companies), strengthening the view that many funds are concentrating on existing portfolios. The Money Tree survey for the third quarter of 2001 showed a further overall decline, with high-tech companies raising $330m in the quarter, down 68% on 2000 – but similar to the level of investments in late 1999.

3.10 The driving influence on the high level of investment activity in Israeli high-technology companies in the three years 1998-2000 was a technology 'land-grab' by US corporates, aided and abetted by US VCs. There was a strong belief that Israel had unique technology in sectors perceived, at the height of the technology boom, as critical to the future of large US corporates. The particular technology sectors included network software and hardware (especially optical networking technology), IT security, real-time graphical emulation and wireless technologies. Many of these technologies were areas where the Israel defence industries had been investing heavily in the previous ten years.

3.11 The end of the 'land-grab' has been apparent to the Israeli VC industry since the last quarter of 2000. The industry has slowed its rate of new investment and most fund-managers to whom we spoke at the Israel Venture Association Conference in April 2001 stated that their attention would be focused on the development, and even survival, of their existing investee companies for the foreseeable future.[42]

3.12 In addition to relying heavily on US funding, many Israeli VCs also relied on finding US-based personnel to run investee companies. Now, however, it appears that VCs are less keen to recruit American CEOs to run start-ups. Although generalisation is difficult, part of the reason may be that US personnel were being recruited for their ability to focus on execution – manufacturing, marketing, delivery, and ultimately internationalisation – to work alongside the "improvisation" prevalent amongst Israeli entrepreneurs.

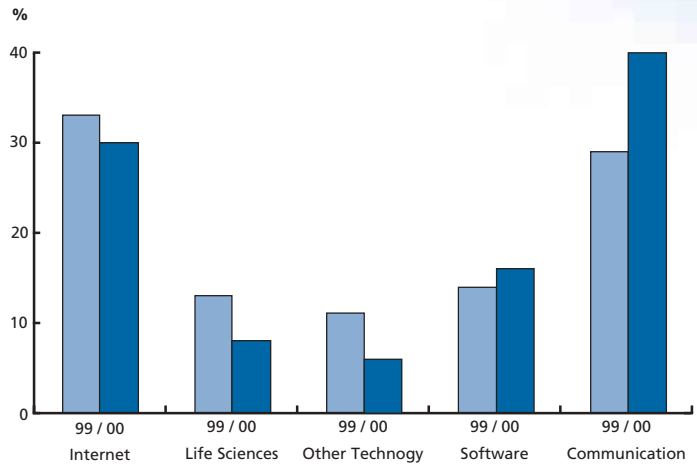
Chromatis Networks Inc

Chromatis, a network technology business developing fibre-optic 'metro switches', was acquired by Lucent Technologies Inc in June 2000 for stock worth about $4.5 billion.[41]

Chromatis was originally an Israeli start-up three years earlier backed by Jerusalem Venture Partners. The two founders, Rafi Gidron and Orni Petruschka, had developed technology that would allow smaller telephone network operators to integrate voice, data and video on optical networks, thereby freeing up bandwidth.

On 27 August 2001, Lucent announced that it was closing its Chromatis division with immediate effect, as part of the major restructuring prompted by the collapse in the value of its stock to 15% of that at the time of the Chromatis acquisition.

Capital Raised by Sector



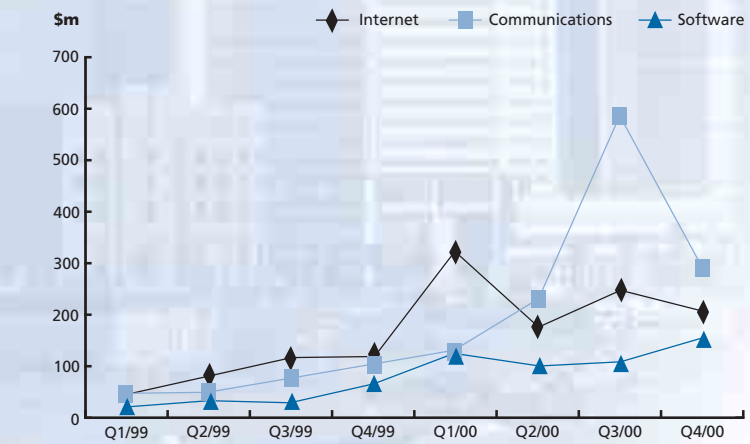
Source: IVC Online High-Tech VC Survey

41 http://www.lucent.com/press/0500/000531.coa.html

42 http://www.israelventure.com/iva_home.htm

3 Venture (and other) Funding

Capital Raised by High-Tech Companies in the Major Sectors



Source: IVC Online High-Tech VC Survey

Harnessing the two cultures requires sensitivity. As we were told several times, including by one former Chief Scientist:

"Improvisation is not a word with negative connotations in Hebrew."

3.13 Nonetheless, a major limitation of the Israeli VC industry is the lack of senior management experience in large technology businesses among Israeli investment executives. Many executives come from a research or development background, suited to the circumstances of the technology 'land-grab' of the mid 1990s, but unsuited to a climate in which businesses need to sell products and generate profits before there is any prospect of realisation.

3.14 As one of our experienced interviewees (currently raising a further follow-on fund for its previously successful early-stage funds) said: "Israel is like Boston, only perhaps smaller and can only support perhaps ten leading funds, each with different strategies…Israel is geographically small enough for it to be inadvisable for us to invest in one field only. Are there really enough stars to satisfy the specialist medical funds?"

The survivors of the winnowing process which the industry currently faces are likely to be those firms which can emulate the 'business model' investment methodology of the successful US funds. This will entail Israeli VCs building skills in all aspects of the growth of successful technology businesses, not just in the research and development of ground-breaking technology.

3.15 A number of non-US VC firms, typically from Europe or the Far East, has opened offices in Israel in the past two years focussed on backing Israeli technology businesses to access their home markets, both for trade partnerships and for investment. Some have been formed with the specific intention of ultimately floating Israeli companies on their domestic capital markets.

VENTURE LENDING

3.16 One form of financing which has become established in Israeli high-tech sectors in recent years (and which is not currently widespread in the UK) is venture lending. Put briefly, venture lending provides additional debt facilities with "kickers" (equity options or warrants to subscribe for equity in an amount and at a price established or determinable from the outset). Such debt is normally only provided alongside development capital and may take the form of a leasing facility against specified assets.

3.17 Sources of venture lending include major banks (such as Bank Hapoalim and Bank Leumi) as well as a limited number of specialist providers, including Plenus (see p29), established by the former head of Bank Hapoalim's high-tech specialist banking department and part of Dovrat Group[44]. The thinking behind venture lending from the bank's point of view is that the additional reward provided by the warrant compensates

tecc-IS

tecc-IS, which was floated on the UK Alternative Investment Market in September 2000, is a company investing in early-stage Israeli high-technology companies with the specific aim of helping them enter European markets. The investment focus is on internet technologies and enabling technologies, IT and telecommunications and applied science and the company has invested in six businesses to date.

tecc-IS has a UK and Scandinavian based advisory board with both applied technology skills and expertise in corporate finance and investment banking. It shares offices with the Israel Discount Bank which is also an investor in tecc-IS.[43]

43 http://www.tecc-is.com/intro.htm

44 Dovrat & Company Ltd, an Israeli holding company. Other entities include equity funds

for the additional risk of lending to companies which may be at an advanced stage of development but which are often not yet profitable. The expertise was developed through studying at first hand the specialist US banks, such as Silicon Valley Bank and Imperial.

3.18 As one experienced lender put it to us:

"High tech is not like real estate. With limited revenues, you must measure the potential and look to the future ….VCs here only used to think of equity."

3.19 With limited competition at the outset, the first bank to move into the sector (c.1997) was initially able to take 100% warrant coverage for its loans, later reducing cover to 80% but still only taking the best deals. The price of the warrant is linked to the price of the shares. Other banks moved into the market as the first movers showed profits of some $50m after two years by exercising warrants in successful IPOs such as Accord, LTI and Iridion, notching up 15 exits and no failures in 1999-2000. In one case, the lender "made profits of $12m on facilities of $4m, with $1m warrant coverage at 25%."

3.20 A number of Israeli banks took the view that a high-tech banking department cannot provide a full range of services without venture lending, even if American banking strategies needed to be adapted to fit the needs of Israeli companies:

"For the customer, venture lending is typically a credit facility, say for $5m over two years with a commitment fee but with utilisation tailored to draw-down. However, venture lending may also be a short-term bridge loan – after all, most high-tech lending is short-term, usually up to six months."

3.21 Changing market circumstances led to a reconsideration of how venture lending works in detail, including the pricing of warrants:

"But when the market went down, interest in venture lending went down. In the US from 1995 to 2000 warrant coverage declined to 7% at the height of the bull market. So people like Comdisco[45] went into receivership. Their chances of covering the defaults are very limited – pledges of fixed assets are useless."

3.22 Is there a material difference between venture lending and venture leasing? In Israel unlike the US there is no tax benefit in leasing. However, equipment will be fully pledged as part of the loan package. It is nevertheless recognised that pledges against PCs or electro-optical equipment are likely to be of little worth after one year. Most lenders take a floating charge and a fixed charge on intellectual property: "Venture capitalists do not object to this, they feel that you should not interrupt but rather complete what they do."

3.23 The first criterion for most venture lending specialists is: who are the investors? Having an experienced VC fund on board is the starting point. However, the relationship is reciprocal: "For their part funds want to see that a high-tech professional is giving the loan, not a conventional banker who may not understand the business, pull the loan and run away."

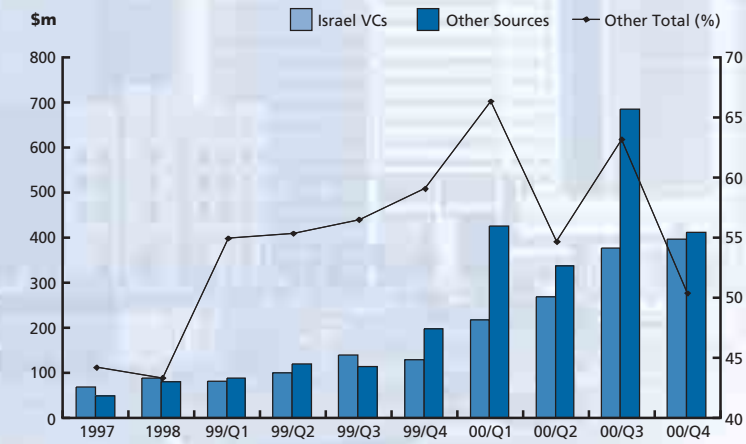
3.24 Warrant cover is currently running at about 30% but it can be higher. For instance on a $3m facility the warrant cover will be $900,000. If the customer is going through a private placement, that may used as the valuation for the equity price, but a discount will apply if no such funding event is imminent. It may even be necessary to go back to an investment in a previous year for a valuation, but an external valuation should always be sought.

3.25 As for when to exercise warrants: "It is better for me to exercise warrants as far away as possible, maybe four to seven years away. We want to deal with those companies who are not desperate." Exercise of warrants and sale of shares need not be simultaneous. In November 2001, Bank Hapoalim sold all the shares it owned following exercise of its options in Lumenis, making a profit of $7m. The options had been exercised in the third quarter.

45 On 16 July 2001 Comdisco announced that it was filing for bankruptcy protection, cutting jobs, selling its technology services unit to Hewlett Packard and had received financing commitments of $600m. Based in Rosemont, Illinois, Comdisco was frequently cited to the authors in November 1999 as underpricing the venture lending market in Silicon Valley as we researched *Funding Technology – Lessons from America*

3 Venture (and other) Funding

Investment in High-tech by Source



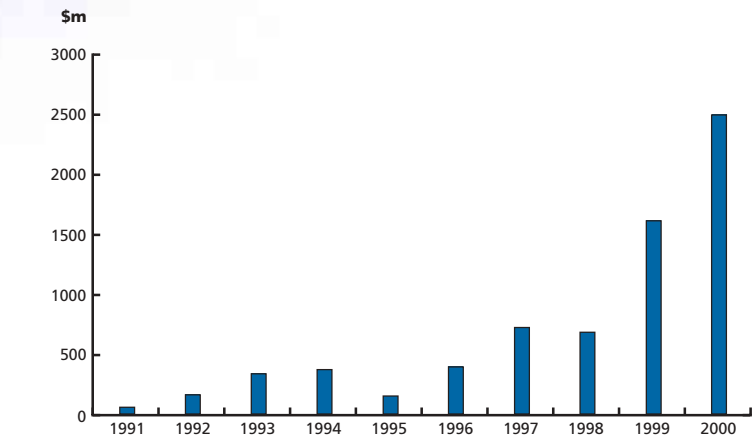
Source: Zinook Ltd

ROLE OF THE BANKS

3.26 High concentration characterises the commercial banking sector, with five groups (Hapoalim, Leumi, Israel Discount, Mizrahi and First International) accounting for more than 90% of the sector; the three largest alone account for 70% of the market.

3.27 Israel's leading banks operate as "universal banks", providing a broad range of retail, wholesale, investment banking and capital markets and fund management services, although they are precluded from insurance provision other than as agents. The four largest banks passed into government control after a financial crisis in 1983, but a privatisation programme through placing shares in the banks on the Tel Aviv Stock Exchange has been underway since 1997. A controlling stake in Mizrahi was sold to an Israeli investment group in 1994. Control of Bank Hapoalim was sold to a US/Israeli investor group in 1997.

Capital Raised by Israeli Venture Capital Funds



Source: Zinook Ltd

3.28 Financial deregulation has been assisted by the re-admission of foreign banks from 1997, and there are now a number of leading US and European banks providing both corporate advisory and investment services. It remains difficult to compete head to head with the indigenous banks for mainstream services.

3.29 Israel's relationship with the diaspora led until recently to a skewing in the domestic market through an abundance of deposit funds. As one experienced lender with many years experience in both Israel and the US put it to us:

"Historically the banks in Israel were too large for the size of company and were therefore in asset acquisition mode. They were cash rich with foreign currency deposits from the diaspora and were able to offer much lower lending margins even in the mid-market than would be the case in comparable economies."

3.30 The mismatch in supply and demand for funding meant that "there is very little Israeli paper on the international capital markets." However, privatisation and increasing international competition are leading to a restructuring of pricing and credit policies. Until recently, most banks could afford to operate on a cost-plus basis, whereas they are now beginning to be benchmarked on return on equity.

BANKS AND TECHNOLOGY FIRMS

3.31 A number of entrepreneurs to whom we spoke, with experience of the US market, claimed that Israeli banks cannot compete with the level of sector specialism provided by the US technology-specific banks. However, some of the market leaders have set

Plenus – "Just-in-time-venture-lending"

Plenus was established in late 2000 by Aharon and Shlomo Dovrat and the Investment Corporation of United Mizrahi Bank "to provide mid to late-stage emerging, high-tech businesses with timely bridge loans while helping them avoid excessive dilution."

Its management team includes a number of experienced technology lenders and entrepreneurs: Moti Weiss, a serial entrepreneur previously with Oshap and Tecnomatix, who turned round Sapiens International; Ruth Simha, formerly head of the high-tech banking department at Bank Hapoalim; Momi Karako, former finance director of Sapiens in Israel; and Gadi Moshe, also formerly at Bank Hapoalim. It is a dedicated venture lending fund and its sister entities include venture capital funds.

Many Israeli banks and financial institutions invested in Plenus (United Mizrahi Bank, Union Bank of Israel, Industrial Development Bank of Israel, Bank Leumi, Kahal, Israel Continental Bank, Beynleumi Provident Funds, Mercantile Discount Bank, Nassuah Zenex, D. Partners and CMA Technology Venture Partners) as have overseas investors; in July 2001 Citibank announced that it had invested $8m in the fund. Investors receive a running return, for instance from interest received on loans, as Plenus acts simply as a pipeline. The management company will not participate in any profits until the total commitment has been paid back to investors. A management charge is levied and the founding documentation closely resembles a venture capital limited partnership. To date, Plenus has raised $50m out of a target $100m.

Plenus aims to limit equity dilution through the provision of short-term bridge loans (12 to 18 months). It had completed five transactions by the end of 2000, with its customers displaying the following characteristics:

- Solid investor backing
- Professional management
- Innovative ideas with significant development progress
- A clear path to market

Although by mid-2001 few companies in the expanding portfolio were heading for flotation, the fund had generated revenues in excess of $30m. Its investments range from $2m to $15m and Plenus will generally sell down: individual companies have to deal solely with Plenus and the resources of the fund are leveraged. Banks are not concerned that investing in Plenus and buying in to its syndicated loans increases their asset allocation to the sector, and in any event Plenus's deals are only mid-market in size.

Revolving the principal (up to three times) produces respectable returns. Over two years Plenus intends to invest in two dozen companies and keep the warrants at each stage of investment. It accepts that although it has had no failures yet, the portfolio will inevitably suffer one or more casualties over time. Its current deal flow is 60 - 70 a month. Plenus believes that the performance of venture lending improves over time and that its status as a fund enables it to be more nimble and less bureaucratic or conservative than most banks. A portfolio approach is required, and the mindset is halfway between banking and venture capital.

Plenus differs significantly from mainstream US practice in that its due diligence is similar to that undertaken by a VC, although its investigations will not cover technology issues (this remains VC territory) and concentrates on markets, management and investors. Despite the prominence of investors as a criterion, Plenus claims that unlike some US venture lenders it will not agree to a deal simply because it has been introduced by a "top ten" fund. Leading US venture lenders have a portfolio of 500 or more customers, whereas Plenus has only done a dozen or so deals averaging $12m in its first year of operation. It normally takes up to a month to provide an answer on a funding request: initial checked term sheet, due diligence, legals.

Despite the impact of NASDAQ Plenus argues that Israel cannot move away from the technology revolution. Israel is "technology-content rich, not a dot.com phenomenon. US companies talk about markets or the future, Israelis discuss technology. Israeli entities in the US produce 'systemic' products – add-ons for existing technology solutions, which adjust to the market through technological improvement and cost reduction. Beware of companies who simply say they will sell to the whole world."

up specialist banking groups. For instance, Poalim Venture Services was set up in July 2000 within Bank Hapoalim to expand the bank's involvement with high tech and bring a "unified approach to venture lending and other banking services required by emerging growth companies"[46] PVS has relocated to Herzelia, which is fast becoming the "Sand Hill Road" of Israeli venture finance.

3.32 The recent downturn in technology sectors has affected the approach of the banks to these sectors. All the large banks have cut funding for start-ups, with Bank Hapoalim cutting facilities by between 66% and 75% in the first half of 2001, and the average retrenchment across the banks being 50% or more. The five largest banks have set up special start-up financing units to apply revised criteria to technology ventures:

"Emphasis is being put on how long the applicant company can survive until its next financing round. The banks are agreeing to offer financing to companies whose cash supply, taking into account their cash flow, will be sufficient to support them until the sector recovers – that is, at least until the end

of 2002 […] this year, the five largest banks gave credit to only 200 start-up companies: 100 received financing from Bank Hapoalim and 50 from Bank Leumi, while the rest were financed by Discount Bank, United Mizrahi Bank, and The First International Bank. The five banks gave loans totalling $250 million this year: Bank Hapoalim extended $150 million in loans, Bank Leumi $60 - 70 million, and the balance was provided by the other three banks"[47]

3.33 In July 2001, the Supervisor of the Israeli banking system issued a directive requiring all commercial banks and their overseas subsidiaries to report quarterly on their exposure to companies, start-ups and borrowers in high tech sectors, as of the third quarter of 2001. Banks are to report their total exposure to customers (whether manufacturing or services) associated with electronics, communications, computers and pharmaceuticals, distinguishing between start-up and mature companies. These regulations also apply to customers closely associated with R&D and whose R&D costs amount to 20% or more of sales, and to customers whose principal business is to develop new technologies, products, ideas and processes. The emphasis is on start-up and high tech firms with steep increases in sales and employees in the context of the global downturn in tech stocks.

CORPORATE VENTURING & INFORMAL FUNDING

3.34 In research based on the experience of 325 venture capital backed, IT IPOs – and cited a number of times by speakers at the Israel Venture Association annual convention in April 2001 – Maula and Murray hypothesised that:

"New technology-based firms co-financed by corporate venture capital organizations of industry-leading corporations receive higher IPO valuations than comparable firms financed exclusively by independent venture capital firms."[48]

3.35 Similar considerations appear to apply in Israel, with early-stage firms benefiting most from as broad a range of investors as possible. However, in Israel the role of the entrepreneurs themselves and private investors is significant. In her award-winning research *Money and Knowledge: Sources of Seed Capital and the Performance of High-technology Start-ups*[49], Susanna Khavul argued that:

- "Firms where institutional sources hold controlling interest in equity are not more likely to complete new product development or take products to market faster than firms where company founders and private investors or angels hold controlling interest in equity.
- Further, firms where the structure of equity control is mixed are significantly more likely to complete new product development and do so faster than firms where either institutional or non-institutional sources exclusively control equity ownership. Thus, the entrepreneurs and investors who share ownership control are significantly more likely to turn ideas into products and do so faster. The results suggest that a mix of stakeholders in the firm matters to meeting early performance milestones.
- Finally, firms with higher overall resource positions are significantly more likely to take products to market and complete their first international sales. Start-up firms that invest in building their organizational resources have a better chance of having international sales and earlier in their lifecycles."[50]

SUMMARY

3.36 Despite the rapid changes in technology finance in recent years and the current depressed state of the market, a number of key messages emerge:

- Israeli government intervention through Yozma was a significant driver of the fast growth of the domestic VC industry between 1995 and 2000.
- Technologies developed for the Israeli military in IT security, networking and

47 *Globes – Israel's Business Arena* 24 June 2001. www.globes.co.il

48 Maula M & Murray G (2000) p7

49 Winner of the Academy of Management's 2001 Heizer Award for "Outstanding Research in the Field of New Enterprise Development."

50 From the summary paper of Dr Khavul's findings, p3. We were informed by a number of experienced financial intermediaries that "real" (i.e. management value-added) angel funding is rare in Israel, although it may simply be even more informal and impossible to systematise or quantify than in the UK

Gemini Israel Funds

Gemini, one of the ten VC funds started with Yozma, was founded in 1993 with $25m under management. It now manages over $350m from an investor base including Bear Stearns, Conexant Systems Inc, Telecom Italia, Telstra and Tyco International. It has had a significant number of successful exits. IPOs include Commtouch (NASDAQ: CTCH); Jacada (JCDA); Ceragon Networks (CRNT); Oridion Medical (SWX NM: ORIDN); and Precise Software Solutions (NASDAQ: PRSE).

In addition, Servicesoft Technologies was sold to Broadbase for $645m, RadNet was sold to Siemens for $75m; Ornet Data Communications was sold to Siemens for $30m; Butterfly VLSI was sold to Texas Instruments for $50m; AbirNet to Memco for $27m; Ultracom to Terayon (NASDAQ: TERN) for $32m; and Exactium to IFS for $15m. Its current portfolio includes promising companies such as InfoCyclone, Saifu Semiconductors, Lambda Crossing, Celletra and Allot Communications.

Gemini's policy is to be actively involved with its investees, often building a company from the ground up, starting with just a basic idea or technology. It assists in recruiting the right team and has direct access to the best strategic partners. Gemini's own team comes from a wide range of technical and marketing backgrounds. Its three main areas of focus are: telecommunications and data communications; internet infrastructure; and fabless semiconductors ("fabless" means that the investee does not operate its own semiconductor fabrication plant). That said, the 52-strong portfolio includes 11 healthcare related investments, mainly in medical device businesses.

Gemini has a Silicon Valley office, with a specific task: "In order to provide stronger support for our US-based portfolio companies, Gemini has established Gemini Inc to provide introductions to potential strategic partners and top-tier US venture capital firms. The Silicon Valley operation enables a much closer co-operation between Gemini and its portfolio companies, bridging the gap between Israel and the US target markets and enhancing our hands-on approach."

Finally, Gemini is a microcosm of the Israeli VC and technology transfer sector. Ed Mlavsky holds a science PhD from a major European university; he has worked extensively in the US and was himself an entrepreneur. He was one of the originators of BIRD. BIRD was not an equity vehicle but its success showed the way to the creation of Yozma, out of which grew Israel's VC industry. One of Gemini's directors is Dr Orna Berry, formerly Chief Scientist, and one of the principal architects of today's government policy for the sector. Israel is a small enough and young enough society for such connections to be frequent and normal.

See www.gemini.co.il

semiconductors, drove a 'land-grab' by US investors and corporate acquirors between 1998 and 2000.

- Israeli VCs are going through a process of rapid re-orientation from investment in technology itself to investment in growth businesses exploiting technology, following the end of the US 'land grab'.
- Non US VCs are increasing their presence in Israel.
- Israel has seen the development of products in the venture lending and other mezzanine finance sectors, although their long-term success is unproven.
- Israeli banks are relatively conservative although they have considerable exposure to early stage technology businesses and managing that exposure is an issue for them over the next few years.
- Israeli banks have had limited success in developing products to meet the particular needs of technology-based businesses.

3 Venture (and other) Funding

Incubation and Entrepreneurship

"The State supports R&D because it has a positive spillover effect. R&D benefits the entire economy, far beyond the specific company. The analogy used by economists is a bee flying from flower to flower and sipping, while pollinating the flowers. No one plans the spillover effect, but it helps the economy."

Dr Carmel Vernia, Chief Scientist, Ministry of Industry & Trade (2001)[51]

"L'antisémite reproche au Juif de 'n'être point créateur', d'avoir 'l'esprit dissolvant'. Cette accusation absurde (Spinoza, Proust, Kafka, Darius Milhaud, Chagall, Einstein, Bergson ne sont-ils pas Juifs?) a pu sembler spécieuse du fait que l'intelligence juive prend volontiers un tour critique. Mais ici encore, il ne s'agit pas d'une disposition des cellules cérébrales mais du choix d'une arme."[52]

Jean-Paul Sartre, *Reflexions sur la Question Juive* (1954) p137

INTRODUCTION

4.1 Half of Israel's 24 technology incubators operate in national priority regions. The incubator project is defined formally as a supporting framework to enable beginning entrepreneurs with innovative technological ideas to develop them into commercial products and set up new businesses in order to sell them. Incubation has had a key role in fostering entrepreneurship and in enabling Israel to turn to advantage the large-scale immigration of the early 1990s. Other countries (including Morocco) have sought Israeli guidance on incubation. However, policy changes taking account of the evolution of society and the economy since the project was first introduced are now in hand.

ORIGINS OF ISRAELI INCUBATION

4.2 Incubation in Israel took off in the early 1990s, at about the same time as venture capital began to take root. Although the incubation programme was not formally an assimilation initiative, it developed urgency on account of the significant influx of immigrants from the former Soviet Union. Reports at that time of surgeons employed as cleaners accelerated the drive towards programmes which could help those with innovative ideas and technical expertise – but limited commercial experience – to convert ideas to marketable propositions.

4.3 In 1990, there were 300 or more incubators in the US. Israel adapted US models to suit its own needs. Three main principles applied:

- Incubation was not to be an absorption programme (whatever the immediate impetus) but a technology initiative sponsored by the Ministry of Industry & Trade (not the Ministry for Absorption).
- Incubation programmes were to be open to everyone meeting the criteria.
- There were to be no new government agencies to run the incubator programmes.

4.4 The fundamental problem was seen as how to deal with the first stages of technology proposals. Proposals were to be taken from the stage where no private money was willing to take on the risk and over two years turn such proposals into "investable" propositions. The object is not to compete with venture capital investors but to develop initially sketchy ideas to the point where they are of interest to the private sector.

4.5 Those responsible for the incubator project maintain that perhaps only 1% of proposals would have been commercially interesting without help from incubators, but more than half (52%) of incubator graduates survive two years or more outside the incubator and attract third party investment. However, reservations about incubation in general and its role within institutions of higher education are now also commonly voiced. As one former Chief Scientist put it to us:

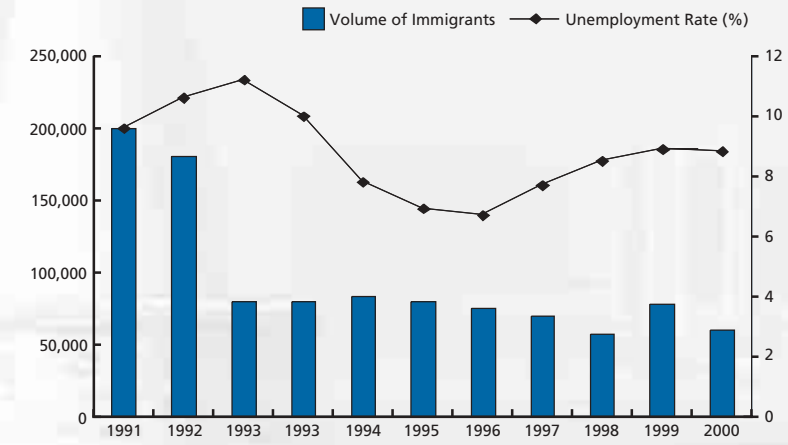
"I do not understand why universities set up incubators – they are there to teach and carry out research. Even MIT's rate of return is very low. [Two of the best-known US

51 Quoted in *Israel's Business Arena* 15 August 2001

52 "Anti-semites criticise Jews for 'not being creative', 'for having a destructive spirit'. This absurd accusation (aren't Spinoza, Proust, Kafka, Darius Milhaud, Chagall, Einstein, Bergson, Jewish?) may have seemed plausible because the Jewish cast of mind readily adopts a critical approach. But then again, this is a choice of weapon not a result of the structure of the brain cells."

4 Incubation and Entrepreneurship

Unemployment Rate and Immigration



Source: Israel Export Institute

incubator funds] have been commercial failures. They squeezed money from the public for psychological not commercial reasons. No experienced entrepreneurs went into incubators, so you now only get second rate people with second rate ideas – the concept is now commercially untenable."

THE INCUBATOR NETWORK

4.6 The rules for government sponsorship of incubators were put together rapidly, following discussions with proposed partners such as the Technion and the Weizmann Institute; ten or twelve incubators had been established by the end of the first year. Three types of "lead partner" were identified:

- Universities (in addition to the Technion and the Weizmann Institute, Tel Aviv University and the Jerusalem College of High Technology were participants in the incubator scheme.)
- Local authorities and municipalities.
- Well-established technology-based companies.

4.7 Some incubators had a combination of all three constituencies as partners, such as the one at Tel Aviv, initiated in conjunction with commercial partners.

4.8 There are now 24 technology-specific incubators, with a wide geographical spread, from the Lebanese border to the Negev Desert (where the lead partner is Ben Gurion University and a cluster has developed in both chemicals and pharmacology). Each incubator should be an independent entity to facilitate monitoring. Other incubator requirements include:

- It must have suitable R&D facilities.
- At any given time there should be at least ten projects in progress.
- Each site must have an experienced incubator manager.
- Its board of directors is to consist of unpaid volunteers from industry, commerce, research and the public sector.

Input from the board of directors is seen as critical as we were informed on several occasions that "they bring unofficially to the incubator the resources of the organisations behind them."

LEGAL STATUS

4.9 Incubators are currently able to generate income but not distribute profit (as with a company limited by guarantee in the UK), although this position may change as the debate over privatising incubators in Israel is taken forward. There is already a de facto partial privatisation of incubators to the extent that 16 of the 24 have private sector partners.

4.10 In addition a new model incubator is being piloted, with third party investors taking more responsibility than today in terms of both funding and management input. As a senior government official put it:

"We are still working on this. The intention is to try it out on three incubators, then take a decision. An imperative is to reduce government expenditure at all times. Keep the incubator teams small. It will increase incubator capabilities if private money goes into incubators, as opposed to individual projects. They can then become for-profit without changing their purpose. The government will continue to give grants to the individual projects."

INCUBATOR SERVICES

4.11 "Every service is to be provided, including services the entrepreneur thinks he does not need," the same official said. For instance:

- Incubatees should accept an admin manager onto the team; most start-ups will be formed by scientists or technologists with little

experience of team-building or regulatory and accounting issues.
- Documentation is a key issue. Without intellectual property protection, nothing can be successfully commercialised but "most ex-Russians are paranoid about the theft of IPR".
- Considerable attention is paid to how to stick to budgets and timetables, not least as incubatees must graduate within two years.

4.12 As for the role of the incubator manager, the official continued:

"The manager is in charge of everything in the incubator. Grants are channelled through the manager. The manager imposes discipline. Part of the success of the incubator manager is in creating an atmosphere of trust. Without co-operation the entrepreneur cannot continue in the incubator. The project initiators know the terms from the outset."

CRITERIA FOR ACCEPTANCE

4.13 For a project to be accepted on the government-backed incubator scheme the following criteria must be met:

- The idea put forward must be capable of being developed into a commercial product (a service alone is insufficient). If the proposal has already been developed to the product stage, the initiators will not be eligible for the incubator scheme but should seek commercial investors directly.
- The innovation must have significant R&D content.
- It must demonstrate uniqueness.
- It should be mainly aimed at the export market (the domestic Israeli economy is too small to justify government intervention).
- The budget approved for the project must be sufficient for the purpose.
- The promoter must be an individual not an existing company.

4.14 An initiator may hold discussions with several incubators at the outset. The incubator is to check that the criteria have been met and a preliminary professional assessment will be conducted to ensure "that the wheel is not being re-invented, that there is a market need, that IPR issues have been covered and that the business capabilities are or can be put in place".

ENTREPRENEUR BENEFITS

4.15 Once approved by the Chief Scientist's committee and assisted by the incubator on the R&D programme, the initiator is able to recruit a team, purchase equipment and start working. The incubator manager is intensely involved at the outset and responsible to the government for the payments made.

4.16 Each project is to be registered as a limited company, with specific rights of ownership defined at the outset. "Entrepreneurs do not like this but it is a philosophical process." There will normally be a team of three to five people with a budget of $350,000 to cover the two year period in the incubator:

- A grant currently of $300,000 (being raised to $400,000 in central regions and $500,000 in outlying ones)
- with the additional $50,000 (15%) to be brought in by the entrepreneur from private sources (which entrepreneurs are helped to find) in exchange for equity.

SUCCESS RATES

4.17 How successful the government incubator scheme has been financially is difficult to quantify. It was put to us that the main achievement of the incubator network is that Israel now has a well-oiled working instrument to which every initiator can apply, even if he has no resources at the outset. Within the incubator, entrepreneurs can execute their business plan and find everything required for this purpose. There are some 200 projects live at any given time, with each incubator having a turnover of three to five projects a year.

4.18 As one incubator specialist put it to us:

"In the US, incubators are a real estate business, with a trend to leave more mature companies on site. This leaves neither the room nor the patience to deal with the crazy new ideas. Here, we provide both infrastructure and atmosphere."

4.19 As for tangible evidence of success rates, by the end of 2000 more than $500m of private investment had been made into incubator and incubator "graduate" projects. It was put

TEIC Technion Entrepreneurial Incubator Co Ltd

The TEIC, near the Technion and in the Technion-Nesher Science Park outside Haifa, was established in the early 1990s in the light of the influx of immigrants from the former Soviet Union, part of the overall project of the Chief Scientist at the time to establish a network of (now) 24 incubators. The focus is on zero-stage businesses: reviewing the concept, checking patents, scoping the market and, if the appropriate criteria apply, approaching the Office of the Chief Scientist on behalf of the initiator(s) for funding.

Businesses taken on must raise capital or find strategic partners within two years, to take the project to the intermediate stage. The critical input at the incubation stage is to reduce the technology risk, learn marketing skills, solve IPR issues and create the management capability to establish a leading team – venture funds are unlikely to take an interest unless the eventual market for the product is upwards of $500m a year.

To be backed under the incubator programme, businesses must be innovative, and the main milestone whilst at the TEIC is to produce a prototype in two years with the resources provided. Projects must be aimed at commercial sales, not just developing technology. The complementary funding of 15%, which must be found for government grants to be provided, can come from any source.

The TEIC provides all admin support, networking and mentoring, and can call on the Technion for technical support. The total government incubation annual budget is $30m for incubation; $376m of continuing "post-graduate" support has also been levered in. The incubator budget is to rise 10% in 2002.

At any one time there are between nine and twelve active projects, sometimes up to 15. The incubator has lost its initial "Russian" flavour. TEIC has nine staff in total, including those on the maintenance side; about half its budget goes on salaries.

TEIC sees the primary goal for each project as "raising capital and/or finding strategic partner during the incubation period" and the intermediate goals as "removing technology risk, learning the market. Solving intellectual property issues, creating management capabilities and establishing a leading team."

to us that venture capital firms have been keen to keep screening the books of the incubators for the "new new thing" and that 52% of incubator projects had attracted third party investment and survived two years or longer after leaving the incubator. However, to date only limited evaluation of the cost-effectiveness of the government incubator programme has been conducted. Four incubators have been closed since the project began in 1991, for which ministry officials hold the incubator management responsible.

4.20 The managers of the incubators take it in turns to host a meeting every two months to review items of common interest with members of the central Ministry of Industry & Trade team.

PRIVATISATION

4.21 In August 2001 the OCS finalised plans to privatise in part the incubator network. Three to five incubators will be privatised at the outset, turning them into profit-making concerns. Other changes will introduce flexibility into the percentage equity holdings accorded to each party. Instead of a fixed 50%, the entrepreneur will receive equity in a range from 30% to 70%. The Chief Scientist, Dr Carmel Vernia, also proposes changes to the rules on what financial investment by the State will bring:

"Another distortion of the incubator project that I personally dislike is the lack of proportion in the number of shares bought by each dollar invested in the company. If the State invests, say, $300,000, it gets 20%. Later a private investor comes along and invests $50,000, for example, and he also gets 20%. He can also invest more but it makes no difference. One person's dollar can be worth five or six times someone else's dollar. I think that's wrong – everyone's shares should cost the same."[53]

4.22 The new plan favours outlying regions, where

53 *Israel's Business Arena* 15 August 2001

a beneficiary can receive a State loan of up to $500,000 covering 49% of fixed expenses. In the central region, the maximum will be $400,000; the current maximum in all regions is $300,000. This incentive is intended to accelerate development in outlying regions, where costs also tend to be lower.

4.23 At the same time, the Ministry of Industry & Trade is setting up a new NIS200m fund to support companies at the seed stage. This is part of an overall programme to support economic growth. The fund will invest alongside private venture investors in activities of national strategic importance, such as biotechnology. NIS30m will be allocated to the fund in 2001, NIS170m in 2002. In 2003 the fund may either be continued with a larger budget, or privatised. It is not intended to finance R&D but to provide seed capital.

ARAB INCUBATOR

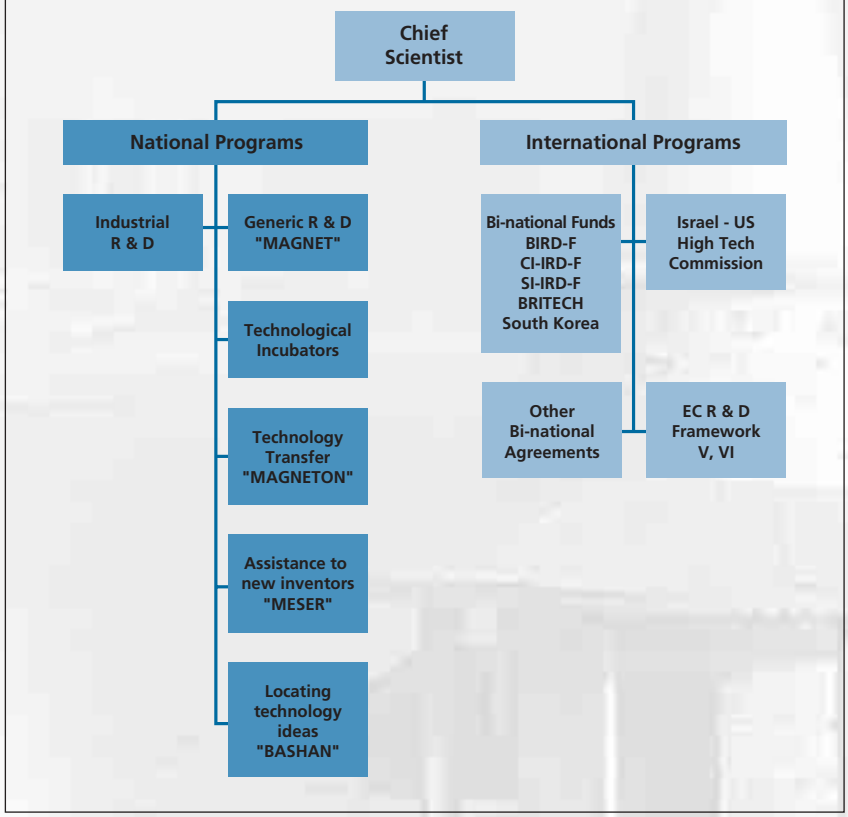
4.24 In August 2001, the Minister of Industry & Trade announced the decision in principle that one of the new privatised incubators will be set up in an Arab area. Arab representatives are to organise as a consortium to start establishing sufficient projects to justify an incubator. This project is considered an affirmative action measure by the Chief Scientist.

INCUBATION & ENTREPRENEURSHIP IN RETROSPECT

4.25 Assessments of the success of the incubation project vary, but there is a growing consensus both that the policy was needed in the early 1990s and that Israel has moved on since then. This is not a criticism of government intervention in incubation but a further recognition that the imperatives of contemporary necessity having been met, practical wisdom dictates that as with Yozma and its intervention in venture capital, the state should now move on. As one former Chief Scientist put it to us:

"I am very sceptical about the incubation system now. The goal was different then,

Technology schemes supported by the OCS



using public money. The agenda was related to immigration from Russia, with 25% of immigrants having academic degrees. The level in Israel then was 10-12% – which itself was high by world standards. We wanted to give those without experience of the Western world the ability to compete fairly. But now compared with the rest of the world, incubation success rates are low."

SUMMARY

4.26 Incubation as a government policy grew out of the particular immigration circumstances facing Israel in the early 1990s. Although incubation was not meant to be an assimilation issue, its status in this respect was ambiguous. In a society with short lines of command, incubation could be rolled out rapidly. The lessons of the early years are being learned as government involvement is decreased. However, even as the rules are adapted, incubation continues as a feature of technology finance in Israel.

4 Incubation and Entrepreneurship

Other Government Programmes

"In Israel, for example, principal clusters are related to agriculture (crops, fertilizers, irrigation equipment, other specialized equipment and machinery) and defence."

Michael Porter, *The Competitive Advantage of Nations* (1990)[54]

"Prosperity is the blessing of the Old Testament, adversity is the blessing of the New."

Francis Bacon, "Of Adversity" (1625)

"The role of government is to build real infrastructure, which most of the Western world has not realised or managed. Contrast Singapore: with limited resources in a hostile environment, its government is run like a management team, with ministers having annual objectives. Quality people, commercially rewarded, have been selected – a carrot and stick approach."

Former Israeli Chief Scientist, in interview with the authors, summer 2001

INTRODUCTION

5.1 In an area fraught with controversy, general agreement is found that modern Israel is not the Biblical "land flowing with milk and honey" (Exodus 3:8), although gas exploration is now taking place – see Annex A. In recent years, government intervention has aimed to address a number of weaknesses in the economy, compensating for Israel's relative lack of natural resources by encouraging the exploitation of its research base. In addition to business incubation (covered in chapter 4) programmes focus on co-operation between business and research institutes and co-operation with overseas partners.

5.2 The collaboration between public and private sectors has been such that in under a decade Israel's "clusters" have moved from being mainly related to agriculture and machinery to being more focused on software and biotechnology. As with incubation, general policy has been to seek to ensure that state intervention works with the grain of the market and will be adapted, even withdrawn, once targeted weaknesses have been addressed. Many of the government's programmes complement the incubator project and are administered through the Office of the Chief Scientist.

GOVERNMENT & SCIENCE

5.3 Government support for civilian, industrial R&D goes back to 1968, when the commission under Prof Kachalsky recommended the creation of the Office of the Chief Scientist (OCS), with the ability to subsidise private sector R&D. Previous support outside defence and agriculture had been confined to academic research and National Laboratories. After the OCS was set up, industrial R&D rose rapidly:

"Between 1969 and 1987 industrial R&D expenditures grew at 14% per year, and High-Tech exports grew from a mere $422m in 1969 (in 1987 dollars), to $3,316m in 1987."[55]

5.4 The Law for the Encouragement of Industrial R&D was passed in 1985 (and has been revised several times since). This key legislation has provided the framework for government policy. It provides for the OCS to develop science-based, export-orientated industries to promote employment and

54 Porter M (1990) p149
55 Trajtenberg M (2000) p5

improve the balance of payments.
"At the heart of the law is a program of financial incentives. Companies – whether big corporations or small start-ups – which meet certain eligibility criteria, are entitled to receive matching funds for the development of innovative, export-targeted products. The OCS funds up to 50% of R&D expenses in established companies, and up to 66% for start-ups."[56]

MAGNET PROGRAMME

5.5 Established in 1994, MAGNET supports research and development of generic pre-competitive technologies, i.e. a broad range of common technologies, components, materials, manufacturing methods and processes with wide-ranging applications across numerous industries.[57]

5.6 MAGNET's current annual budget is $70m and "its mission is to create a framework for the efficient exploitation and optimization of the national resources dedicated to industrial R&D. This is achieved by helping industry invest money and manpower in long-term development programs, which are more risky, more ambitious and more difficult to undertake than what any company would be able to pursue single-handedly."[58]

5.7 Applicants may approach MAGNET in one of three ways. The first and most popular is the technology R&D route, where the consortium ("3+1") is seeking to achieve a common vision of what the next generation of products will be, for instance the next generation of hospital operating rooms ("from cut and see to see and cut to real time operating information"). Secondly, the distribution and implementation route; only one such consortium currently exists, in electronics. This is not to create new technology, but exposure to new technology; for instance, up to 66% of costs will be funded to enable SMEs to send employees overseas. Thirdly, MAGNETON, a new programme aimed at academic researchers was piloted in 2000 and is discussed in more detail below.

5.8 Proposals submitted to MAGNET for support will need to demonstrate:

- Advantages to the economy in terms of export and employment potential.
- Technology which is both innovative and generic.
- The importance of government support for the companies concerned.
- Cooperation between industry and academia.

5.9 The rationale behind the MAGNET programme is, first, that as Israel is a small country co-operation is essential in creating common technologies; and, second, to encourage industry to take advantage of Israel's numerous leading academic institutions. A consortium should consist of at least three different companies and one academic research institution. As the programme has now been running successfully for some eight years, the Office of the Chief Scientist within the Ministry of Industry & Trade is well-placed to choose partners; it will take into account what is best for Israeli industry and whether the country has a strategic advantage in a given sector.

5.10 The incentives offered are:

- A 66% grant of the approved budget, without royalty fees and with full recognition of expenses for dedicated equipment.
- Intellectual property rights to the technology developed within the programme belong to the developer, but with an obligation to share with all the participants innovations resulting from MAGNET funding.

5.11 In the first seven years since MAGNET started, 120 participants from industry and academia have taken part in 21 programmes covering sectors as varied as communications, electronics, micro-electronics, bio-technology, materials, software and energy. A review prepared by external consultants of the success of the programme is due to be published at the end of 2001, using data from the first consortium, concluded in 1998.

56 ibid. pp5-6
57 Ministry of Industry and Trade 2000 p20
58 ibid. p75

MAGNETON

5.12 MAGNETON, which grew out of the MAGNET programme, was piloted in 2000 and 2001 is its first operational year. This programme is for "dual co-operation" (rather than for consortia) between an industrial company and an academic group, with a view to transferring technology to industry. It is aimed at researchers who do not necessarily want to leave academia to establish a SME.

5.13 For instance, researchers may have a patent with commercial potential. MAGNETON enables them to "taste" the world of technology transfer, providing funding of up to $800,000 over two years, at the end of which the researcher has the option to sign a contract with the commercial partners to develop the product. MAGNETON pays "for the stage of understanding whether the technology is good for them or not". Licences when signed can be exclusive or open. MAGNETON is not seen as funding a feasibility study as its purpose is to demonstrate the upscale. Up to 66% of costs can be covered.

MATIMOP

5.14 MATIMOP, the Israeli industry centre for research and development, "acts as the administrative and professional umbrella in Israel for the range of bilateral R&D agreements and funds that Israel has with countries in North America, Europe and the Far East as well as the Fifth Framework Agreement with the European Union. Most significantly MATIMOP keeps a constantly updated comprehensive database of Israeli technology entrepreneurs seeking international cooperation."[59]

5.15 MATIMOP is a public organisation (there are persistent rumours of privatisation) established 20 years ago by associations of manufacturers, the kibbutz industry association and the trades unions (membership of which has shrunk, often following privatisation of state industries). Originally to encourage industry and government in the promotion of technology activities, it now focuses on encouraging co-operation between Israeli and foreign companies. Many leading tech-based SMEs are too small to penetrate international markets alone and the solution is seen as assistance in finding strategic partners. It is hoped by MATIMOP that such co-operation will not be limited to R&D but will also cover areas such as manufacturing and marketing.

5.16 MATIMOP also issues a bi-monthly news bulletin on a free subscription basis giving information on SMEs looking for collaboration and joint venture opportunities.

5.17 MATIMOP maintains three different databases:

- Profiles of Israeli companies, focusing on their technology capabilities and what kind of co-operation they are looking for. There are currently 3200 profiles on record, with only those capable of running R&D programmes included.
- Advanced R&D programmes, where partners are sought. This is a dynamic database of some 450 - 500 projects, with considerable activity mainly in agriculture, communications and the mechanical sector.
- The start-ups section, consisting mainly of information on projects such as incubators and other sources of assistance.

5.18 Currently 75% of MATIMOP's budget comes from the Office of the Chief Scientist, with 25% coming from income for services to Israeli companies, and in the past two to three years funding has also been received from the European Union for running special projects, such as Innovation Relay Centres, of which there are 68 across Europe. MATIMOP programmes are conditional grants: if the project fails, the grant is written off; if it succeeds, the grant is paid back 100%.

5.19 As for the government funding available to MATIMOP, the law relating to R&D sets out a special fund: from each grant 1% is set aside to pay for infrastructure, of which MATIMOP is the principal user. The law came into effect 15 years ago; conditions have now changed and a new law will replace the current rules shortly. Currently, intending

59 ibid. p25

users should convince the Office of the Chief Scientist that they can use the results of government-funded research in Israel; they cannot license know-how to third parties in Israel or abroad.

INTERNATIONAL AGREEMENTS

5.20 The importance of overseas co-operation is already evident in the "co-operation databases" operated by MATIMOP. But MATIMOP is also the hub for administering a number of international trade agreements. Uniquely, Israel is part of two free-trade areas, North America and the European Union. Israel can therefore leverage its R&D position provided that the 30%-40% manufacturing content requirements under international treaty are met. In some respects, Israel is a world technology entrepot, with considerable R&D being undertaken locally and manufacturing split between Israel and the Far East, with which numerous trade arrangements exist.

5.21 International co-operation agreements exist with the EU, the US (for information on the Israel-US Binational R&D Fund – BIRD – see below), Canada (CIIRDF), Singapore (SI-IRD), and Korea. Of particular relevance to UK-based companies is the British-Israel Industrial R&D Fund – BRITECH – details of which are set out on p43. The Office of the Chief Scientist also operates industrial R&D agreements with government offices responsible for promoting applied R&D in France, Holland, Spain, Portugal, Austria, Belgium, Ireland and India:

"At least one company from each country must participate in each project. Projects must include innovative technology and have a reasonable chance of generating a marketable product. […] Projects must be submitted in both countries at about the same time. National applications are made in English by every company."[60]

BIRD

Started in 1977, the Israel-US Binational R&D (BIRD) Foundation has a $110m endowment of equal contributions from each country, and received a growing amount of repayments from successful projects each year. BIRD was set up to promote non-defence R&D and plays a major role in encouraging joint industrial projects between American and Israeli companies. Representatives of both governments comprise the Board of Governors.

BIRD helps by:

- Sharing its extensive experience with companies, VCs and other investors.
- Giving its seal of approval as part of the due diligence process; each project is reviewed by BIRD, the Office of the Chief Scientist in Israel and the National Institute of Standards and Technology in Washington.
- Increasing corporate value through strategic R&D projects. Any two companies – one from each country – may jointly apply provided that between them they have the capacity to "define, develop, manufacture, sell and support an innovative product."[61]

US companies should have development, manufacturing, sales and support capabilities but require additional products and innovations to enhance their core technology. Israeli partners are start-ups or SMEs with a technical edge and effective management.

40% of BIRD projects achieve commercial sales. BIRD is not a venture fund and does not take equity or seek intellectual property rights. Any increased value remains in the individual company, and BIRD's services are provided free of charge.

BIRD will meet up to 50% of the costs of a joint venture project, in the form of off-balance sheet financing as a conditional grant. "Repayments are 2.5% to 5% of sales of the mutually developed product, totalling no more than 100% of the grant if completed in the first year of sales. Thereafter, repayments grow linearly, remaining at a maximum of 150% at the fifth year and beyond."[62]

In June 2001, $12m of funding was approved under the scheme for 14 projects with total budgets in excess of $32. Six of the projects were in life sciences/healthcare, with two aimed at developing drugs for malignant diseases and nervous system degeneration, the others deal with medical devices, industrial use of enzymes and medical database systems. Other approved projects included an innovative technology for separating propane from propylene, to replace part of the energy-consuming splitters for separating propylene.

For further details see www.birdf.com

60 *Technologies & Innovations 2000* pp60-61
61 see Ministry of Industry & Trade June 2000 p44 (www.tamas.gov.il)
62 ibid. p45

CURRENT DEVELOPMENTS

5.22 On 6 August 2001 the Minister of Industry & Trade (Dalia Itzik) and the Chief Scientist (Dr Carmel Vernia) proposed amendments to the Encouragement of Industrial R&D Act (1985), scheduled to be passed as part of the Amendments Act 2002 to be put forward with the State Budget at the beginning of 2002. The main changes to the R&D rules are as follows:

- Companies applying for R&D grants will be allowed to export up to 10% of production without the need for special authorisation from the OCS. Notification to the OCS research committee will be required for exports to be increased. A company acting outside the terms of the law will be required to return the grant received plus 20%.
- The current law forbids subsidised companies from exporting know-how. In future, if commercial circumstances require the transfer of know-how overseas, grant recipients must make amends in one of two ways at the election of the OCS: return the OCS grant with a 20% premium or if the company is losing money, return 150% of the grant plus interest and associated benefits.
- The OCS will be permitted to collect on a company's debts without a court order.
- The State is to have first lien on know-how and intellectual property rights on products developed with the support of the OCS, and all royalties from the company's sales of the products concerned. Even in the event of company dissolution or receivership, rights to the product may not be sold until all state investment in it has been returned.
- New criteria will apply for the OCS's participation in R&D costs, at flexible rates (20% - 50% thereof).
- Companies appealing against decisions of the OCS may request a re-hearing by the research committee against a NIS5,000 fee.

5.23 These proposals, prepared in November 2000, were held up by disputes with the Ministry of Finance, for instance concerning the level of fines to be imposed in the event

BRITECH

In 1999 the UK and Israeli governments agreed to set up a five-year £15.5m British-Israel industrial R&D Fund – BRITECH. The fund is used to promote joint industrial R&D collaboration between firms in the two countries: BRITECH supports bi-national industrial R&D projects leading to the development of commercial projects or processes.

A joint application is reviewed by experts. If approved by the BRITECH board, support will be given in the form of a conditional grant limited to 50% of the total approved R&D costs. No more than £300,000 will be made available in any one year to an individual project, or £450,000 over three years.

Eligible costs include:

- Personnel costs, to cover researchers, technicians and other support staff employed solely on the project.
- Depreciation, leasing or rental costs of equipment for the time it is used on the project.
- Consultancy and similar costs incurred exclusively for the research project, including research, technical knowledge and patents bought from outside sources.
- Additional overheads incurred directly as a result of the research activity, subject to a pre-determined ceiling.
- Other operating expenses incurred directly as a result of the project, such as materials and supplies.

Eligibility criteria for a project under BRITECH include:

- The project must involve at least one UK and one Israeli private sector business, each with a significant contribution to make to the success of the project.
- It must involve R&D and marketing activities necessary for the development of a market-driven product or process.
- It must specify joint technical development and marketing plans between the businesses in the UK and Israel, including provision for the downstream commercialisation and distribution of the product or process, and for the protection of intellectual property and other assets created by the project.

When a project successfully generates sales, a royalty of up to 150% of the original grant will be repayable to BRITECH. Only commercially-oriented projects are considered.

In February 2001 the first co-operative scheme to be funded under BRITECH – between FMIS (based in Faversham) and Magic Software Enterprises of Tel Aviv – brought its novel software tool to market. The joint venture company, Enabler Technology Limited, markets a product for the development of web-based applications software programmes operating over the Internet. It enables people with little or no technical skill to develop software applications and exploit the power of the internet. FMIS brought unique technological capabilities to the venture, and Magic contributed a broad market presence. The joint venture led to product launch in nine months, considerably faster than BRITECH would expect as an average (18-24 months).

For further details, consult www.britech.org

of transgression. The OCS recognises that apart from public companies, for which full transparency applies, it relies on an honour system to know whether know-how has been used outside the terms of grants provided.

EFFECTIVENESS OF GOVERNMENT PROGRAMMES

5.24 Referring to the assessments undertaken to date and new evidence concerning aggregate sectorial indicators provided through a new classification of the manufacturing sector introduced in the mid-190s by the Research Department of the Bank of Israel, Tratjenberg (2000) noted that in relation to the impact of the various OCS grants available:

"The evidence thus far available from these studies provide[s] then econometric support, albeit limited, to the presumption that OCS grants have had a positive and significant impact on productivity in R&D-intensive sectors, and through them on the economy as a whole [...The manufacturing sector] was divided into 'advanced', 'traditional' and 'mixed' sectors, according to the quality and composition of the labor force (e.g. the percentage of scientists and engineers) the quality of capital stock, and the relative size of the R&D stock […] The advanced sectors outperformed the two other categories in virtually all dimensions during the period (1995-98). The differences between them increased substantially in 1997 and 1998, a period characterised by a rather severe recession."[63]

EU FRAMEWORK VI

5.25 Increased co-operation with the EU is envisaged through Israeli participation in the Sixth Framework Programme, allowing Israeli scientists to use 300 leading research institutes in Europe. Total funding under the programme is $15.4bn ($14.3bn without nuclear-related research) and three key sectors have been identified: genome and biotechnology, IT to upgrade information companies and nanotechnology for smart materials.

SUMMARY

5.26 Government schemes to assist technology sectors have been numerous and varied over the past decade. Some have focused on developing common technologies, others on encouraging individual spin-outs. Domestic programmes have gone hand-in-hand with international agreements. By and large, the aggregate effect on the Israeli economy has been favourable. And as one long-established professional adviser put it to us:

"There's a revival of interest in government R&D schemes and subsidies whilst the VCs are sitting on their hands. And though VCs follow the Delaware incorporation model you need to be an Israeli company to access government funding."

63 Tratjenberg M (2000) pp20-21

Universities and Research Institutes

"If David had to meet Goliath, he must possess a sling. During the Second World War Jewish scientists had played a critical part in making the first nuclear weapons. They had done so because they feared Hitler would develop an atomic bomb first. In the 1950s and 1960s, as Soviet and Arab hostility to Israel grew, Israeli scientists worked to equip the state with a means of deterrence."

Paul Johnson: *A History of the Jews* (1987) p582

"It is no coincidence that Israel's first president, Chaim Weizman, was an eminent scientist. The founders of the Jewish state were deeply convinced that science would provide the basis for a flourishing country."

British Council (1996) p7

INTRODUCTION

6.1 The modern State of Israel may have begun largely as a rural society of kibbutz pioneers, but it is worth noting that a number of its institutions of higher education pre-date the foundation of the state. Over the past generation, the role of universities in transforming Israeli society has been widely recognised, with successful incubators located at or near universities.[64]

6.2 However, a number of Israeli commentators have queried whether the remarkable rise of technology-based entrepreneurs is "killing the goose", as numerous students at leading universities leave without finishing their courses to work for start-ups, and institutions have increasing difficulties in recruiting the full complement of faculty members against competition from industry for the best candidates. Will this trend eventually choke off the blue-sky research on which commercial innovations are ultimately dependent, or do current market difficulties impose a necessary correction?

ISRAEL'S UNIVERSITIES

6.3 Israel has eight major institutions of higher education, including: five universities granting undergraduate and graduate degrees in science subjects; Haifa University (limited to degrees in social sciences); and the Weizman Institute of Science (MSc and PhD degrees in science). The Hebrew University, the Weizman Institute of Science and the Technion were all founded before the State of Israel itself.

6.4 How effective are Israel's universities in the overall process of technology transfer? As one recent study put it:

"Effective technology transfer policies are arguably more crucial for Israel than for any other country. While Israel is among the world leaders in the productivity and intensity of its basic research in science and technology, its ability to transfer the fruits of this knowledge creation engine to commercial applications is inadequate. According to IMD's World Competitiveness Yearbook (2000), out of 47 countries Israel ranks 11th in 'science and technology' and 8th in 'people' (human resources), yet only 23rd in overall global competitiveness. Despite the high ranking in 'science and technology', the IMD report shows Israel trails in key technology transfer areas, ranking 41st in 'company-university cooperation' and 40th in 'development and application of technology'."[65]

6.5 Meseri & Maital did, however, go on to note that "it is reassuring that University TTOs [technology transfer officers] choose projects much in the same way that the private sector chooses to invest its funds. It is noteworthy that 'contribution to the national economy of Israel' was one of the lowest-scoring selection criteria."[66]

64 We are grateful to the British Council for considerable assistance in compiling this chapter. See especially *Israel: a science profile* compiled by Leora Frucht-Eren and issued by the British Council in 1996

65 Meseri O & Maital S (2000) p3

66 ib p9

6 Universities and Research Institutes

Higher Education in Israel at a Glance

THE HEBREW UNIVERSITY OF JERUSALEM founded in 1925, is spread over four campuses (three in Jerusalem, with an agricultural school in Rehovot) and teaches a wide range of scientific, arts and social science subjects, with a prominent medical, pharmaceutical and dental school, and a teaching hospital, Hadassah. This university has consistently contributed to Israel's development through ground water exploration, agricultural technology and bio-medical research.

TEL AVIV UNIVERSITY founded in 1956 is now the largest university in Israel, covering the broadest range of science and non-science subjects. It also has a medical school. Israeli space and aeronautical research is concentrated here and at the Technion.

THE TECHNION or Israel Institute of Technology, based in Haifa, is Israel's oldest university (founded 1924) and a leader in science and technology. It is unusual in combining the teaching of hard and life sciences, including medicine, and has made distinguished contributions to bioengineering and biotechnology.

HAIFA UNIVERSITY founded in 1971, is a comparatively small institution concentrating on social sciences and the humanities.

BEN GURION UNIVERSITY OF THE NEGEV was founded in 1970 and is located in Beer Sheva, where it is developing the arid Negev desert, which forms 60% of Israel's territory. It covers the full range of science and non-science disciplines, prominent amongst which is desert research (including the Blaustein Centre where scientists study and live in the desert) and a community medical school.

THE WEIZMANN INSTITUTE was established in 1934 at Rehovot as the Daniel Sieff Research Institute but later renamed after its founder, Dr Chaim Weizmann, the first president of Israel and a distinguished scientist. Its focus is both basic and applied research and it offers graduate training in natural sciences and mathematics. It conducted Israel's first geological survey and is renowned for biomedical research, its sub-micron centre and solar energy.

JERUSALEM COLLEGE OF TECHNOLOGY only undertakes undergraduate training and conducts research in a limited number of fields (electronics, electro-optics and computers).

BAR ILAN UNIVERSITY at Ramat Gan near Tel Aviv was opened in 1955. Its emphasis is on Jewish Studies, and basic Jewish heritage studies are required of all students, although it does now also have a Faculty of Exact Sciences and a Faculty of Life Sciences.

UNIVERSITIES & THE RESEARCH BASE

6.6 Perhaps as a result of the focus on the US for both commercial and academic purposes, we found most of our interviewees unaware of the research or spin-out work being carried out in leading European clusters such as Munich or Cambridge. However, Cambridge does provide a useful cross-reference for the strength and depth of the Israeli science base. Moving away from "inputs" (such as per capita spend) and looking at outcomes, it is notable that Cambridge has been home to 77 Nobel Prize winners[67] (68 if Literature, Economics and Peace are excluded, and 53 in total since 1948, when the State of Israel was established).

6.7 By contrast, no science Nobel Prize has been awarded to an Israeli-based academic, but the Israel Science and Technology Homepage[68], established by a former adviser to the Israeli Prime Minister, lists 94 Jewish laureates in Chemistry, Medicine and Physics. To the extent that Israeli research institutions can call on the resources of the diaspora (as the Weizmann Institute does in using Nobel laureates as referees) Israel benefits from numerous, dispersed informal links in furthering its scientific endeavours.[69]

67 www.amtp.cam.ac.uk/user/smb1001/camnobel.htm. The number of Cambridge laureates is equal to the totals for Harvard and MIT combined. The next most successful university is Chicago (72), and the only non-UK/US institution in double figures is Humboldt University, Berlin (29). Oxford's tally is 28

68 www.science.co.il/Nobel.asp

69 "League tables" also run the risk of considerable double counting. For instance, Sir Aaron Klug (1982 Laureate in Chemistry and former Master of Trinity College) features on the Cambridge list as well as the Israel Science and Technology Homepage, where his country of origin is shown as Lithuania. Dr Baruch Blumberg (1976, Biomedical Science; former Master of Balliol College) features on the Oxford list as well as that for Columbia

6.8 There can be no doubt that science is a key differentiator for Israel, whereas the US (for instance) has balancing strengths in production and marketing. One of the longest-established Israeli venture capital investors, with numerous co-investments in the US, put the size of the research base and its commercial implications to us thus:

"I believe there are about 500 serious tech companies in Israel. Israel competes on 'deep' science: you have to have technology as a basic factor or else you compete on execution."

FUNDING – GOVERNMENT & ALUMNI

6.9 Most of the funding for universities comes via a government committee similar to the Higher Education Funding Councils in the UK. Universities with strong science can be expected to attract considerable external funding. But as Cambridge and other successful European clusters have found, research and teaching funding must also be seen in the context of the broader question of financing infrastructure to serve high technology centres, and the ability to build supporting services such as science parks. As it was put to us at Ben Gurion University in the Negev:

"The University is 30 years old and now only about 70% of our funding comes from the government. As we are expanding […] the government is stopping us recruiting more. But our President [Professor Avishay Braverman] is an effective visionary and has attracted $200m over five years for the building programme alone […] Companies we establish need not be here – they can be virtual. But we have good locations and are ahead in socio-economic terms in Israel. Hence the vision of a green city burgeoning in the desert. There are now 18 trains a day to Tel Aviv, with a direct service to Haifa, and the station is now in the centre of town."

6.10 In the medium-term, tech transfer is seen as a source of revenue, but in the intermediate period it requires funding, from donations or quick commercial wins. Again drawing on the Ben Gurion University experience:

"At BGN [the commercial arm of the university] we have a clear tech transfer policy, even if it is not clearly accepted. 40% goes to the university. BGN has to meet all its own costs, with no subsidy […] We recently raised a $5m fund run and managed by our company, investing in projects to be implemented within two years, steering students towards commercial applications […] We want to raise a $10m [equity investment] fund in the form of donations – alumni don't generally do this yet in Israel, unlike the US."

COMMERCIAL INVESTMENT

6.11 A number of recent announcements of corporate involvement with the university sector show that investment is still being made despite harsher economic circumstances. In August 2001, Clal Biotechnology Industries agreed to invest $2m in the nano-science, nano-technology centre at Tel Aviv University, as part of $20m being invested in the centre by a consortium of companies put together by the University. The University entity concerned with the funding of the project is Ramot, the Tel Aviv University Authority for Applied Research and Industrial Development, and the funding will contribute to infrastructure and the application of new projects.

6.12 Again despite worsening international uncertainty, in October 2001 Intel donated an advanced industrial engineering laboratory to Ben Gurion University in the Negev, to serve 450 industrial engineering and management students. It is to provide for simulation of conditions confronting engineers, and long-distance learning about manufacturing processes, product flow and decision making. In November 2001, Ben Gurion University also signed a commercialisation co-operation agreement with Columbia University in New York, one of the objects of which is to raise money from industry to finance joint developments.

MANAGEMENT TRAINING

6.13 The Israeli government has not channelled resource into development of specialist centres to provide training on "entrepreneurship" within universities. In the UK and US, "enterprise" or "entrepreneurship" centres have typically either developed as extensions of business schools, or have been set up as practically focused cross-disciplinary teaching units with

strong links to diverse business incubation services. In Israel, business education is more likely to be considered as something that should be accessed overseas. Israeli business and management schools may therefore seek to attract students by the joint delivery of programmes with overseas universities, or by bringing in overseas visiting faculty.

6.14 Examples of such programmes that incorporate entrepreneurship elements include the following:

- High Tech Management School[70] at Tel Aviv University. HTMS delivers an MBA programme in partnership with the Kellogg Graduate School of Management focused on high technology ventures.
- Technion Institute of Management (TIM)[71] delivers programmes that are "uniquely appropriate" for the needs of Israeli knowledge-based companies. One example is the Solow Management Program for Emerging Companies, supporting high potential technology start-ups through rapid growth.

6.15 Israeli universities have built up extensive networks of partnerships with overseas universities, and overseas universities (in particular from the US) have been keen to have a foothold in Israel. These provide resources and know-how to support the development of new technology ventures. Examples of this can be seen in the faculty of the Technion Institute of Management (drawn from Harvard, MIT, INSEAD and many other leading universities) and through the activities of the Israeli Chapter of MIT's Enterprise Forum.[72]

SUMMARY

6.16 Israel has a highly developed science base, in which technology transfer is an increasingly sophisticated component. Recent studies do suggest, however, that Israel can take the commercialisation process much further, which is good news in the context of the contribution made so far to the economy as a whole by knowledge industries. Although Israel itself may not have won as many international research prizes as its reputation suggests, the country is adept at exploiting its international connections. As in Europe (but not in the US?) infrastructure and related planning issues need to be considered alongside the funding of curiosity-driven science and seed capital for spin-outs. Although American in tone, Israeli universities are not yet as deft as most leading US schools in tapping alumni for funding. Management studies are taught, but many successful Israeli managers also study abroad.

70 www.tau.ac.il/htms

71 www.technion.ac.il/shell/Academic/TIM.html

72 www.mit-forum.co.il

73 www.weizman.ac.il

74 "The problem of transliteration from Hebrew to English is one which sometimes defies consistency […] The first name Chaim also appears in different transliterations as Haim, Hayim and Hayyim. The same surname can also vary, as with Chaim Weizmann, the first President of the State of Israel, and Ezer Weizman, his nephew, the President at the time of the State's fiftieth anniversary." *Gilbert* (1998) p xiii

75 British Council (1996) p7

76 Contrast the following: "As I look out before me today, I don't see a thousand hopes for a bright tomorrow. I don't see a thousand future leaders in a thousand industries. I see a thousand losers […] You didn't drop out, so you will never be among the richest people in the world." Larry Ellison, CEO of Oracle, speaking to the Yale University Graduating Class of 2000, reported in *Sunday Business,* 9 September 2001

THE WEIZMANN INSTITUTE OF SCIENCE[73]

The Weizmann Institute was founded first in 1934 as the Daniel Sieff Research Institute and re-founded in 1949 in honour of Israel's first President, Dr Chaim Weizmann[74].

"By the late 1920s, the Jewish entity in Palestine already had two major universities, a medical school, a prestigious scientific institute and a large agricultural research organization. It is interesting to note the British connection in this context. Weizmann, who was later to become Israel's first president, as well as the founder of the distinguished Weizmann Institute of Science, spent several years working as a scientist in Britain. (The Russian-born chemist was given as DSc by the University of Manchester where he was also a Reader in biochemistry.) During World War I, he was summoned by Winston Churchill to find a solution to the serious shortage of acetone, a solvent necessary for manufacturing munitions for the British war effort. Weizmann's success in this mission is often attributed with being one of the factors that led to the historic 1917 Balfour Declaration – the British promise to establish a Jewish Homeland in Palestine. Although this version – recounted by Lloyd George among others – may be exaggerated, there is no doubt that the outstanding scientist was instrumental in making Lord Balfour sensitive to Zionist aspirations. In this respect, science played a significant, if unusual role in the very establishment of Israel."[75]

Dr Weizmann did not see basic science as being in contrast with applied, the one leading to the other; science was "for society as well as for itself." One branch is curiosity driven, the other product driven, and even today the Institute "may not support product development but will reach for technology transfer where it can be encouraged – if Thomas Edison were to have improved the candle he would not have invented the light bulb."

The Weizmann Institute only operates graduate programmes. PhD students are only accepted once they have agreed a research plan with a supervisor. The community is some 2400 strong, with some 350 tenured faculty members, 600 other scientists, 600 research students, and the balance technicians. "We believe in the importance of basic science. Surprises cannot be planned." However, Yeda, the Weizmann Institute"s technology transfer arm, was founded in 1959 and even today is a small company, with some five or six people only, although its staff is about to be substantially increased. Yeda is an independent company with a contract to commercialise the Institute's research, although in practice a majority of agreements with industry may start directly with the researchers involved, not Yeda or the technology transfer office.

"We have been lucky, even embarrassingly successful. Our nominal revenues this year put us second or third in terms of the most successful university in the world at tech transfer. Columbia is the leader, but its income derives mainly from just one or two products. Our income derives from five programmes." The Institute's recent successes include two competing drugs for multiple sclerosis and a cryptography smartcard used by Sky TV.

The Weizmann Institute gives researchers incentives. By law in Israel, intellectual property developed by researchers belongs to their employer, but "when we commercialise, 40% of the proceeds go to the scientists who developed the IP. They serve as role models […]. The 40% goes to all the inventors on the project, not just the lead name, and one head of a research group got nothing because he had not actually contributed [to the commercially valuable patent]. An individual's percentage relates to specific scientific involvement, and researchers can plough back up to $200,000 for the Institute to match their contribution."

Researchers can be supported by industry but "strings" are discouraged. Some 20% of funding comes from industry, 50% from government (the lowest percentage of Israel's universities as it does little teaching; the University of Haifa receives c.95% of its funding from the equivalent of the higher education funding council), 25% from donations and the balance from grants, from bodies such as the EU.

The Weizmann's commercial undertakings have been affected less than most by the fall in NASDAQ. "Most of the fall attributed to technology had nothing to do with hard science. For dot.coms, perhaps higher education was a drawback[76]. One invention we sold to AOL was based on serious science. VCs know long-term science is a better investment.

"Commercialisation principles are clear: We will only license the use of a patent, never assign it. […] Some assignees take patents to block further development of the technology for competitive reasons. Or they run out of cash. Either way, we suffer from a donor's point of view if a patent is not being developed. We are also careful in the use of our name, which may not be used without our consent."

In summary, although the Weizmann Institute encourages technology transfer and has had some remarkable successes in a number of fields, research is the dominating principle: "Most faculty will have studied abroad at leading places for their subjects. All lectures here are in English. Promotion is primarily based on research achievement and we rely on opinions from abroad, letters of orientation from Nobel laureates and the like […] Years ago, involvement with industry was not seen as good, now it is fine, but promotion will not flow from it. We want to maintain science excellence."

It was put to us that there are two main approaches to tech transfer and associated intellectual property rights:

- The MIT model: MIT may own the IPR for work undertaken by faculty as an institutional project, but professors can 'moonlight' in their own time.
- The Harvard model: faculty can undertake no research independently of the college. All IPR belongs to Harvard if it is developed by a serving faculty member.

(In the UK, these models correspond approximately to the routes followed by Cambridge and Oxford respectively). The Weizmann Institute follows mainly the Harvard approach. "But we are not as strict. Nor do we allow researchers to work part-time. Sabbaticals are taken after six years, most faculty go abroad, though you could work in industry. But we try to be careful that this is not used as a channel out for IPR. Faculty can, of course, take leave of absence unpaid in industry, and some have decided to stay, but a number come back, even if they are financially successful."

The climate, reflective atmosphere and well-tended setting of the Weizmann Institute is reminiscent not so much of Boston as of CalTech in Pasadena, Southern California. One popular bon mot concerning the Institute runs: the Weizmann is a wonderful place, it's within walking distance of Israel.

6 Universities and Research Institutes

Professional Services

"The Ministry of Justice lives too much in the realm of theory. The new companies law spent 17 years in committee and looks like a camel."

Partner in Israeli Law Firm in interview with the authors, summer 2001

"The proliferation of fragments of the True Cross famously prompted the Protestant reformer John Calvin to scoff, at the close of the Middle Ages, that if all these fragments were collected, they would be 'comparable in bulk to a battleship' (an assertion that is carefully refuted in the 1913 Catholic Encyclopedia, which argues that they would all add up to no more than about a third of a whole cross weighing 75 kilograms."

Edward Fox, *Palestine Twilight* (2001) p51

INTRODUCTION

7.1 Part of the "golden chain" of technology funding is the provision of legal and financial advice by practitioners who understand the issues confronting technology firms (such as volatility and uncertainty) as much as the markets in which they operate, including ways of dealing with a downturn. Israel has successfully built up a cadre of specialist legal and accounting firms, although reforms of the company law system and of the tax regime continue to exercise growth companies and their advisers.

LAW & LAWYERS

7.2 As in the US, leading law firms work closely with venture funds and are seen by many entrepreneurs as likely to be successful introducers of proposals to investors. They also are often asked to act as general business advisers, even if this is not a role they have sought out. One experienced lawyer told us:

"Clients ask, are these terms standard, what other funds are doing this, do the VCs feel strongly about this clause?"

7.3 Again as with specialist US practices (Wilson Sonsini, Venture Law Group) leading Israeli law firms have concentrated recently on technology, but they have maintained other specialisms as well. Most documentation tends to be in English (even employment contracts) and transactions are geared to transparency. There has been a shift over the past five to six years, since at the beginning of the current phase of technology investment few firms were doing company/commercial work, and often lawyers were not involved in transactions. Now there is generally seen to be a good ratio of quality law firms to start-ups, a development mirrored in the accountancy world.

7.4 Legal advisers might take equity in clients, unlike accountancy practices, which are constrained by audit regulations. The Israeli Bar recently amended the rule on taking fees in anything other than cash, and there are specific exceptions for start-up companies. Equity might be taken for no cash in lieu of fees, or a cash investment might be made.

COMPANY LAW

7.5 Company law resembles that in the US or the UK (real estate law is based on Ottoman principles). But the new Israeli Companies Act 1999 came into effect in 2000, replacing the British Companies Ordinance 1929. Concepts have been incorporated from Civil Law (this is sometimes attributed to the number of officials at the Ministry of Justice of German or Italian descent).

7.6 Basic to the new law are concepts of *good faith and reasonable manner.* These apply to contracts, litigation, even the duties of shareholders in voting shares in the best interests of the company – those who know their minority shareholding might constitute

a "swing vote", or venture capitalist with a right of veto. The courts may grant an injunction, disqualification or order directing how shares can be voted. This contrasts with the Anglo-US model, where fiduciary duties apply to directors only. The breadth and uncertainty (partly caused by the untested nature of the new law) have led many practitioners to question its wisdom.

7.7 Secondly, *piercing the corporate veil* (previously only vestigial in case law) is also a prominent feature of the new act. When a court deems it just and equitable it may look through the veil of incorporation and impose personal liability on directors, officers and even members. New proposals to restrain piercing the veil to focus on fraud are likely to be enacted shortly as this is a critical issue for foreign investors.

7.8 The uncertainty caused by the new law has reinforced the existing tendency of many Israeli firms to re-incorporate under Delaware law on receiving venture capital investment. In addition to the commercial advantages of having the "look and feel" of an international company for doing business with suppliers and customers in the US and elsewhere, entrepreneurs benefit from the relative clarity of the US model. Being a Delaware Corporation can help in attracting the right chief executive or chief technical officer, though there are now several Israeli companies with high-profile US directors. Some US VCs (Benchmark, Sequoia) still insist on investing in an American-incorporated entity.

7.9 Furthermore, under Delaware law, *the business judgement rule* acts as a protection for the board provided that they have observed reasonable process. In Israel there is an affirmative duty to act reasonably, and it is substantive not procedural. Insurance, exemption and indemnification are allowed but in general Israeli corporations can only indemnify an officer in retrospect. It is more difficult to do so in advance as a reasonable or prudent board has to consider each case on its merits. Similar considerations apply with insurance.

TAXATION

7.10 Taxation also will influence the decision of where to incorporate. The Israeli climate is, overall, favourable, with lengthy tax holidays or reduced rates available. Although many tax breaks are aimed at encouraging major international companies to come to Israel, the rules are also beneficial for start-ups as net profit calculations impact on price/earnings ratios.

7.11 Until May 1998 Israel was subject to foreign currency control regulations, dating from the British Mandate and making it difficult to gain permission from the Bank of Israel to set up an overseas subsidiary. Since 1998, reporting requirements persist, but these can be handled by a company's bankers.

7.12 Tax at the shareholder level applies to CGT rather than to dividends (which are rare in early-stage businesses). The Israeli system is territorially linked; the US system of taxation is personal. The onus is on the Israeli tax authorities to show that goods were produced in (or income generated from) Israel, so the ability from May 1998 to incorporate abroad opened up a world of tax planning.

7.13 Theoretically, a US firm incorporated as an Israeli entity, not controlled or working in Israel, would pay no tax in Israel. The resulting complications usually lead to a compromise being reached with the Israeli tax authorities, anxious not to create a legal precedent. (US) VCs were given pre-rulings to limit their tax bracket to 20%, although this extra-statutory concession has not been tested in the courts. It is now possible to be considered tax-exempt in Israel if a firm would be so considered in the US; otherwise investors pay tax at the rate of 20% through the fund.

7.14 Double taxation created difficulties highlighted in 1999 when Lucent bought Chromatis in a $4.5bn share swap. If investors had paid 20% tax in Israel, there would be no tax credit in the US, and this rule would have applied to all portfolio companies. As a result Israeli funds kept shares in Lucent (on a share-for-share swap), which then fell 90% over the following two years.[77]

77 Ironically, on 23 August 2001, Lucent announced large-scale lay-offs, including discontinuation of Chromatis's activity

7.15 The Israeli tax authorities have stated that they will work with the investment community: when there is a risk of double taxation, Israeli tax will be waived (although it is not currently clear how this will be documented). The 2000 tax reform initiated by the Barak government was not fully carried through. The plan was to change from a territorial to a personal system of taxation. Capital gains tax was reduced to 25% on both individuals and corporations (from 50% on individuals and 36% on companies). The Minister of Finance stated a wish for there to be public discussion of a plan to "re-ignite the high-tech sector" encouraging foreign direct investment and reduce capital gains tax.

7.16 On 13 August 2001, the Minister announced that Israeli companies incorporated overseas and traded on foreign stock exchanges will be granted exemption from capital gains tax if they obtain a dual listing on the Tel Aviv Stock Exchange (TASE); the new regulation will apply retroactively to include the 2001 tax year. Israeli investors will obtain exemption from capital gains on dual listed companies, the exemption being similar to that allowed for all capital gains on TASE-listed shares. The intention is to increase the number of Israeli technology firms returning to Israel.

7.17 On 24 September, the Minister further announced that foreign investors in venture capital funds will be fully exempt from taxes. The exemption took effect immediately and will last until January 1 2004. Investors will need a pre-ruling from the Income Tax Commission, and regulations will apply to prevent Israeli residents "round-tripping". The tax exemption will not apply to VC investments pledged before the announcement. The practical details were agreed between Israel's Income Tax Commissioner and the Israel Venture Association at the end of October.

AUDITORS

7.18 One contrast between the UK and the US, which we noted when compiling *Funding Technology – Lessons from America,* was that whereas in the UK SMEs are likely to approach their accountant or their bank for general business advice in the first instance, in the US law firms are often an early source of general business advice. Israel in this respect is closer to UK than to US practice. This may be partly because Israel start-ups know that they have to internationalise from the outset (which would not necessarily be true of a Texan or Californian firm). With this in mind, Israeli SMEs are likely to seek to conform to international (i.e. US) business standards and accounting practices.

7.19 All the "big five" firms are heavily represented in Israel, with most having specialist technology practices and being active participants in the Israel Venture Association. Ethical restrictions apply to prevent auditors having conflicts of interest, for instance through taking equity options in lieu of fees. However, the major accountancy practices also operate in an advisory capacity, and as such have been key players in ensuring that quality professional advice is available to early-stage technology firms. These services include:

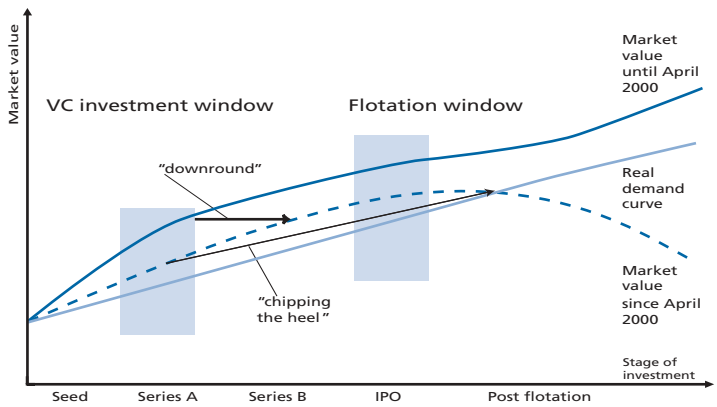
- Business planning
- Strategy advice
- Option planning
- Worldwide tax
- Export issues
- Relocation advice
- Assistance with fund-raising (where possible)
- Guidance on mergers and acquisitions.

Asked whether not being able to take options in client companies was a hindrance, one audit partner commented: "We have 56 products to sell on a daily basis and options would limit my ability to offer a full range of services."

7.20 Major audit practices have also been a good source of qualified personnel for early stage businesses. When asked whether losing staff was a problem, one audit partner told us:

"We take on 150 recruits for every one that will ultimately make it to partner, so we are geared to losing trained people. We have been successful with our own placement agency within the office to facilitate our staff leaving to work for a client. This provides employee satisfaction, helps our clients and keeps open channels with both; we don't charge, it's done pro bono. Leavers can be good ambassadors for us, and this facility helps us forecast our own needs – in fact, we would have a problem if the downturn continues and staff

Israeli Tech VC 2000 - 2001



Source: Ernst & Young, Tel Aviv

do not leave the firm. Three years ago we started an Alumni Club, which meets every six months."

7.21 In addition to acting for SMEs, accountants also act as advisers to investors, which requires maintaining detailed information on market conditions. We are grateful to Mr Yoram Tietz of Ernst & Young in Tel Aviv for the above analysis of the current position of the Israel technology sector and the dilemma facing venture capital investors. The "real value" of a technology stock – taking account the demand for its products and other economic fundamentals - is represented by the straight line. The top line represents what was the expected (inflated) market value of a VC stock until April 2000; portfolio values could until then confidently be expected to increase in between the seed round and the IPO window, and stocks generally continued to rise after flotation.

7.22 Since April 2000 and the first major NASDAQ correction, stock values (represented by the dotted line) have not only fallen significantly below market expectations of 18 months previously, but are even falling below their "real value". Even if a company can reach IPO (and the IPO pipeline has frozen in most major markets) perhaps as many as three out of every four stocks will trade below the IPO price. Investments are routinely worth less than VCs paid for them. These market conditions have a knock-on effect down the funding chain, as one leading accountancy adviser explained to us:

"In 1999, money was no object, firms received investment for branding, profits were not an issue. In 2001, money *is* an object. Many are stuck on the curve between seed capital and expansion funding – it is death valley. Perhaps 3% will get through as they are. Another 12% will go back to existing shareholders for a "down round", that is, the next round of money will value the company below what it was at the previous round. And 85% will go down."

7.23 As for accessing funding on behalf of clients in the current market, we were told:

"There are no real business angels with management added-value in Israel, only people with money prepared to make informal investments – lawyers, accountants, sitting CEOs and diamond merchants. They are not serial entrepreneurs. Successful young people hang on to their money. These investors want to sell, or want the company sold, after six months. But the big VCs do operate 'Friends and Family' funds, as in the US."[77a]

7.24 Several experienced accountants to whom we spoke said that they were now reverting to providing tough "old-fashioned" advice to early stage companies, even those successful in raising expansion capital, on how to control expenditure: since top line revenues are unpredictable, it is the only way of influencing the bottom line. But asked whether these conditions make for an active industry consolidation, one accountancy adviser of long standing commented:

"Many companies only really have R&D, so there is little to consolidate. You find a number of players in the same niche but the personalities prevent them from merging, or people leave as a result of the merger, but without products all you had to merge was the people. And if two companies each with only one product come together, you can find the aggregate is less than the sum. Also, post merger a VC might be diluted from

77a But see also Khavul S (2000) p172: "...the CEOs often contrasted venture capitalists' involvement with the involvement of private investors. They regarded private investors as more experienced and committed to understanding their business and needs."

Israel and the Factors for Successful Clustering

Professor James F Gibbons of Stanford University identified ten factors necessary for high tech clusters[78]. How well does Israel score according to this list?

Universities and centres of academic excellence: Israel has a history of academic excellence pre-dating the founding of the modern State (the Technion, the Weizmann Institute, the Hebrew University), a tradition being taken forward with newer institutions such as the Ben Gurion University of the Negev.

Entrepreneurs with marketable ideas and products: entrepreneurship has returned to the fore in recent years, with regulatory liberalisation and a recognition of the importance of the private sector. Hitherto, many Israeli start-ups may have relied heavily on US executives for execution and marketing. The current approach of VC investors may represent a transition to greater reliance on Israeli personnel and non-US markets.

Business angels and established seed funds: until recently seed funding was not seen as an issue by most of our interviewees. The slow down in capital markets activity, cutting off the flow of capital back to serial entrepreneurs and other interested investors, will sorely test the ability of early-stage firms to access money at this critical juncture.

Sources of early stage venture capital: again, the inability of established venture funds to liquidate investments through IPOs or M&A is having a severe impact along the whole chain of investment stages. But Israel has built up a venture industry from scratch, with considerable know-how and networks, in eight years. The industry should survive the consolidation, even if many individual funds do not.

Core of successful large companies: despite the severe downturn in both the US and Israel during 2001, a number of Israeli companies achieved "billion dollar corporation" status (Amdocs, Checkpoint, Comverse)and a remarkable number of leading US firms continue to be represented in Israel (Intel, Motorola).

Quality management teams and talent: there is still a lack of senior management experience in large technology businesses in Israel, with many executives coming from a research background, which was suitable for the "land grab" of the 1990s but unsuitable where sales and profits are paramount.

Supportive infrastructure: Israel does now have an established venture industry (including professional advisers who specialise in tech sectors). To some extent, even physical infrastructure issues are being addressed, with improved rail links between Haifa and the Negev Desert and investment in road improvement. Physical infrastructure is a contentious issue in other successful clusters, from Cambridge to San José.

Affordable space for growing businesses: considerable real estate development has taken place in addition to the government incubation programme. The northern suburbs of Tel Aviv, such as Herzliya Pituach, now resemble the San Francisco Bay area, and the downturn in the economy is making well-positioned space more affordable.

Access to capital markets: during 1998 through to 2000, numerous Israeli companies successfully floated on NASDAQ, to the point where Israel ranked immediately behind the US and Canada in terms of NASDAQ representation. The current near-complete freeze of the IPO pipeline is a worldwide phenomenon.

Attractive living environment and accommodation: Israel's political problems are well-known. Nevertheless, one experienced, widely travelled scientist now a partner in a major Israeli venture fund told us: "Israel is still one of the best countries in the world to bring up children."

18% to 9%, and as a minority investor he will lose interest in trying to make the new company work."

INVESTMENT BANKING

7.25 As would be expected in an economy with growing capital markets activity and a flow of IPOs on NASDAQ, during the 1990s a number of mainly US investment banks opened representative offices in Israel: Lehman Brothers, Goldman Sachs, Merrill Lynch and others. More recently, despite less favourable market conditions, two major international "universal" banks (HSBC and Citibank) have opened full branches to provide corporate and private banking services in addition to investment banking.

7.26 At the same time, other European banking groups have increased their investment on the ground in Israel, and have non-advisory mandates for IPOs, fund-raisings and mergers & acquisitions which might previously have been awarded to US competitors. The beginnings of a trend towards using European rather than US intermediaries is another small but

78 Presentation to the Cambridge Network Ltd, 17 March 1998, Robinson College, Cambridge

indicative example of how Israel may mitigate its over-reliance on US markets and organisations.

SUMMARY

7.27 Israel benefits from an appropriate "infrastructure" of professional services firms. As in the UK – but perhaps unlike the US – accountants are likely to be consulted by SMEs at an early stage, although law firms do also provide general business advice. Lawyers can and do take options in clients, auditors do not. All the "big five" accountancy firms are represented, a function of early internationalisation among their clients. These firms provide a wide range of consultancy services, including advice on fund-raising. Recent company law reforms have not been widely accepted as successful, and further reform of the tax system is under way to ensure Israel continues to attract foreign investment.

7.28 In addition to legal and accountancy advisers, Israeli high tech firms can call on the services of other consultants; a particular niche is in preparing entrepreneurs to make elevator pitches and similar presentations. Current trends in investment banking may mirror a new emphasis on European markets generally.

Annex A – Geographical Distribution of Incubators

A Geographical Distribution of Incubators

Annex B – Short Chronology of Modern Israel

'La seule loyauté qui s'impose est celle que je dois aux principes, et non pas aux peuples ni aux gouvernements. Je crois que la politique de colonies sur la rive occidentale [du Jourdain] est contraire aux intérêts d'Israël, car non seulement elle l'expose à de grands périls, mais elle porte atteinte à la grande cause fondatrice d'Israël, celle qui en fait une communauté exemplaire bâtie sur la Justice et l'Humanité. Je crois qu'Israël doit proteger sa sécurité de toutes les façons possibles, mais je pense que la politique étroitement nationaliste de Begin met en péril la sécurité du pays au lieu de la renforcer.'"[79]

Jacques Attali, Un Homme d'Influence – Sir Siegmund G Warburg 1902 -1982 (1985) pp504-5

In 1896, Theodore Herzl (1860-1904) published *Der Judenstaat* (The Jewish State), which called for the establishment of a national Jewish state. The following year the first World Zionist Congress was held. Jews had kept a presence in Palestine since Biblical times, but for 2000 years diaspora Jews had said "next year in Jerusalem" as part of the Passover prayers. From the end of the nineteenth century Jewish organisations in Europe began the task of buying land from mainly absentee landlords, and beginning settlements.

With the Balfour Declaration in 1917, Britain formally recorded its sympathy for the creation of a Jewish Homeland in Palestine. The Declaration, which went through several drafts, contained the ambiguous line "it being clearly understood that nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities in Palestine".

The First Aliya (Immigration) followed pogroms in Russia in 1881-1882, with most of the olim (immigrants) coming from Eastern Europe; a small number also arrived from Yemen. Most chose agricultural settlement as their way of life and founded moshavot – farmholders' villages based on the principle of private property. Three early villages of this type were Rishon Lezion, Rosh Pina, and Zikhron Ya'akov. Nearly 35,000 Jews came to Palestine during the First Aliya, with some 15,000 establishing new rural settlements.

Most of the founders of Zionism knew that Palestine had an Arab population. Some spoke nevertheless of "a land without a people for a people without a land". Only a few regarded the Arab presence as an obstacle to the fulfilment of Zionism. In the late nineteenth century, Arab nationalism did not yet exist, and the Arab population of Palestine was sparse and apolitical. Zionist leaders believed that since the local community was relatively small, friction between it and the returning Jews could be avoided; they were also convinced that the subsequent development of the country would benefit both peoples, thus earning Arab endorsement and co-operation.

The Second Aliya followed in the wake of pogroms in Czarist Russia. Most of its members were young people inspired by socialist ideals. Many models and components of the rural settlement enterprise came into being at this time, such as "national farms" where rural settlers were trained; the first kibbutz, Deganya (1909); and Hashomer, the first Jewish self-defence organisation in Palestine. The Ahuzat Bet

79 "The only loyalty which is imperative is that which I owe to principles and not to nations or governments. I think that the policy of colonizing the West Bank [of the Jordan] is contrary to the interests of Israel, as not only does it expose her to great danger, but it also damages the great founding cause of Israel, that of an exemplary community built on Justice and Humanity. I believe that Israel must protect her security in every possible way, but I think that Begin's narrowly nationalist policy imperils the security of the country." February 1980

neighbourhood, established as a suburb of Jaffa, developed into Tel Aviv, the first modern all-Jewish city. The Hebrew language was revived as a spoken tongue, and Hebrew literature and Hebrew newspapers were published. During this period, 40,000 emigrants arrived.

For some time many Zionists found it hard to understand and accept the depth and intensity of Arab opposition, which became a clash between two peoples both regarding the country as their own.

The Third Aliya was triggered by the October Revolution in Russia, the ensuing pogroms there and in Poland and Hungary, the British conquest of Palestine and the Balfour Declaration. Most members of the Third Aliya were young halutzim (pioneers) from Eastern Europe. Although the British Mandatory regime imposed aliya quotas, the yishuv (Jewish community) numbered 90,000 by the end of this period. Projects such as the draining of marshes in the Jezreel Valley and the Hefer Plain were undertaken. The Haganah (the Jewish defence organisation) was formed. Approximately 40,000 arrived in Palestine during the Third Aliya.

Anti-semitism in Europe increased the flow of immigration to the Holy Land. The Arabs felt betrayed by the Europeans having waged the "Arab Revolt" during the First World War to free themselves from their Turkish masters only to find them replaced by British and French mandates. The Balfour Declaration was a cause of resentment.

The Fourth Aliya was a direct result of the economic crisis and anti-Jewish policies in Poland, along with the introduction of stiff immigration quotas by the United States. Most of the immigrants belonged to the middle class and brought modest sums of capital with which they established small businesses and workshops. The Fourth Aliya brought 82,000 Jews to Palestine.

The Fifth Aliya was triggered by the Nazi accession to power in Germany (1933). Throughout the country, "stockade and tower" settlements were established. During this period – in 1929 and again in 1936-39 – violent Arab attacks on the Jewish population took place. The British government imposed restrictions on immigration, resulting in Aliya Bet – clandestine, illegal immigration. By 1940, nearly 250,000 Jews had arrived during the Fifth Aliya and the yishuv's population reached 450,000. From this time on, the practice of "numbering" the waves of immigration was discontinued

The British Army solved some of its manpower shortages at this time by recruiting from the Jewish population in Mandated Palestine. In 1940, the Jews of Palestine were permitted to enlist in Jewish companies attached to the East Kent Regiment (the "Buffs") until the creation of an independent Jewish military formation. Skills gained in the Jewish Brigade and in the British army in general was experience that would be put to use again during Israel's War of Independence.

Britain's inability to reconcile the conflicting demands of the Jewish and Arab communities led the British government to request that the 'Question of Palestine' be placed on the agenda of the United Nations General Assembly (April 1947). As a result, a special committee was constituted to draft proposals concerning the country's future. On 29 November 1947, the Assembly voted to adopt the committee's recommendation to partition the Land into two states, one Jewish and one Arab. The Jewish community accepted the plan; the Arabs rejected it. Following the UN vote, local Arab militants, aided by irregular volunteers from Arab countries, launched violent attacks in an effort to frustrate the partition resolution and prevent the establishment of a Jewish state. After a number of setbacks, the Jewish defence organisations routed most of the attacking forces. On 14 May 1948 when the British Mandate came to an end, the Jewish population numbered some 650,000.

The State of Israel was proclaimed according to the 1947 UN partition plan. Less than 24 hours later, the regular armies of Egypt, Jordan, Syria, Lebanon and Iraq invaded the country. In Israel's War of Independence, the newly formed, poorly equipped Israel Defence Forces (IDF) repulsed the invaders in fierce intermittent fighting, which lasted some 15 months and claimed over 6,000 Israeli lives (nearly one percent of the country's Jewish population at the time).

It is a widely held belief in modern Israeli society that the IDF lacked the manpower and weaponry to fight effectively in this war, but by the end of the war, the IDF outnumbered their enemy by two to one. Although equipped with a challenging mixture of WWII era weapons from a variety of sources, there were no shortages. Another common belief in Israel is that immigrants were offloaded from the boats and sent immediately to the front. This was the

Modern Israel: Key Dates

1839 – Sir Moses Montefiore, London-based Jewish philanthropist, proposes establishment of a Jewish state
1878 – founding of Petah Tikva, the first wholly-Jewish colony, and revival of Jewish nationalism in Palestine
1896 – publication of *Judenstaat* (The Jewish State) by Theodor Herzl (1860-1904), Hungarian-born first president of the modern secular World Zionist Organisation, who also convened the first Zionist Congress at Basel (1897)
1901 – Jewish National Fund established to purchase land in Palestine for Zionists
1904 – Jews escaping pogroms in Russia and Poland constitute Second Aliyah
1909 – Tel Aviv founded as first modern Jewish city. Russian Jews create first kibbutz – Degania, on the shores of the Sea of Galilee
1916 – secret Franco-British agreement for the recognition of a federation of Arab states in the area then nominally subject to Turkish suzerainty, but with provision for international administration for Palestine
1917 – Balfour Declaration: policy statement from the British Foreign Secretary to the World Zionist Organisation supporting in principle the establishment a national home for the Jewish people in Palestine
1919-48 – British Mandate in Palestine under the League of Nations
1924 – Foundation of Technion
1925 – Opening of Hebrew University, Jerusalem
1934 – Foundation of Weizmann Institute (as Daniel Sieff Research Institute)

"6 November 1944
Usual early start from home and a difficult COS at which we discussed the problems of the partition of Palestine for the Jews. We were unanimously against any announcement before the end of the war, but our hand may well be forced […] 5.30: our usual Cabinet, which turned out to be an exciting one. First of all the PM announced that Lord Moyne had been shot in the neck in Cairo by terrorists! Then Winston and Amery had a set to on the India question."
Field Marshall Lord Alanbrooke, *War Diaries 1939 - 1945* , Ed. Danchev and Todman, London 2001, pp 617-8
[Lord Moyne, British Minister Resident in the Middle East, was assassinated by the Stern gang.]

29 November 1947 – Partition Resolution approved at United Nations, calling for creation of an Arab state and a Jewish state within Mandate territory and international status for Jerusalem. Worsening of violence
14 May 1948 – David Ben-Gurion proclaims independent Jewish State of Israel, one day before agreed withdrawal of last British forces. Fierce fighting erupts
May 1949 – UN-sponsored ceasefire. Israel admitted to the UN
1950 – Law of Return grants citizenship to every Jew
1956 – Suez operation led by Britain and France against Egypt enables Israel to extend into Gaza Strip and Sinai. UN ceasefire terms return these land gains to Egypt
1964 – Palestine Liberation Organisation founded
5-10 June 1967 – Six Day War. Following successful repulse of Syrian and Jordanian attack Israel takes control of Golan Heights, West Bank, Gaza Strip and Sinai
6-24 October 1973 – Yom Kippur War. After initial reverses, Israel turns back Egyptian invasion. Prime Minister Golda Meir forced to resign
1974 – the Palestine National Council (responsible for nominating leaders of the PLO) accepts principle of Palestinian state in the West Bank and Gaza Strip only
19 November 1977 – President Sadat of Egypt visits Israel to negotiate peace with first non-Labour Prime Minister, Menachem Begin
26 March 1979 – Camp David Agreement. Recognition of Israel by Egypt and return of Sinai
6 October 1981 – Sadat assassinated by fundamentalists posing as soldiers at commemoration of start of 1973 war
June 1982 – Israel invades Lebanon to force out PLO, remaining in occupation until 1985
September 1993 – "Oslo Accords" signed by Yassir Arafat and Yitzhak Rabin in Washington
1994-95 – most of Gaza Strip and West Bank granted limited self-rule
4 November 1995 – assassination of Yitzhak Rabin by Yigal Amir, a religious student at Bar-Ilan University
1996 – Prime Minister Shimon Peres orders new offensive against Lebanon. Yassir Arafat voted President and head of Palestinian National Authority in Palestinian elections. First ever direct elections for Prime Minister result in Likud's Binyamin Netanyahu becoming Prime Minister
October 1998 – "Wye River Accord" establishes principle of Israel handing over a further 13% of the West Bank; Palestinians to abrogate call in Palestinian National Charter demanding destruction of the State of Israel
May 1999 – new Labour government formed under Ehud Barak
28 September 2000 – Likud politicians led by Ariel Sharon to Temple Mount/al-Haram al Sharif
17 October 2000 – Red Sea summit hosted by President Clinton; Barak and Arafat agree to a ceasefire and pullback of Israeli forces
6 February 2001 – following breakdown in the Peace Process, Ariel Sharon elected Prime Minister; national unity government formed (5 March)
13 June 2001 – Ceasefire framework negotiated by CIA director George Tenet
17 October 2001 – Assassination of Rehavam Ze'evi, Israel's Tourism Minister

"The Oslo peace process finished years ago. It is an illusion to pursue it."
Natan Sharansky, Israeli Deputy Prime Minister and Minister for Housing, quoted in *The Observer,* 21 October 2001

exception rather than the rule, and an intensive, albeit brief training programme was created by the infant IDF for its new recruits from Europe. The majority of the senior officers were either trained by or were actually ex members of the British Forces.

The State of Israel affirmed the right of every Jew to come to the country and, upon entry, to acquire citizenship. In the first four months of independence, some 50,000 newcomers, mainly Holocaust survivors, reached Israel. By the end of 1951, a total of 687,000 had arrived, over 300,000 of them refugees from Arab lands, doubling the Jewish population. In the 1950s, the character of immigration began changing. The gates of Eastern Europe were closing, and the focus moved to North Africa. Some 240,000 North African Jews came to Israel between 1952 and 1964.

The economic strain caused by the War of Independence and the need to provide for a rapidly growing population required austerity at home and financial aid from abroad. Vast expansion of areas under cultivation had brought about self-sufficiency in the supply of all basic food products except meat and grains, while some 50,000 acres (20,000 hectares) of mostly barren land were afforested. Not all the land was barren. Arab villages that were abandoned during the Independence war were either reallocated to Jews, bulldozed or absorbed by Jewish towns. Those that were bulldozed were by and large forested over to erase their existence there.

Upon the signing of a tripartite military alliance by Egypt, Syria and Jordan (October 1956), the imminent threat to Israel's existence was intensified. In collusion with the British and French Armies and over the course of an eight-day campaign, the IDF captured the Gaza Strip and the entire Sinai peninsula, halting 10 miles (16 km) east of the Suez Canal. A United Nations decision to station a UN Emergency Force (UNEF) along the Egypt-Israel border and Egyptian assurances of free navigation in the Gulf of Eilat led Israel to agree to withdraw in stages (November 1956 - March 1957) from the areas taken a few weeks earlier.

When Egypt again moved large numbers of troops into the Sinai desert (May 1967), ordered the UN peacekeeping forces (deployed since 1957) out of the area, reimposed the blockade of the Straits of Tiran and entered into a military alliance with Jordan, Israel found itself faced by hostile Arab armies on all fronts. Israel launched a pre-emptive strike (5 June 1967) against Egypt in the south, followed by a counterattack against Jordan in the east and the routing of Syrian forces on the Golan Heights in the north. At the end of six days of fighting, previous cease-fire lines were replaced by new ones, with Judea, Samaria, Gaza, the Sinai Peninsula and the Golan Heights under Israel's control.

In contrast with UN Security Council Resolution 242, the Arab position, as formulated at the Khartoum Summit (August 1967) called for "no peace with Israel, no negotiations with Israel and no recognition of Israel." Hostilities ended in 1970 when Egypt and Israel accepted a renewed cease-fire along the Suez Canal. Three years of relative calm along the borders were shattered on Yom Kippur (Day of Atonement), the holiest day of the Jewish year, when Egypt and Syria launched a co-ordinated surprise assault against Israel (6 October 1973), with the Egyptian army crossing the Suez Canal and Syrian troops penetrating the Golan Heights. During the next three weeks, the Israel Defence Forces repulsed the attackers, crossing the Suez Canal into Egypt and advancing to within 20 miles of Damascus.

While the 1973 war cost Israel a year's GNP, by the second half of 1974 the economy had recovered. Foreign investments grew considerably. The 1977 Knesset elections brought the Likud bloc, a coalition of centrist parties, to power, ending almost 30 years of Labour party dominance. The visit of Egyptian President Anwar Sadat to Jerusalem (November 1977) was followed by negotiations between Egypt and Israel under American auspices. The resulting Camp David Accords (September 1978) contained a framework for a comprehensive peace in the Middle East, including a detailed proposal for self-government for the Palestinians. Israel withdrew from the Sinai Peninsula, exchanging former cease-fire lines and armistice agreements for mutually recognised international boundaries.

The Palestine Liberation Organisation (PLO) redeployed itself in southern Lebanon after being expelled from Jordan (1970). The Israel Defence Forces crossed the border into Lebanon (1982), removing the bulk of the PLO's organisational and military infrastructure from the area. Israel maintained a small security zone in southern Lebanon adjacent to its northern border. The South Lebanon “Security Zone” was evacuated in May 2000 as part of Ehud Barak’s election promises.

The convening of the Madrid Peace Conference (October 1991), held under American and Soviet auspices, brought together representatives of Israel, Syria, Lebanon, Jordan and the Palestinians. Following months of intensive behind-the-scenes contacts in Oslo between negotiators for Israel and the Palestine Liberation Organisation (PLO), a Declaration of Principles (DOP) was formulated outlining self-government arrangements for the Palestinians in the West Bank and Gaza Strip.

Its signing was preceded by an exchange of letters (September 1993) between PLO Chairman Yasser Arafat and Prime Minister Yitzhak Rabin, in which the PLO renounced the use of terrorism, pledged to invalidate those articles in its Covenant which deny Israel's right to exist and committed itself to a peaceful resolution of the decades-long conflict over land. In response, Israel recognised the PLO as the representative of the Palestinian people.

The first step, setting up self-rule in the Gaza Strip and Jericho area, took place in May 1994. In August of the same year, the second stage was introduced involving the transfer of specific powers and responsibilities to Palestinian representatives in the West Bank. The Interim Israeli-Palestinian Agreement of September 1995, constituting the third stage, broadened Palestinian self-government in the West Bank by means of an elected self-governing authority – the Palestinian Council – to allow the Palestinians to conduct their own internal affairs.

B Short Chronology of Modern Israel

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References

Appendix 1 – Organisations and Individuals Interviewed

We are grateful to the following organisations and individuals for providing us with interviews and/or comments and written information in the preparation of this report.

ISRAEL

Adi Riza – *BRITECH*
Max Livnat – *Senior Deputy Director General, Ministry of Industry & Trade*
Ed Mlavsky – *Chairman & Founding Partner, Gemini Israel Venture Funds*
Carmel Vernia – *Chief Scientist, Ministry of Industry & Trade*
Nissim Chen – *Lapid Pharmaceuticals*
Jeremy Levy – *Israel-Australia, New Zealand & Oceania Chamber of Commerce*
Avraham Shitzer – *Technion/Israel Institute of Technology*
Ra'anan Shmueli – *TEIC/Technion Entrepreneurial Incubator Co*
Julie Kunstler – *Portview Communications Partners*
Shlomo Kalish – *Jerusalem Global Ventures*
Ian Morrison – *Director, Trade, British Embassy Tel Aviv*
Yigal Levine – *Commercial Officer, British Embassy, Tel Aviv*
Edward Murad OBE – *Economic & Commercial Adviser, British Embassy, Tel Aviv*
Orna Berry – *Gemini Israel Venture Funds*
Rina Pridor – *Program Director, Technology Incubators, Ministry of Industry & Trade*
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Joseph Riback – *Israel Discount Capital Markets & Investments*
Simon Larah – *tecc-is*
Zvi Artstein – *Weizmann Institute of Science*
Ora Horovitz, Reuven Sadeh – *BG Negev Technologies and Applications*
Shmuel Shakked, David Kahn – *Poalim Venture Services*
Ran Arad – *Garage Technology Ventures*
Edouard Cukierman – *Catalyst Investments*
Modi Ashkenazy – *Cukierman & Co*

UNITED KINGDOM

Tony Warwick – *BRITECH*
Susanna Khavul – *London Business School*

Organisations and Individuals Interviewed

Appendix 2 – Report Authors

Bob Campbell, David Gill and Martin Rigby outside the Technion, Haifa

Bob Campbell, Tim Minshall and David Gill in front of Temple Mount and the Wailing Wall, Jerusalem

David Gill is Head of the Innovation & Technology Unit at HSBC Bank plc in London. The Unit develops products and services to support technology-based early-stage companies. These have included establishing HSBC Chairs of Innovation at Brunel University and the University of York, and a network of Technology Banking Managers across the UK. He is a member of the Enterprise Panel, an Industrial Fellow of Kingston University Business School and a Fellow of the Royal Society of Arts. Educated at Cambridge, David qualified as a barrister before working in corporate finance for US and UK banks. His previous publications include a study of the German banking system; he is one of the joint authors of *Funding Technology – Lessons from America.*

Tim Minshall is a member of the board of St John's Innovation Centre Ltd (one of the UK's most successful incubators for new technology ventures) and Director of Research at the University of Cambridge Entrepreneurship Centre (CEC). He worked previously as a plant engineer, consultant and freelance writer in the UK, Japan and Australia. Tim has a Bachelor's degree in Engineering from Aston University and a PhD from Cambridge University Engineering Department, and was also a joint author of *Funding Technology – Lessons from America.*

Martin Rigby is a venture capital fund manager based in Cambridge. He started his venture capital career at 3i having previously been a regular army officer. He is the founder and managing director of ETCapital Limited, which manages two seed funds focused on investing in young, technology-based businesses with strong growth potential. Since 1986, he has invested in nearly 50 early stage companies and currently sits on the boards of Bango.net, CellFactors, Cyan Technology, Force12 and WAX info, among others. He read history at New College, Oxford for his first degree and has a Cranfield MBA. He was also a joint author of *Funding Technology – Lessons from America.*

Bob Campbell read Islamic Studies and Middle East Politics at the Hebrew University, Jerusalem. A fluent Hebrew speaker, he was a regular soldier for three years in Israel before returning to the UK to work in venture capital and serve in the Territorial Army. He is currently studying at the Royal Military Academy, Sandhurst.

Report Authors

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