PROMOTING HIGH TECH ENTREPRENEURIAL SYSTEMS

REFLECTIONS ON THE ISRAELI EXPERIENCE

Morris Teubal, 04-09-2013

Acronyms

VC-Venture Capital, VC organization, LP-Limited Partnership*[a VC organization form],*

PE- Private Equity, Private Equity organization; SU-high tech start up company;

R&D-Business expenditure in Research and Development; GERD-Gross Expenditure in Rresearch & Development; M$-Million dollars

I-Commercial Innovation; BS- Business Sector, STE-Science, Technology, Higher Education

EHTC- ICT-oriented, high tech, Entrepreneurial High Tech Cluster, Israel;

VC/EHTC-VC market/industry embedded in the EHTC

ILC- Industry Life Cycle; EHTC-Extended ILC

S/E-Systems Evolutionary; SIP-Strategic Innovation Policy

SC-Structural Change, CU-Cath UP;HLO-Higher Level Organization/System *(Meso-Level entitie)*

MF-Market Failure SF-System Failure GF-Government Failure

OCS-Office of the Chief Scientist, Ministry of Industry and Trade (Israel)

Yozma Program (or Yozma)-Israel's VC-directed Policy Targeting of VC/EHTC

DIRS-Dynamic Increasing Returns to Scale

BIRD-Bi-national R/D Program; TTO-Technology Transfer Office

E-Effectuation; E(E)-Entrepreneurial Effectuation; C-Causation; E(C)-Entrepreneurial Causation

SIP (E)-an Effectuation stretch of the SIP process; SIP (C)-idem with respect to Causation

MOTIVATION AND SPECIFIC OBJECTIVES-1

Israel successfully made a transition from an underdeveloped economy whose main exports during the 1960s were oranges and textiles to a high tech powerhouse based on an ICT-oriented Entrepreneurial High Tech Cluster (EHTC) which emerged during 1993-2000.

During the 1990s, Israel's EHTC was one of the most successful ICT-oriented, entrepreneurial high tech clusters beyond the US, with over 2500 start up companies (SUs)-up from 300 during 1992- and over 50 VC (Venture Capital) funds (up from 2 or 3 in the early 1990s).

A strong Venture Capital industry and market emerged and co-evolved with the new wave of SUs during the 1990s, it being one of the major factors underlying Israel's success

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This VC industry and market became embedded in and co-evolved with the above cluster

It was the outcome of a series of Innovation and VC policies and their impact, particularly a Grants to R&D* (of firms) *program, starting in 1969, and a targeted VC policy implemented during 1993-97/8

At the time, both represented, in some sense Policy Innovations

-3

While such policies were critical for generating background and pre-emergence conditions, and for sparking EHTC emergence during 1993-7/8, the accelerated process of emergence was essentially Endogenous, driven by market forces and other system component-driven processes.

-4

Another central factor underlying this phenomena was the strength of that country's Science, Technology and Higher Education (STE) infrastructure, which began in 1925-during the pre-State period- with the creation of two of the most important Universities: The Hebrew University of Jerusalem; and the Technion (Israel Institute of Technology in Haifa) of Haifa.

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As a result, Israel attained Catch Up in terms of a number of critical technological parameters, but not in terms of GDP/capita. For example GERD/GDP increased from between 2 and 3 % in the early 1990s to over 4.5% by 2007/8; the share of (business)R&D in total GERD, increasing to more than 70%; and the share of BERD financed by the State declining to less than 10%

How can we explain the successful High Tech and Country Catch Up (CU)?

Could other countries benefit from an analysis of the Israeli Experience?

While CU in other countries (Korea and many others) was based on *non*-High Tech industries, that country is now strongly interested in entrepreneurial systems and in the Israeli case [Korea has a new Overarching National Goal of *'promoting creative industries'*]

This could be related to Keun Lee's argument that '**sustained CU requires not only an entrance into mature industries (which are still new to the newcomers), but also leapfrogging into emerging industries that are new to both advanced and developing countries' (K. Lee, 2013, p.228)**

Moreover other Advanced Countries with High Tech industries which are not particularly entrepreneurial (e.g. Finland and many others) are strongly interested in 'strong entrepreneurship' (Lerner 2009) and high tech entrepreneurial systems

The underlying reason is the dynamic global environment facing countries where continued growth requires-not only enhanced productivity of existing sectors- but continued Structural Change (SC) **[understood as generating new meso-level Higher Level Organizations(HLOs) e.g.sectors, industries, clusters or systems].**

Moreover, the prevailing (Knightian) radical uncertainty and wild randomness (Taleb 2009) implies that successful SC requires experimentation and learning, including 'on the ground' to generate 'options for SC'

Over and beyond their <u>direct</u> impact (which in the case of Israel was very high), 'options for SC' is precisely what high tech entrepreneurial systems might generate.

-9 Objectives

A. Present comparative data on the EHTC that emerged in Israel during the 1990s *[see main text]*

B. Undertake a Systems/ Evolutionary (S/E) analysis of the process *[approx. 1969-2000 in Israel]* ***leading to the above entrepreneurial cluster***

This will be undertaken by proposing an E*xtended* Industry Life Cycle (EILC), three phase model, covering the 1969-2000 period. The focus will be on the *pre-emergence phase* -where an option for an ICT-oriented, entrepreneurial high tech cluster (EHTC) will be generated- and on the *emergence phase* which is a cumulative process with positive feedback (DIRS-Dynamic Increasing Returns to Scale) which in Israel led to EHTC

C. Analysis of Israel's Yozma Program which policy targeted that countries VC/EHTC

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-10: OBJECTIVES-2

D. A focused analysis of key policy dimensions of the above process from the Strategic Innovation Policy (SIP) perspective

* **Present the essentials of SIP e.g explicit creation of national priorities; a measure of separation between priority setting** *[upstream in the policy process]* **and** *[downstream]* **policies on the ground; and a distinction between Type *1[risk]* and Type 2 *[radical uncertainty]* priorities**

***Apply the SIP framework to i) analyze the evolutionary process leading to Israel's successful *Policy Targeting of Type 2, new HLOs* [**Israel's policy targeting through Yozma involved such a new HLO**] and ii) to interpret Israel's success in terms of its Vision, globalization processes, Innovation Policies broadly conceived, Liberalization, favorable exogenous events, etc; and Good Luck.**

A. DATA ON ISRAEL's EHTC OF THE 1990s

Venture Capital

- ***VC <u>raised</u> increased from 58M$ in 1991 to 4.557 M$ in 2000 (back to 558M$ in 2003)***
- ***VC <u>invested</u> as a share of GDP rose from 0.4% in 1997 to 2.6% in 2000 (and back to 1.2% in 2004)- highest share among OECD countries***
- ***High (est) <u>share of VC investments in 'early phase'</u>*** (e.g SU up to 5 or 6 years of age)

A-2

High share of VC entrepreneurs with S&T backgrounds and with high tech experience

90% of funds coming from foreign sources

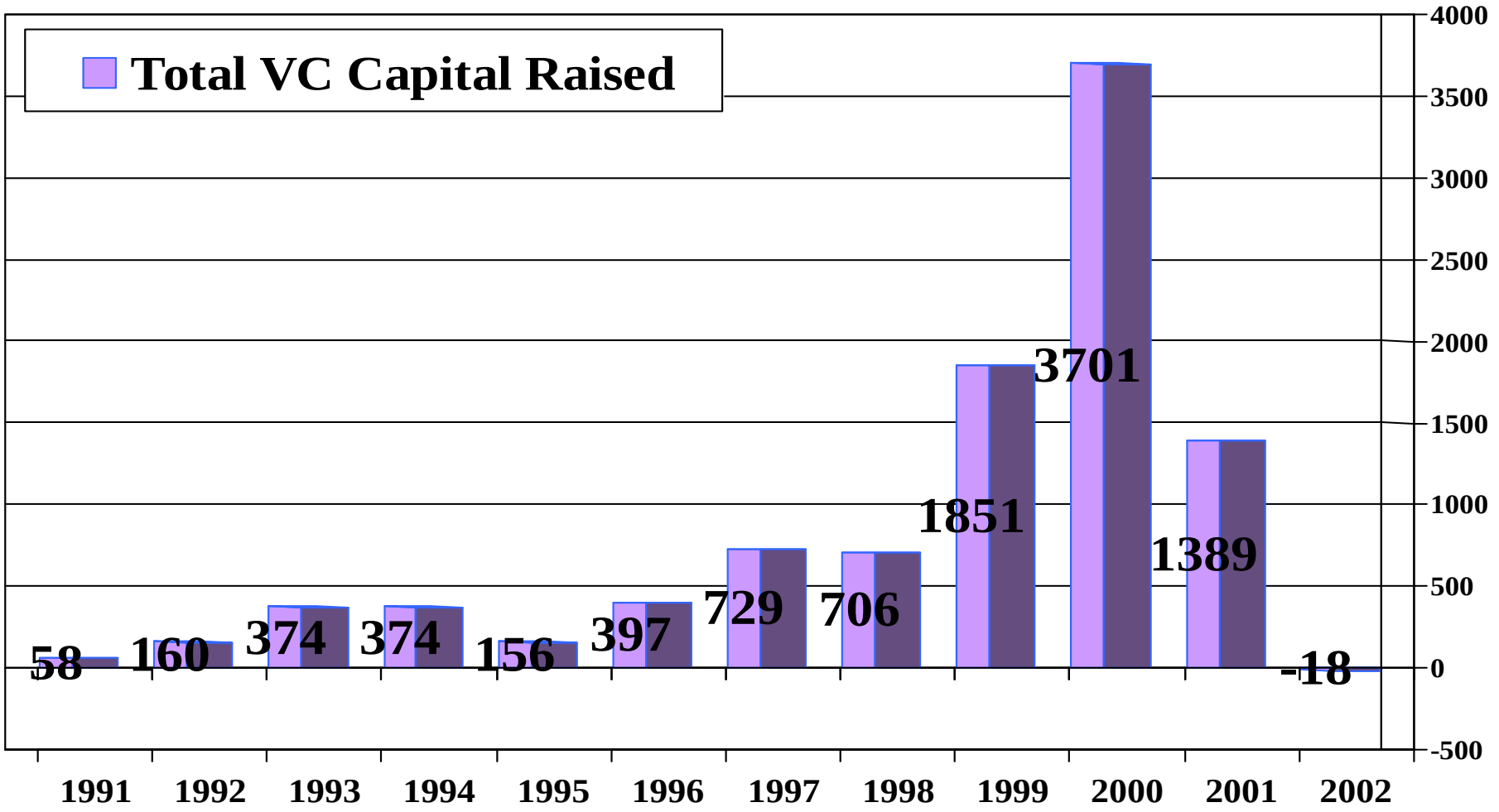
Negligible investments by Domestic Pension Funds

Dominance of Limited Partnership form or organization

VC co-evolved with High Tech (particularly SU segment)

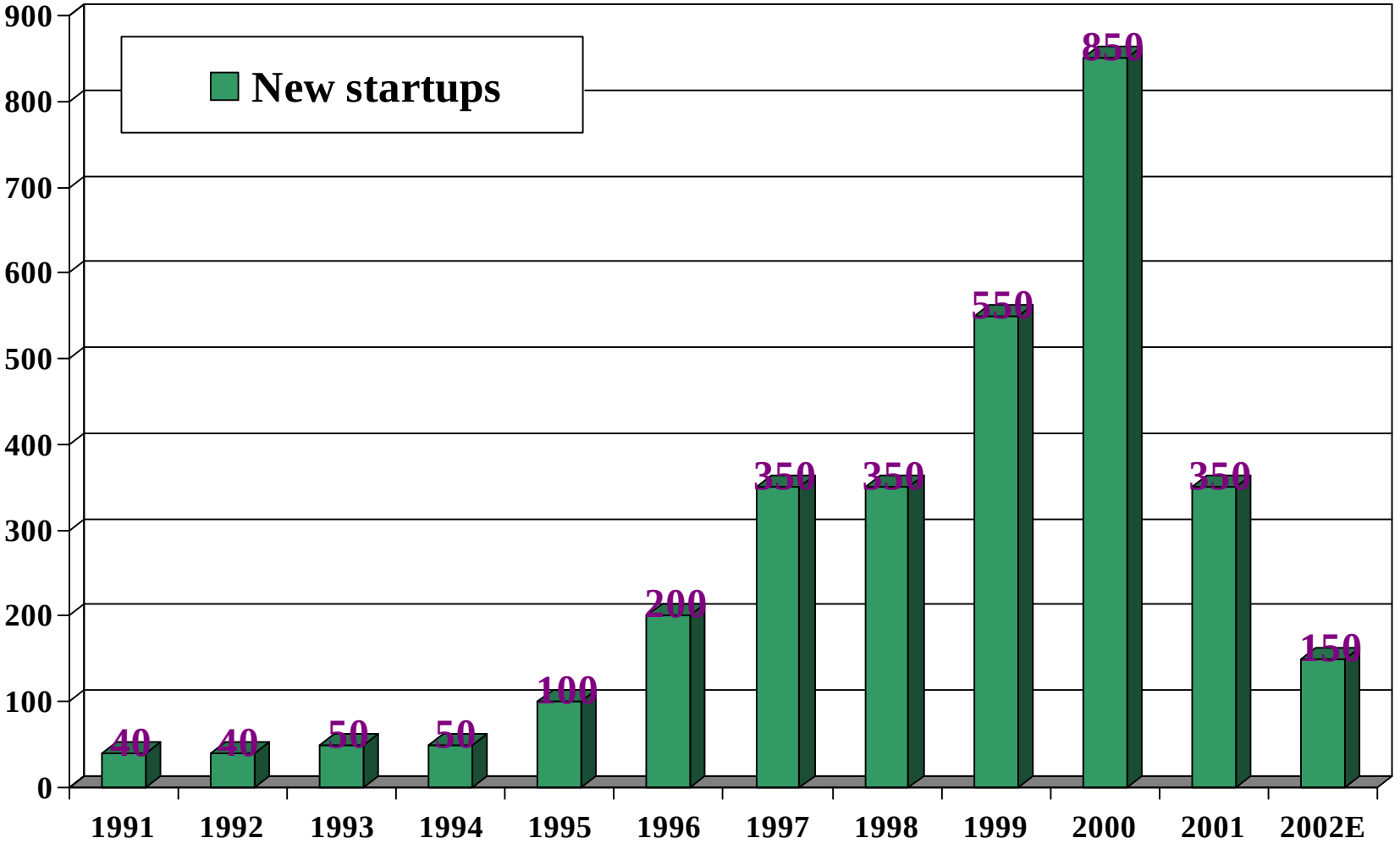
Acceleration of Rate of Growth of VC Activity

Figure 1: Capital Raised by the Israeli VC industry: 1991-2002



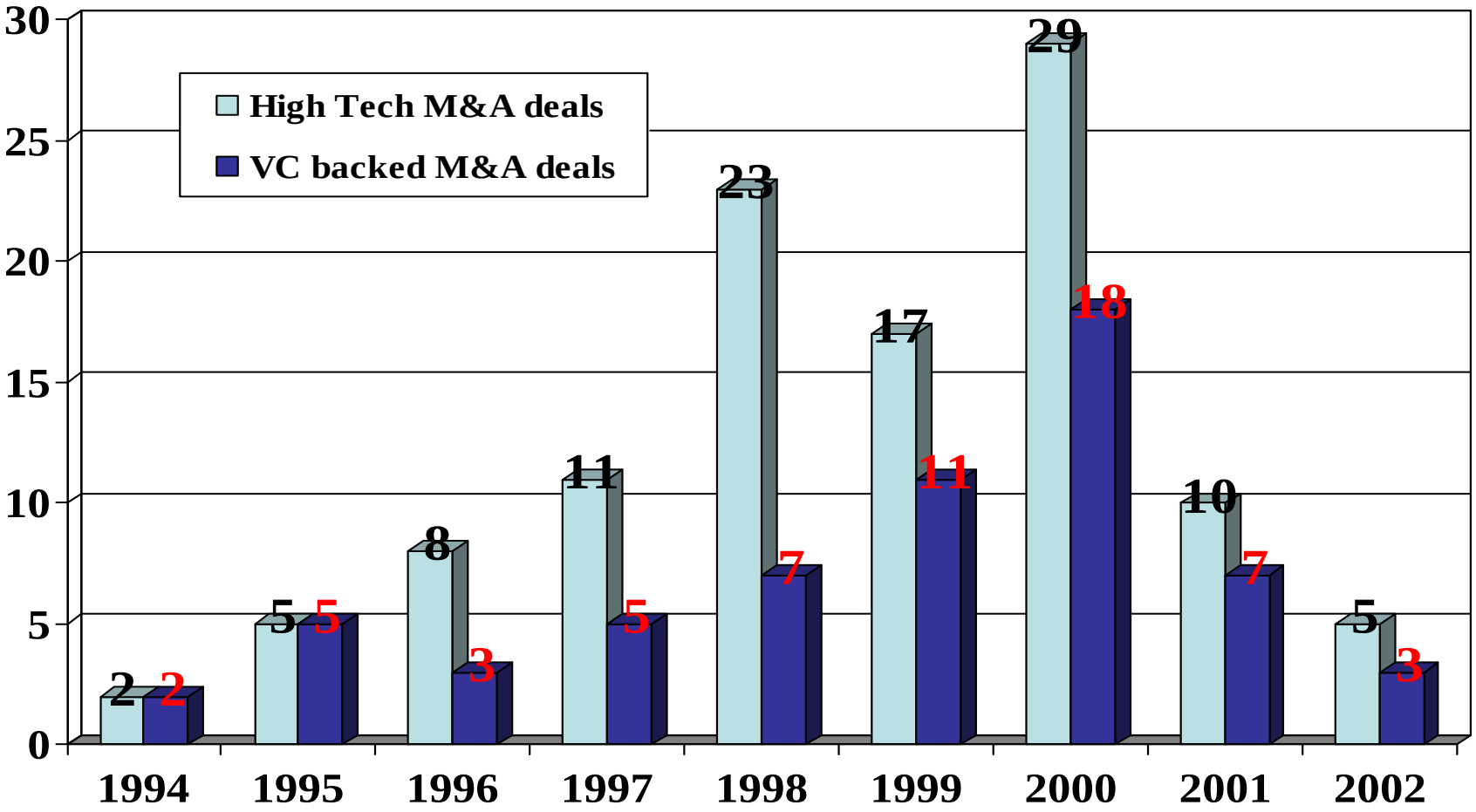
Source: IVC

Figure 2: Foundation of SU companies: 1991-2002



Source: IVC, D&A, D&B, S&P, OCS, CBS and other sources

Figure 3: Israeli high Tech companies which were Targets in M&A deals 1994-2002



Source: Avnimelech 2002

Table 1: The 1990s compared with previous decades

Decade	90s	80s	70s
Accumulative Number of Startups established:	~2,500	~300	~150
Accumulative Number of VC Companies:	~100	3	0
Capital Raised by VCs: M$	10,000	~50	0
Capital Invested in Israeli Startups: M$	~6,500	~100	0
Accumulated No. of High tech IPOs (in NASDAQ):	~150	~10	1
Accumulated capital raised by SU in IPOs (in NASDAQ and EU capital markets) and in M&As: B$	~35	<0.5	<0.25
Share of hi-tech Exports in Total Manufacturing Exports	58%	40%	~25%
Share of high tech industries in Total Manufacturing Sales	34%	24%	~18%

Source: Avnimelech and Teubal 2002 (OCS, CBS, IVA and other sources)

Table 2: Israeli Software & Electronics Sale (M$)

	1991	1995	1999	2000	2001	2002
Software Sales	540	950	2,950	3,700	4,100	2,800
Software Exports	110	300	2,000	2,600	3,000	1,900
Electronics IT sales	3,600	5,900	8,600	12,500	11,500	9,700
Electronics IT Exports	2,300	4,300	7,100	11,000	9,800	8,200

Source: IASH and IAEII

A-8: Summary of EHTC towards 2000

Numbers of SU created: 2,500
Accumulated VC funds raised: 8,500 M$
VC Investments in Israeli SU: 6,650 M$
Accumulated Nos. of IPOs: 126
Accumulated VC-backed IPOs: 72
Accumulated Nos. of significant M&A by MNE: 75
Number of VC companies: 100
Share of ICT exports in manufactured exports (end of decade): 54%
Civilian R&D as a share of GDP: 4.3% (2004)
Three/Four fold increase in ICT output/exports->13 B$

B: Salient Features of the Evolutionary Process in Israel

Israel's success in VC and entrepreneurial policies in the 1990s **[e.g the Yozma Program which triggered Emergence of the EHTC]]** ***was the result of a 25 year Evolutionary Process involving both Positive and Normative factors***

<u>We can distinguish 3 phases</u>

Phase I, 1969-84: Creation of Favorable Background Conditions

Phase II, 1985-92: Creation of Favorable Pre-Emergence Conditions

Phase III, 1993-2000: Emergence of an Entrepreneurial Cluster

B1´

Policy was crucial in each phase, particularly for the transition between Phase 2-pre emergence- and Phase 3-emergence *[no 'truncation']*. Truncation of the process was common in many countries, including in Europe at least up to and including the 1990s, due to inadequate policies and to other factors

The overall experience of countries strongly suggests that a long term policy perspective would also seem to be crucial for VC and entrepreneurial systems policy of other countries

This also is a central message from Lerner's book (Lerner 2009). He states i) that most policies in this area failed e.g. Finland, Canada, individual US states; and ii) that VC & entrepreneurial policy success seemingly must involve a long term commitment from the State**.**

B-2

Phase I: Background Conditions Phase(1969-85)

These are Necessary but not Sufficient Conditions for the eventual emergence of an entrepreneurial cluster in the *medium term* (*15 or more years depending on initial conditions e.g rule of law and efficient regulatory framework for the business sector*).

Different types of countries may have different mixes of background conditions. In Israel these included

- ***A good and growing STE system* (starting in 1925/6)*-part of Israel's Vision***
- ***Identification of potential for creating innovative companies (mostly innovative SMEs)+ 'demand' from early entrepreneurs-→ creation of the OCS***

- ***Identification of a BS priority, namely,* "creating an innovative BS with an increasing number of innovative companies".**
- ***The beginnings of Government Subsidies to BS R&D (for R&D projects of individual companies); and their growth through time in response to ´demand´.***

B-3

- ***No attempt at quantifying returns to company R&D supported by the State, beyond general reference to company exports [i.e. a long term view of policy]***

The outcome was an *Increasing numbers of companies (mostly innovative SMEs) undertaking R&D;* and f*irst SUs appearing in the early 1980s*

Other favorable factors favoring civilian oriented R&D and innovative SMEs

- ***the BIRD program starting in 1982 approx. and other International Links;***

- Macroeconomic/high inflation problems towards the end of Phase 1/beginning of Phase 2-→ Reductions in Defense expenditures (e.g. cancellation of Lavi fighter plane project)→ more engineers and technicians allocated to the civilian BS (stock and flow)

-Exogenous Factors e.g beginning of a separate Software Industry world wide→ new SU opportunities; and global liberalization of communications ´markets

B-3: **Phase II (Pre-Emergence Phase)-1**

Phase II

Generating Conditions i) for a 'purely' Endogenous Emergence* of an Entrepreneurial cluster or system in the short term, or

ii) for an option for the eventual Policy Targeting of a EHTC)if needed

Policy makers may decide to wait for more favorable exogenous conditions which may increase the chances of success. Such conditions may be complementary (and also in a limited way, substitutes) to a range of actual policies implemented, whether policy targeting or more general [see next slide]

**** In principle "endogenous emergence" may or may not include the case of 'General Policies' (see next slide). I hereby assume that it does.***

B-3: 2

******There are alternative profiles of Policy promoting Emergence* **[successful policy implementation defines the intersection between Phases 2 and 3]*:***

- ***General Policies*** **e.g. liberalization (trade, FDI, foreign exchange in Israel) or regulatory/institutional (pertaining to the BS as a whole**

- ***Policy Targeting/ Directed Policies:*** either

  --*Light Policy Targeting* of a new HLO through e.g. sector-specific regulatory changes and/ or other 'minimal' support

  --*Full Fledged Policy Targeting* e.g. through direct support of key variables associated with triggering and sustaining emergence of the new HLO aimed at by policy makers

*** *Israel's Yozma Program was an example of Light Policy Targeting*- it was catalytic & focused on 'triggering' a cumulative process of emergence by focusing almost exclusively in one variable -early phase VC funds [i.e. it was a VC-directed program]**

B-4 Pre-Emergence Conditions-1

By definition, during pre-emergence a full fledged entrepreneurial cluster /system does not exist. The existing *proto-cluster* is populated by a relatively small number of young/early stage SUs (<5 years) which operate without the required complementary early stage VC and other support.

Early Stage VCs are required during pre-emergence since they alone can provide early stage SUs with the required 'added value' in the areas of strategy, management, marketing including penetration of foreign markets, search for investors and partners, underwriting, networking and reputation.

Moreover they have the capabilities for assessing the potential of early stage SUs and thereby to effectively consider high risk, high opportunity possibilities. The added value and other capabilities are difficult to acquire and may be non-existing in late stage VCs/ PEs

B4-2

In Israel, the conditions which eventually promoted emergence included

i)Creating a 'Critical Mass of SU' [*Demand Side Policies*, since SU are the demand side of the future VC market].

This would assure sufficient deal flow [which means the 'existence of investment-ready opportunities'* (Mason and Harrison 2003) *for early stage VC funds].

Otherwise, such VC organizations might not operate in the country, thereby blocking emergence of an entrepreneurial system (at least during the 1990s)

On the other hand, if the critical mass exists and *early stage* VC funds begin to operate, *a virtuous VC-SU co-evolutionary process* could be ignited, one leading to a new VC market

B4-2’

Moreover, absence of early stage VCs and other service suppliers implies a <u>Valley of Death situation for SUs</u>, even for very good ones **[such SUs would survive and even prosper if they would be part of a full fledged entrepreneurial cluster]**

Therefore, a key constraint for successful Pre-Emergence is overcoming the above-mentioned <u>Valley of</u> <u>Death</u> **or Coordination or Low Level Equilibrium Trap Problem**

B4-2”

ii) A key success factor is implementing ‘Out of the Box Policies’ at least with respect to SUs (and possibly for promoting early stage VC s).

Government subsidies might not solve the Valley of Death problem facing early stage SUs. *This because the key inputs required are knowledge, links, networking and reputation.* Even if SUs would develop a technologically sound product it might not satisfy ‘user needs’; and even if it would, a successful post R&D phase of global market penetration would be questionable [things might to some extent be changing].

This is the reason why *private* early stage VCs were and may continue to be important (since they combine ‘finance’ with the additional added value services required by such SUs). While Government VCs could make a contribution, as with subsidies, they alone would not solve the problem.

B4-2’’’

‘Out of the Box Policies’ could include”

***being attentive to the specific needs of individual companies**

***SU-specific ‘policies’ rather then the same conditions for everybody; and not only involving financial support but also eliminating bureaucratic hurdles (e.g. implementing exceptions to existing rules in some cases)**

***Networking, activating diasporas and linking with key agents abroad to contribute to finding partners, SU marketing, joint venturing, raising capital, etc abroad**

***Experimenting with new policies and developing capabilities to do so**

*** Promoting collective learning in the proto-cluster and diffusion of business and other relevant information.**

A policy involving financial incentives exclusively risks remaining in Phase II for some time, and be stuck there, without creating the conditions for eventual emergence (Argentina? Some EU countries up to the 1990s ? Australia 2011?, Russia?).

B-5’

iii) Continued reinforcement of STE infrastructure and capabilities **(in Israel, also helped by Military R&D)** ***including fostering University-Industry Links*** **[TTOs at major Universities circa 1985-; Magnet program 1992-)**

iv) “System Learning” **and other** ***Policy relevant Knowledge and Capabilities, required for Policy Targeting***

It led in Israel to a <u>better understanding of the eco-system required for a successful SU-intensive cluster in Israel</u> e.g. while original policy makers thought that the problem resided in weak SU ‘managerial capabilities’ they soon realized that another set of agents-early stage VCs which bundle early stage ‘equity’ finance with other ‘added value’ for ‘young’ SU -was the critical additional cluster component. Also the focus on software, communications and medical instruments

Such knowledge contributed to <u>define, characterize and specify a new, meso-level VC/EHTC priority</u> for Policy Targeting in Israel, starting in 1993.

B5''

This also <u>translated into certain key, innovative, features of the Yozma (Policy Targeting) program</u> e.g. support of Limited Partnership (LP) VC funds as the adequate early stage ´financial intermediary´ for Israeli SUs; a Fund of Funds program which essentially avoided the 'Crowding Out' phenomena which characterized direct (or through government owned VC funds) government investment in SUs; and the requirement that at least one 'reputable' foreign investor be involved.

v) Institutional Changes *-which are strongly context dependent- e.g.* **entrepreneurial-friendly Bankruptcy Laws, possibilities of creating Limited Partnerships, possibility of the State investing in private companies, some 'initial change' in the attitude of young people towards entrepreneurship, etc**

***vi) "Search Networks" (*to compensate for absence of early phase VC, and permit commercialization and expansion of SU after the early, R&D focused, stage**

B5’’’

vii) ***Other Pre-Emergence Support implemented in Israel***

***continuation of Grants to R&D** (in firms) **program**

***successful creation and operation of TTO’s at Universities**

***strengthened networks of various kinds [Academic, Military, Commercial, Financial]**

*** Magnet and Technological Incubator’s programs, etc**

Note that while Pre-Emergence may “succeed” in creating ‘suitable’ conditions for Emergence, successful Policy Targeting may also benefit –like in Israel- from favorable exogenous conditions /endogenous events during Phase 2. These included:

- **Globalization of NASDAQ,**
- **Technological Change in Software and Communications,**
- **Liberalization of Communications markets in the US, UK and Japan;**
- **A profitable global VC industry;**
- **Defense R&D,**
- **The Oslo Peach Treaty,**
- **Massive Immigration from the former Soviet Union to that country**

B-6: Phase 3-Emergence

Emergence is a cumulative process with positive feedback, where the relevant agents generate and benefit from externalities. It is a Dynamic Increasing Returns to Scale (DIRS) process

Successful Emergence of Israel's VC/EHTC depended on **[see Sections C and D]-**

- **Favorable pre-emergence conditions**
- **Favorable exogenous events**
- **Succesful Policy Targeting of VC/EHTVC (The Yozma Program)**
- **Luck**

B-6’

The DIRS involves a number of sub-processes leading to <u>SU-VC co-evolution</u>, e.g

Profits from early VC investments led to new VC investments into domestic SU;

Reputation (due to early successful ‘exits’) effects from exits during early emergence;

The presence of Foreign agents of various kinds which supported a wide range of services and/or invested directly (strategic investors, MNEs and corporate VCs, financial companies, angels, investment banks, US pension funds, and eventually US top tier VC funds, consultancies, etc);

Across the board learning processes, etc.

B-7

Several of the favorable pre-emergence ‘exogenous factors’ (plus some new ones during emergence) contributed to the successful emergence of VC/EHTC during the 1990s e.g.

- ***diffusion of the Internet,***
- ***new communication technologies;***
- ***the Oslo Peace Process;***
- ***the increase in NASDAQ index during the 1990s;***
- ***immigration from the former Soviet Union***
- ***Highest Returns to the Global (US) VC industry, etc.***

The simultaneous impact of these factors highlight the fact that ***success under radical uncertainty also depends on ´luck***

B-8: Israel's Policy Targeting of VC/EHTC

Israel during 1993-7/8 was an intermediate case i.e. between *full fledged* and *light* Policy Targeting.

It involved a "minimum" of resources invested through the Yozma Program (100M$)which in 5 years flowed back to the Government.

That program *targeted VC* and *indirectly the EHTC*

It sparked the process and that's about all (then endogenous factors took over the dynamics of cluster emergence and subsequent growth)

B 9: Preliminary Summary of Israel's Success *[extended Summary in Section D]*

The Salient Features of Israel´s successful evolutionary and policy process leading to a high tech entrepreneurial system-which other countries may want to consider- are:

A multi-phase process involving both 'positive' and 'normative' factors

Priorities, policies and their impact and links (including the slew of SIP factors, see below) must be made an explicit part of the evolutionary process through their explicit incorporation into *phase specific "dynamic sequences*" (see Section D below)

Policies are linked through time

For example, the *Horizontal* Grants to R&D in firms may create conditions e.g. through enhanced innovation and increased numbers of innovative SMEs and eventually SUs, for subsequent successful *Policy Targeting* of an entrepreneurial cluster (a meso-level entity)

B-10

A long run commitment of Government

This is not always recognized by Ministries of Finance/Treasury Departments. This despite the fact that –at least from the Israeli perspective- more Government *today* may be required for more Innovation and Less Government *tomorrow*

The Pre-emergence phase is critical

Should overcome a difficult coordination problem, namely `*overcoming the Valley of Death´* resulting from *Absence of early stage* VC→ *fragile existence and small numbers of* [insufficient] SU; and *insufficient SU*→ no *early stage* VC no----→> no VC market can be created. The activity is very likely to remain stalled at low levels of activity

A number of critical pre-emergence conditions (e.g. a critical mass of SU) are required to assure a virtuous co-evolution between VC and SU. These may be extremely difficult to achieve. Would need "out of the box" policies [e.g. personalized services, networking, diasporas, continued experimentation, etc]as well as standard measures such as incentives and institutional & regulatory changes.

B-11

<u>The Specifics of the Yozma Program, implemented during 1993-7/8 which were instrumental in sparking emergence</u> [see data file] e.g.

- Fund of Funds, with the latter being LPs
- A requirement of reputable investors
- Incentives to the Upside

<u>The Preliminaries of an explicit Strategic Dimension to Innovation Policy</u>

While a strategic view of the relevant process and of possible futures to some extent existed in Israel, it was not explicit enough nor was it embedded in a full fledged Strategic Innovation Policy system and process, one involving specialized institutions and a new Governance profile. Adopting this is a key challenge for all countries in the post 2000 world.

Still there was significant knowledge creation and choice among a set of possible alternative 'visions' and 'trajectories' of emergence of the new entrepreneurial cluster aimed at, especially during Phase II and during the Phase II-III interface when Policy Targeting was designed and implementation began (see Section D "Summary and Conclusions")

C. Strategic Innovation Policy (SIP) Dimensions in Israel's Policy Targeting of an EHTC

C1. Key SIP Elements: Priorities and Priority Setting

C2. Risk versus Knightian Uncertainty: Type 1 and Type 2 Priorities

C3. Why this Distinction is Important

C4. Why Separation of Priority Setting from Policy Making?

C5. SIP Effectuation [SIP(E)]

C6. Types/Modes of Priority-Policy Coordination

C7. Modes of Policy Targeting of new HLOs
(Strong/Weak; Type 1/Type 2 priorities) ***with examples***

C1. *The Key component of SIP: Priorities and Priority Setting-1*

- ***Explicit*** Priority Setting (area *identification, definition, specification)*; and priority-policy coordination issue)

- ***Continued Process*** of priority setting and-when circumstances change-of re-setting; and possibly of transforming one priority into another, and/or deletion of priorities
- ***A Knowledge intensive process***. Nowadays it *must involve a Systems Evolutionary approach* [very dynamic and interconnected global and domestic environments]

- ***Priorities have Short, Medium and Long term Components***

C1-2

Priorities are related to but are not identical to policy objectives in the relevant areas

-Priorities might be materialized without (additional) policies [i.e. no MF/SF];

-priorities are ***less specified*** *than policies/policy design*

-policies ***may reflect 'politics' of the relevant Ministries*** *rather than the knowledge based priorities set by a separate, independent institutions* [see C. below]

-bona-fide priority ***articulation into policies may be hampered by unexpected constraints*** *e.g.* budgetary constraints or enhanced importance of another priority/priority area

-at any moment of time, ***certain priorities 'are in the making' and have not yet been articulated into policies***

C1-3

For our purposes, ***a "priority" is an evolving text*** which includes also numerical, graphical information *(in some cases its underlying 'body of knowledge' involves a clear, delineated boundary; in others it doesn't).*

It can ***evolve*** through time, be ***deleted*** from the set of priorities of a country, or be ***morphed*** into another priority

A new HLO priority *e.g. Israel's VC/EHTC* **may be identified/defined and specified either at the 'beginning' of a separately identified evolutionary process or as a result of the morphing of other, more general, priorities**

C1-4

In Israel, a very general and essentially ***micro-level*** *priority e.g.*

'generating an innovative business sector with an increasing numbers of innovative companies'

evolved into a more focused, ***meso-level priority*** *[its EHTC]*

'creating an ICT-oriented entrepreneurial system/cluster focusing on software and communications'

(see SIP 2, Section 6; and SIP 3, Section 2 in bibliography).

C1-5

*Moreover, the latter priority may first be **an option** which may later on be materialized or deleted.*

*Finally, there may be e.g. during the emergence process, a **sudden truncation of the process, and even, deletion of the new HLO priority that policy makers aimed at**..*

Also, priorities and policies are linked through time; and *Priority-Policy Interaction* is part of the evolutionary processes leading to SC and economic growth (including those passing through eventual *Policy Targeting of new HLOs).*

C2. Typology of Priorities: Type 1 and Type 2 -1

Traditionally a distinction was made between Horizontal and Vertical Priorities. The SIP perspective adds other dimensions for classifying priorities.

These are related to the Type of Uncertainty & the Likelihood of Unexpected Events ("Black Swans") as emphasized in the paper; the Types of Knowledge relevant for priority setting etc; and (not to be emphasized here) whether the body of knowledge constituting a priority is definable or not or has clear boundaries or not (Weinstein 2011,2012)

These factors in turn will determine the type of Priority Setting Mechanisms or Institutions which seem to be most suitable for each priority type.

C2-2: Type 1 Priorities

'Moderate' uncertainty **["risk"]**
concerning the knowledge underlying such a priority (and the production of such knowledge)

Also, the Knowledge is to a large extent ***structured & explicit knowledge,*** *obtained from search, research and discovery; through a strong component of* ***expert advise***

C2-3: Type 2 Priorities

Radical Uncertainty* + *likelihood of* ***Unexpected Events*+ *possibility of* ***chaotic dynamics****.*

While the relevant knowledge may include* ***structured and explicit components**, some key elements are not necessarily so.*

****Type 2 Priorities involve***

- *A strong component of* ***tacit knowledge****,*
- ***Non-structured knowledge from stakeholders and users***
- *Priority-relevant information and knowledge resulting from* ***key agents' doing on the ground*** [*SIP Effectuation (*Sarasvathy 2001,8)
- *Complex* mutual policy-priority links]

Type 1 and Type 2 priorities are 'ideal' types, the extremes of a continuum. Most priorities are a <u>mix</u> of the two types. **The mix would nowadays tend to favor Type 2 priorities**

C3:Why this Typology is Important-1

This distinction is fundamental, and for three reasons:

1) ***There are key differences in the SIP process and on Policy Targeting of Type 1 and Type 2 priorities*** **(see e.g. slides in C6 below)**

2) ***Globalization and what directly and indirectly goes with it is enhancing the uncertainty of national priorities so increasingly priorities are becoming Type 2 priorities (or a mix with increasing 'share' of Type 2 priorities)***

C3-2

3) The way of thinking and the institutions of Innovation Policy are geared to Type 1 priorities → becoming increasingly irrelevant ('sounds familiar?)

4) i.e. 'More of the Same' is probably not the solution to effectively deal with the increasingly important Type 2 priorities; rather a 'Paradigmatic Shift' in the vision about what Innovation/Growth policy is all about is required….

C3-3

5. A Key component of such change is the introduction of an adequate SIP profile and more generally, enhanced knowledge intensiveness of the policy process & enhanced methodological 'variety' in the process of generation of such knowledge

Understood as comprising both priority setting and policy making

C4. Why Separation between Priorities Setting and Policy Making ?

1. ***Achieve a measure of <u>separation of Knowledge</u> (involved in generating priorities) <u>from Politics (</u>***influencing design & implementation of policies at the Ministry/Department Level**)**

2. ***Achieve <u>Static and Dynamic Increasing Returns to Scale (IRS and DIRS)</u> in the generation and in the implementation/articulation of generic priorities into policies on the ground***

C5-SIP Effectuation [SIP(E)]-1

***Entrepreneurial Effectuation* (=E (E))exists when an entrepreneur faces goals/ends which are uncertain relative to the available means.**

The opposite is Entrepreneurial Causation (=E(C)).

As far as entrepreneurial activity is concerned, we have

E(C): clear goals/ends→selection/choice among a set of uncertain means

E(E): given means→selection/choice of goals among a set of uncertain goals/ends

The entrepreneurial process may have E(E) stretches initially followed by E© stretches.

C5-2: SIP ©

Similarly with the SIP process where both Effectuation (E) and Causation © may be present. We will se this in connection with the evolutionary phases leading to emergence of Israel's VC/EHTC.

For this, note that SIP priorities will be the goals/ends of the SIP process while SIP policies will be the means.

SIP ©: when priorities are well defined even at the outset, the main issue is to select among alternative policies/policy profiles [Type 1 priorities].

In this case the *SIP process would be linear:* first priority setters act, followed by policy makers with no feedback effects

C5-3: SIP (E)

SIP (E): Priorities are not well defined at the outset*-like with Type 2 priorities-** ***so policies cannot be the 'regular' ones; rather policies should be 'experimental' i.e rather than a regular 'impact', their main objective is to further define and specify priorities (and through these, future policy objectives/policies). Their impact would be **indirect**

Under E(E), the key knowledge creation dimension is 'activity on the ground' by entrepreneurs. Under SIP (E) it is the activity of 'key agents' on the ground, which may or may not be entrepreneurs but which have to be entrepreneurial-like in their approach.

C5-4: The SIP (E) *process* leading to VC/EHTC

During Phase 1 and at least part of Phase 2 (pre-emergence) when the priorities were rather vague, the SIP process would involve at least some SIP (E) segments or stretches.

Experimental policies->Activation of key agents on the ground-> further definition/specification of priorities i.e. ***non-linear stretches***

Such SIP (E) would lead: **first** ***to more focus of the initial Horizontal micro-level priority*** [“support of innovative firms”]; **and then, together with other knowledge inputs,** ***to a shift to a meso -level*** **priority** [“promoting emergence of a VC/EHTC”]

C6: Priority-Policy Coordination-1

Priority-Policy coordination ***is an issue pertaining to all priorities, while Inter-Ministerial coordination only for generic priorities*****.**

There are two modes of priority-policy coordination

Linear Mode

Policies should adapt to and be coherent with a pre-existent and well specified priority, like Type 1 priorities

Non Linear Mode*

Since Type 2 priorities are 'initially' 'very general', policies (termed 'experimental') will be needed to contribute to induce reasonable priority definition and specification

Priority setters and policy makers must be *mutually and even simultanously* [to be checked!] *coordinated in this case*

***requires considering SIP(E)**

C6-2

Due to 'disputes' and 'politics', coordination may be relatively easy (difficult) to achieve for Type 1(Type 2) Priorities.

Therefore, <u>Explicit Governance-Based Coordination</u> may be required for Type 2 priorities.

C7: Types of Policy Targeting of new HLOs -1

	Type "1" Priority	Type "2" Priority, [requires SIP(E)]
STRONG (new HLO)	***Traditional Infant Industry Promotion*** -Civilian aircraft (Brazil) -Salmon industry (Chile) -Production-oriented SC and Electronics Industry (Taiwan, up to the 1980s, etc	***ICT-oriented entrepreneurial systems*** -Israel: process 1969-→197/8; targeting 1993-7/8 ***Biotech Clusters*** ***Alternative Energy Sectors*** -Wind-power industry (Germany) ***Advanced Manufacturing in the US*** ***"New" Infant Industries*** -Telecom Equipment (China)
WEAK (upgrading of existing HLO)	***Traditional Cluster Upgrading*** Many countries	*Presumably a thinly populated set*

C7-2

Israel's Yozma (1989-1997/8) is an example of

STRONG* (new HLO) + Type 2 (priorities) *Policy Targeting

A Summary of the process dynamics leading to the successfulPolicy Targeting of Israel's Type 2, VC/EHTC priority has been deleted for lack of space **[see Box 7, pp. 31-2 of paper with same title]**

C7-3: Comparing Policy Targeting of Type 1 with that of Type 2 new HLOs

Type 1	*Type 2*
Linear SIP process	***Non-Linear SIP***
SIP © throughout	***SIP (E) necessary, © possible***
Learning by Doing	***System + 'Other" Learning***
Ex-post Pr-Pol coordination	***Ex-ante Pr-Policy coor.***
Low Probability Disputes	***High Probability***
"Knowledge-Push" effective	***Need Strong Governance***

SUMMARY AND CONCLUSIONS-1

During 1993-2000 a highly successful entrepreneurial high tech cluster (EHTC) with large numbers of SUs (app. 2500) and VCs (between 50 and 100 funds) was Policy Targeted and emerged in Israel, one with a strong impact on that country's economic growth and Balance of Payments

The process, which started several decades before, was relatively robust to the crises of the 2000s.

It led to significant increases in Israel's GERD/GDP (to over 4.5% during 2006), in its business R&D/GERD ratio and in the share of business R&D financed by the Business Sector i.e.a measure of country Catching Up was achieved.

2

Israel's successful high tech entrepreneurial systems policies contrasts with those of several Advanced Countries e.g. Australia, Canada and several countries of Europe [with some exceptions like the UK and Sweden], who, despite the excellence of their STE infrastructure and their policy objectives, failed [up to an including the 1990s] to create highly successful EHTCs.

Also, Israel's Catch Up experience contrasts with the highly successful cases of Korea, Taiwan and Singapore, whose Catch Up processes were based on altogether other processes.

3: Why Israel Succeeded?-1

Since the impact of Yozma which targeted VC/EHTC operated under conditions of radical uncertainty/wild randomeness (Type 2 priorities) the issue is why and how was it so phenomenally successful.

The question is even more pertinent given the fact that no well established SIP structure was operating at the time in the country i.e. **Priorities were imperfectly and only partially formulated, the exception-due to System Learning- being Yozma.**

***<u>At the most general level, Israel benefited from the processes of globalization</u> e.g*.** **Inflows of finance, DFI, skills/people and technology,the possibility of exports and of launching IPOs in foreign capital markets, etc**

4:-2

<u>This was facilitated by strong networks</u> [especially but not only with the US], ***through the Israeli Diaspora and through links with Academics and students, the Military and US companies (a consequence initially of the BIRD program), capital markets (starting with key individuals during the 1970s and with underwriters during the mid 80s).***

Also as with Taiwan who benefited from the Chinese Diaspora in the US, Israel also benefited from its Diaspora and the Jewish connection more generally speaking

5:-3

Policy was crucial in seizing the potential opportunities opened up by globalization

- **support of the *STE infrastructure* (significant and consistent support starting in 1925/6)**
- **significant and consistent support of *R&D in firms* starting in 1969**
- **Liberalization of foreign trade and investment, capital movements, etc**
- **'out of the box' support of SUs during pre-emergence (1985-1992) and early EHTC emergence (approx. 1993-5)**
- **Successful *Policy Targeting* of the EHTC during 1993-7/8 through a highly original VC-directed program (Yozma) which strongly linked VC policy with entrepeneurial systems policy [*a result of 'System Learning' by key policy makers/priority setters including from the Ministry of Finance*]**

6:-4

***Contextual and other policy-related domestic factors also played a role*. They included**

- **A Window of Opportunity opened up by the massive immigration from the former Soviet Union in a context in which *Immigrant Adsorption* was an overarching national goal widely accepted by the political system and the public (it helped funding Yozma and complementary programs and institutional changes)**
- **The entrepreneurial approach and priority setting capabilities of the last Chief Scientist of the OCS prior to Yozma**
- **A smooth and coherent priority-policy link**

7:-5

Also, other specific, favorable exogenous events e.g.

- **Globalization of NASDAQ**
- **High Returns to the Global VC industry during the 1990s**
- **Massive immigration from the former Soviet Union**
- **The internet and the continued ICT technological revolution**
- **Liberalization of global communications (and communication inputs') markets**
- **The Oslo peace process which enhanced Israel's international standing**

8:-6

The slew of favorable exogenous and domestic factors considerably compensated for the high risks and radical uncertainty surrounding Israel's Policy Targeting of its VC/EHTC (it being a Type 2 priority).

Thus the Yozma program was exponentially less costly and more effective that what it would be with less favorable exogenous factors and domestic circumstances

9:Why the Israeli Experience could be of interest?-1

In a dynamic global environment (and Global Financial Crisis conditions), entrepreneurship and the development of high tech entrepreneurial systems could be important for pursuing innovation and structural change based economic growth on a continued basis
[Antonelli and Teubal 2012].

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10-2

Once such a system comprises capable SUs, support organizations and effective global networking, it may play a significant role in generating options for structural change, particularly under conditions of radical uncertainty and wild randomness of the global/domestic environments where continued experimentation and learning are key for success

10’:-2’

This view conforms with that of Lerner (Lerner 2009) when he refers to <u>fast entrepreneurship’s</u> role in creating new industries and in revitalizing the economy. Both Lerner’s and our approach are long term, but ours is explicitly evolutionary with a focus on the transformation of a simple assortment or agglomeration of innovative companies into a higher, meso-level system with a strong potential for an endogenous dynamic of accelerated scaling up and growth.

11:-3

<u>Adopting an evolutionary approach may be important</u>.

Thus a central insight emerging from the analysis of the Israeli experience is that 24 years of continued implementation of the Grants to R&D (in firms) program made a seminal contribution to the creation of conditions for the subsequent successful implementation of the Yozma program.

More specifically, such a program **[together with numerous exogenous events, see above]** ***contributed by 1992/3 to the creation of a critical mass of SUs, may of them of high quality, which was a condition for a VC-directed program like Yozma to ignite emergence of Israel's VC/EHTC.***

12:-4

While there is much more to extract from the Israeli experience with its high tech entrepreneurial system **[see main text]** ***I conclude with the following statement***

"if existing policy making structures and mental models, are, for historical reasons, focused on Type 1 priorities involving calculable risk, then, excluding situations involving a lot of 'Good Luck', the chances of success in policy targeting (and indirectly, of Structural Change based Economic Growth) when confronted with wild randomness/Type 2 priorities would seem to be dependent on a re-invention of the policy system and policy process in the direction of making them more 'systematic/evolutionary, strategic and entrepreneurial' " .

-4

The analysis of the Evolutionary Process leading to such an outcome involved three phases, Background Conditions (1969-85), Pre-Emergence (1985-92)and Emergence (1993-2000).

The policy-intensive, Pre-emergence phase set the conditions for the subsequent, largely endogenous Emergence.

Emergence was an accelerated process led by market forces and other components of the system.