Samuel Neaman Institute
For Advanced Studies In Science And Technology

SEVENTH FRAMEWORK PROGRAMME

Israel's Innovation Ecosystem

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Samuel Neaman Institute
For National Policy Research

SEVENTH FRAMEWORK PROGRAMME

Towards Mapping National Innovation Ecosystems

Israel's Innovation Ecosystem

PICK-ME

Policy Incentives for the Creation of Knowledge: Methods and Evidence

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PICK-ME - Policy Incentives for the Creation of Knowledge: Methods & Evidence

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1. Introduction

The objective of this exercise is to create a visual representation of national innovation ecosystems, simple enough to grasp but complex enough to capture their key elements, as a common foundation or 'language' for enlightened discussion of policy. We seek to define a process that can be used in **each nation** (the participating countries include**: *Israel, Germany, Poland, France and Spain)***, on the assumption that innovation ecosystems have common foundations across countries but some very different elements **specific to each country**. This systemic approach stands in contrast to partial approaches, in which emphasis is placed on specific aspects of the innovation ecosystem, without properly mapping or understanding the system as a whole and how its various parts interact with one another.

The inputs for the innovation ecosystem map are based on a collaborative discussion (experts' workshop) conducted among experts from various realms and disciplines in each of the countries participating in this methodological exercise.

2. Israel's Innovation Ecosystem

2.1 Inputs for the Israeli Innovation System

This section provides a summary of raw inputs collected at the Israeli experts' workshops, conducted by the Samuel Neaman Institute (SNI). ***Table 1*** lists 53 main anchors which were identified by the Israeli experts as the pillars of their Innovation system. ***Table 2*** presents a list of 26 processes which were recognized by the experts as key elements driving and fostering innovation. These processes were ranked by the experts by their importance and classified according to which side of the market (supply or demand) they belong to. The results of the ***cross impact analysis***, conducted by the SNI research team, are presented in ***Figure 1***.

2.2 Analysis of the Israeli Innovation Ecosystem

2.2.1 Organizing the data

The data generated in the Israeli brainstorming workshop was used by the SNI research team as inputs for further and more elaborate analysis. The original cross impact analysis key (***Figure 1***) was transformed to a bipolar five-point Likert scale ranging from strong negative link (1) to strong positive link (5). Subsequent exploratory factor analysis established the validity of the developed scales and helped to avoid redundant items and assured the association of each item to a single scale. ***Figure 2*** shows the cross impact results between anchors and processes after the transformation of the key links into metric values (on scale 1-5).

Table 1: List of Israeli Innovation Anchors

Number	Cluster Name
1	Existence of high quality human capital
2	Belief in "beating the system" and making significant changes
3	Passion to innovate
4	Self-confidence
5	Creativity
6	Business-centered entrepreneurship
7	Reject ‘impossible’
8	Empowerment, achievement
9	High-tech as key success path
10	Pervasive success stories
11	Small country
12	Proximity to US
13	Infrastructure supporting ideas
14	Economic, political democracy
15	Low cost of R&D
16	Immigration from ex-USSR
17	Multi-lingual
18	Diverse population
19	Quality of life
20	Need to export
21	Religious compromise
22	Leadership
23	Trade agreements
24	Perception of Israeli innovation abroad
25	Education creating global perspective
26	Social tolerance
27	Youth entrepreneurship activity
28	Lack of natural resources
29	Survivor mentality
30	Immigrant society
31	Frankness
32	Centrality of high-tech
33	Local stock exchange, NASDAQ
34	Public sector jobs unattractive
35	High % of scientists
36	National survivor instinct
37	Entrepreneurial finance
38	Low govt. regulation
39	Impudence
40	Improvisation
41	Low power distance
42	Ethical flexibility
43	Rejection of authority
44	Lack of conservatism
45	Maturity, responsibility
46	Work ethic
47	Strong university infrastructure
48	High-level medical infrastructure
49	Availability of LT capital
50	Geopolitical instability spurs creativity
51	Defense industries
52	Large defense R&D budgets
53	Human capital formed by military

Table 2: List of Identified Processes Fostering Israeli Innovation, Ranked by Importance and Classified by Market Side

Ranked number (by importance)	Process Name	Demand-side (D), Supply side (S) or both (D S)?
1	Chief Scientist programs for supporting technological innovation	S
2	Constant government investment in basic research	S
3	The new Council for Higher Education model for the creation of human capital	S
4	Private initiative programs for supporting innovation	D
5	Incentives for supporting foreign R&D centers of MNCs in Israel	S
6	Creation of capital and infrastructure in 1990's	S
7	Ministry of Defense programs for supporting technological innovation (TALPIOT, MAFAT)	S
8	International cooperation in business as a way of life	D
9	Globalization	D S
10	Technological incubators	S
11	Interdisciplinary programs in universities	D
12	Nanotechnology - targeted research that supports cooperation	S
13	Independent financial infrastructure	S
14	Dialogue and ties between industry and government	D
15	Programs for incorporating the ultra-orthodox and Arab populations in the workforce	S
16	increasing demand for technological development in biomedicine and biotechnology	D
17	Weakened public sector	D
18	Technology transfer companies in universities & technology transfer between the Academe and industry	D
19	Government support for colleges in the periphery that creates human capital infrastructure	S
20	Synergy between military and civilian R&D	D
21	Israeli Industry Center for R&D (MATIMOP) and the Israel Export Institute	S
22	Government and international funds for research	S
23	Government programs for strengthening scientific and technological education	S
24	Local policy for supporting entrepreneurship	D
25	Conducting research and implementing new methodologies in innovation	D
26	Supporting R&D and innovation in traditional industries	S

Figure 1: Anchors-Processes Linkage Matrix (SNI)

Anchors/Processes	Chief Scientist programs for supporting technological innovation	Constant government investment in basic research	The new Council for Higher Education model for the creation of human capital	Private initiative programs for supporting innovation	Incentives for supporting foreign R&D centers of MNCs in Israel	Creation of capital and infrastructure in 1990's	Ministry of Defense programs for supporting technological innovation (TALPIOT, MAFAT)	International cooperation in business as a way of life	Globalization	Technological incubators	Interdisciplinary programs in universities	Nanotechnology - targeted research that supports cooperation	Independent financial infrastructure	Dialogue and ties between industry and government	Programs for incorporating the ultra-orthodox and Arab populations in the workforce	increasing demand for technological development in biomedicine and biotechnology	Weakened public sector	Technology transfer companies in universities & technology transfer between the Academe	Government support for colleges in the periphery that creates human capital	Synergy between military and civilian R&D	Israeli Industry Center for R&D (MATIMOP) & Israel Export Institute	Government and international funds for research	Government programs for strengthening scientific and technological education	Local policy for supporting entrepreneurship	Conducting research and implementing new methodologies in innovation	Supporting R&D and innovation in traditional industries
Anchors																										
Existence of high quality human capital	++	++	++	++	++	++	++	+	++	++	++	++	+	++	+	++	+	++	+	+	+	++	++	+	++	++
Belief in "beating the system" and making significant changes	0	0	0	++	+	++	+	++	+	+	0	+	+	0	+	++	+	+	+	+	0	+	+	+	0	+
Passion to innovate	+	++	+	++	++	+	++	+	++	++	++	++	0	++	0	++	+	++	+	++	+	++	++	++	++	++
Self-confidence	+	+	0	++	++	++	++	++	++	+	+	++	+	++	0	++	+	++	+	+	+	++	+	++	0	++
Creativity	++	++	++	++	++	++	++	+	++	++	++	++	+	++	+	++	+	++	+	++	+	++	++	++	++	++
Business-centered entrepreneurship	++	+	+	++	++	++	+	++	++	++	+	+	+	++	+	++	++	++	+	++	++	+	++	++	+	++
Reject 'impossible'	0	++	0	++	+	+	+	++	++	+	++	++	+	++	+	++	+	++	+	++	+	++	+	+	+	++
Empowerment, achievement	+	++	+	++	+	++	++	+	++	+	+	+	+	++	0	++	+	++	+	++	+	++	+	++	++	++
High-tech as key success path	+	++	+	++	+	++	++	+	++	+	+	++	+	++	+	++	++	++	++	++	+	+	++	++	++	0
Pervasive success stories	+	++	+	++	++	++	++	+	++	++	+	++	+	++	0	++	++	++	+	++	++	+	++	++	++	++
Small country	0	++	++	+	0	++	0	+	++	+	+	+	0	++	0	+	0	+	++	++	0	0	+	0	+	+
Proximity to US	0	+	+	++	++	++	+	++	++	0	++	+	++	++	0	++	+	+	0	++	++	+	++	0	+	0
Infrastructure supporting ideas	++	+	+	++	++	++	0	++	++	++	+	++	+	++	+	++	++	++	0	+	+	0	++	++	++	++
Economic, political democracy	0	+	+	++	++	+	0	++	++	0	+	+	++	+	0	++	+	0	+	+	+	0	++	+	+	+
Low cost of R&D	+	+	0	++	++	+	0	+	++	++	+	+	+	++	0	++	+	+	0	+	++	0	+	+	+	++
Immigration from ex-USSR	0	++	+	0	0	+	0	0	+	++	+	+	0	0	0	+	0	++	+	0	0	+	++	++	++	++
Multi-lingual	0	+	++	+	+	+	+	+	++	++	+	0	0	0	0	+	+	+	+	0	+	+	+	+	+	+
Diverse population	0	+	+	+	0	+	+	+	++	+	0	0	0	0	0	+	+	+	+	0	+	+	+	+	+	+
Quality of life	0	0	0	+	+	+	0	+	+	0	0	0	+	0	0	+	0	+	+	+	0	0	+	+	+	+
Need to export	+	+	0	++	0	+	0	++	++	+	+	++	++	++	0	+	+	+	0	++	++	0	++	0	+	++
Religious compromise	0	+	0	+	+	0	0	0	0	0	+	+	0	0	0	++	0	+	0	0	0	+	0	0	+	0
Leadership	+	+	+	+	+	++	++	++	++	+	+	+	+	++	0	+	+	++	++	+	+	0	++	+	+	++
Trade agreements	+	0	0	+	++	++	0	++	++	0	0	+	++	+	0	+	+	+	0	+	++	0	0	0	+	+
Perception of Israeli innovation abroad	0	+	+	+	++	+	0	++	++	0	0	++	0	++	0	++	+	++	0	+	++	+	0	0	+	0
Education creating global perspective	+	++	++	++	++	++	+	++	++	+	+	+	++	+	0	++	+	++	0	+	++	+	+	+	+	+
Social tolerance	0	0	0	+	0	+	0	0	0	+	0	0	0	+	+	+	0	+	+	0	0	0	0	0	+	+
Youth entrepreneurship activity	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	++	++	0	+
Lack of natural resources	+	++	+	+	0	++	+	0	++	+	+	+	-	0	+	++	0	0	+	0	+	+	++	0	0	++
Survivor mentality	+	++	+	+	-	++	+	+	++	0	+	+	0	+	++	+	-	+	++	+	+	+	++	0	0	+
Immigrant society	0	+	0	+	0	++	0	+	+	+	0	+	0	0	0	+	-	0	++	0	0	0	+	+	0	0
Frankness	0	0	0	+	-	+	0	++	+	0	+	+	+	+	0	+	+	0	0	+	-	0	+	0	0	+
Centrality of high-tech	++	+	+	++	++	++	+	++	++	+	+	++	+	++	+	++	++	++	+	++	+	+	++	++	++	-
Local stock exchange, NASDAQ	-	0	0	++	0	+	0	+	++	0	0	0	++	+	0	++	++	++	0	+	+	0	0	0	+	+
Public sector jobs unattractive	0	0	0	0	0	0	-	+	+	+	0	0	0	+	+	+	++	0	0	0	0	0	0	0	0	+
High % of scientists	++	++	++	+	++	++	+	+	++	++	++	++	0	+	0	++	+	++	+	+	+	++	+	+	++	+
National survivor instinct	0	++	++	+	0	+	++	+	+	0	+	++	0	+	0	+	-	+	+	++	+	+	++	0	+	+
Entrepreneurial finance	--	0	0	++	0	0	+	++	+	+	0	+	0	++	+	++	+	++	0	++	+	0	0	++	+	++
Low govt. regulation	-	--	-	++	0	--	0	+	++	+	-	-	++	--	0	-	0	++	--	-	+	+	--	+	+	-
Impudence	0	0	0	++	--	+	+	++	++	0	+	+	+	-	0	+	+	++	+	0	+	+	--	0	0	+
Improvisation	--	0	0	+	--	+	+	++	+	+	+	+	+	+	0	+	+	+	0	+	-	-	--	0	0	+
Low power distance	--	--	0	+	--	-	--	+	+	--	+	+	-	-	-	+	+	-	--	0	--	0	--	-	0	--
Ethical flexibility	--	--	0	+	--	--	--	--	+	--	-	-	--	--	0	+	0	--	--	0	--	+	--	-	0	--
Rejection of authority	--	+	0	++	--	0	+	++	++	+	++	++	-	+	-	++	+	+	+	+	+	++	+	-	0	+
Lack of conservatism	+	+	0	++	+	+	+	++	++	+	++	++	++	+	+	+	+	+	+	++	+	+	++	+	+	++
Maturity, responsibility	++	+	0	++	++	+	++	++	++	+	+	++	+	++	++	++	0	++	+	++	++	+	++	+	+	++
Work ethic	++	+	+	++	++	+	++	+	++	++	++	++	+	+	0	++	+	+	0	++	+	+	++	0	0	++
Strong university infrastructure	++	++	++	++	++	++	++	+	++	++	++	++	0	++	+	++	+	++	+	++	+	++	++	+	++	++
High-level medical infrastructure	+	++	++	++	++	++	0	+	++	++	++	++	0	++	0	++	+	++	0	0	0	++	++	+	++	0
Availability of LT capital	-	+	+	++	+	0	0	++	++	--	++	++	+	+	0	++	++	+	+	+	+	0	++	++	+	++
Geopolitical instability spurs creativity	+	++	+	-	--	--	++	--	++	+	++	++	-	++	0	+	+	+	+	+	-	0	+	0	+	+
Defense industries	+	++	+	+	0	++	++	+	++	0	+	++	0	++	0	0	-	++	0	++	+	+	+	0	++	++
Large defense R&D budgets	+	++	+	0	0	++	++	+	++	0	++	++	+	++	0	0	-	++	0	++	+	0	+	0	++	++
Human capital formed by military	+	++	+	++	0	+	++	+	+	0	0	+	0	+	0	0	-	+	0	++	+	0	+	0	+	0

Key	Label
- -	Strong negative link
-	Weak negative link
0	No link
+	Weak positive link
++	Strong positive link

Figure 2: Linkages between Anchors and Processes in the Israeli Innovation Ecosystem, Sorted by the Intensity of the Linkages

Anchors/Processes	Chief Scientist programs for supporting technological innovation	Constant government investment in basic research	The new Council for Higher Education model for the creation of human capital	Private initiative programs for supporting innovation	Incentives for supporting foreign R&D centers of MNCs in Israel	Creation of capital and infrastructure in 1990's	Ministry of Defense programs for supporting technological innovation (TALPIOT, MAFAT)	International cooperation in business as a way of life	Globalization	Technological incubators	Interdisciplinary programs in universities	Nanotechnology - targeted research that supports cooperation	Independent financial infrastructure	Dialogue and ties between industry and government	Programs for incorporating the ultra-orthodox and Arab populations in the workforce	increasing demand for technological development in biomedicine and biotechnology	Weakened public sector	Technology transfer companies in universities & technology transfer between the Academe	Government support for colleges in the periphery that creates human capital	Synergy between military and civilian R&D	Israeli Industry Center for R&D (MATIMOP) & Israel Export Institute	Government and international funds for research	Government programs for strengthening scientific and technological education	Local policy for supporting entrepreneurship	Conducting research and implementing new methodologies in innovation	Supporting R&D and innovation in traditional industries
Anchors																										
Existence of high quality human capital	5	5	5	5	5	5	5	4	5	5	5	5	4	5	4	5	4	5	4	4	4	5	5	4	5	5
Belief in "beating the system" and making significant changes	3	3	3	5	4	5	4	5	4	4	3	4	4	3	4	5	4	4	4	4	3	4	4	4	3	4
Passion to innovate	4	5	4	5	5	4	5	4	5	5	5	5	3	5	3	5	4	5	4	5	4	5	5	5	5	5
Self-confidence	4	4	3	5	5	5	5	5	5	4	4	5	4	5	3	5	4	5	4	4	4	5	4	3	4	5
Creativity	5	5	5	5	5	5	5	4	5	5	5	5	4	5	4	5	4	5	4	5	4	5	5	4	5	5
Business-centered entrepreneurship	5	4	4	5	5	5	4	5	5	5	4	4	4	5	4	5	5	5	4	5	5	4	5	4	5	5
Reject 'impossible'	3	5	3	5	4	4	4	5	5	4	5	5	4	5	4	5	4	5	4	5	4	5	4	4	4	5
Empowerment, achievement	4	5	4	5	4	5	5	4	5	4	4	4	4	5	3	5	4	5	4	5	4	5	5	4	4	5
High-tech as key success path	4	5	4	5	4	5	5	4	5	4	4	5	4	5	4	5	5	5	5	5	4	4	5	5	5	3
Pervasive success stories	4	5	4	5	5	5	5	4	5	5	4	5	4	5	3	5	5	5	4	5	5	4	5	5	5	5
Small country	3	5	5	4	3	5	3	4	5	4	4	4	3	5	3	4	3	4	5	5	3	3	4	3	4	4
Proximity to US	3	4	4	5	5	5	4	5	5	3	5	4	5	5	3	5	4	4	3	5	5	4	5	3	4	3
Infrastructure supporting ideas	5	4	4	5	5	5	3	5	5	5	4	5	4	5	4	5	5	5	3	4	4	3	5	5	5	5
Economic, political democracy	3	4	4	5	5	4	3	5	5	3	4	4	5	4	3	5	4	3	4	4	4	3	5	4	4	4
Low cost of R&D	4	4	3	5	5	4	3	4	5	5	4	4	4	5	3	5	4	4	3	4	5	3	4	4	4	5
Immigration from ex-USSR	3	5	4	3	3	4	3	3	4	5	4	4	3	3	3	4	3	5	4	3	3	4	5	5	5	5
Multi-lingual	3	4	5	4	4	4	4	4	5	5	4	3	3	3	3	4	4	4	4	3	4	4	4	4	4	4
Diverse population	3	4	4	4	3	4	4	4	5	4	3	3	3	3	3	4	4	4	4	3	4	4	4	4	4	4
Quality of life	3	3	3	4	4	4	3	4	4	3	3	3	4	3	3	4	3	4	4	4	3	3	4	4	4	4
Need to export	4	4	3	5	3	4	3	5	5	4	4	5	5	5	3	4	4	4	3	5	5	3	5	3	4	5
Religious compromise	3	4	3	4	4	3	3	3	3	3	4	4	3	3	3	5	3	4	3	3	3	4	3	4	3	3
Leadership	4	4	4	4	4	5	5	5	5	4	4	4	4	5	3	4	4	5	5	4	4	3	5	4	4	5
Trade agreements	4	3	3	4	5	5	3	5	5	3	3	4	5	4	3	4	4	4	3	4	5	3	3	3	4	4
Perception of Israeli innovation abroad	3	4	4	4	5	4	3	5	5	3	3	5	3	5	3	5	4	5	3	4	5	4	3	3	4	3
Education creating global perspective	4	5	5	5	5	5	4	5	5	4	4	4	5	4	3	5	4	5	3	4	5	4	4	4	4	4
Social tolerance	3	3	3	4	3	4	3	3	3	4	3	3	3	4	4	4	3	4	4	3	3	3	3	4	3	4
Youth entrepreneurship activity	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	5	5	3	4
Lack of natural resources	4	5	4	4	3	5	4	3	5	4	4	4	2	3	4	5	3	3	4	3	4	4	5	3	3	5
Survivor mentality	4	5	4	4	2	5	4	4	5	3	4	4	3	4	5	4	2	4	5	4	4	4	5	3	3	4
Immigrant society	3	4	3	4	3	5	3	4	4	4	3	4	3	3	3	4	2	3	5	3	3	3	4	4	3	3
Frankness	3	3	3	4	2	4	3	5	4	3	4	4	4	4	3	4	4	3	3	4	2	3	4	4	3	4
Centrality of high-tech	5	4	4	5	5	5	4	5	5	4	4	5	4	5	4	5	5	5	4	5	4	4	5	5	5	2
Local stock exchange, NASDAQ	2	3	3	5	3	4	3	4	5	3	3	3	5	4	3	5	5	5	3	4	4	3	3	4	4	4
Public sector jobs unattractive	3	3	3	3	3	3	2	4	4	4	3	3	3	4	4	4	5	3	3	3	3	3	3	3	3	4
High % of scientists	5	5	5	4	5	5	4	4	5	5	5	5	3	4	3	5	4	5	4	4	4	5	4	4	5	4
National survivor instinct	3	5	5	4	3	4	5	4	4	3	4	5	3	4	3	4	2	4	4	5	4	4	5	3	4	4
Entrepreneurial finance	1	3	3	5	3	3	4	5	4	4	3	4	3	5	4	5	4	5	3	5	4	3	3	5	4	5
Low govt. regulation	2	1	2	5	3	1	3	4	5	4	2	2	5	1	3	2	3	5	1	2	4	4	1	4	4	2
Impudence	3	3	3	5	1	4	4	5	5	3	4	4	4	2	3	4	4	5	4	3	4	4	1	3	3	4
Improvisation	1	3	3	4	1	4	4	5	4	4	4	4	4	4	3	4	4	4	3	4	2	2	1	3	3	4
Low power distance	1	1	3	4	1	2	1	4	4	1	4	4	2	2	2	4	4	2	1	3	1	3	1	2	3	1
Ethical flexibility	1	1	3	4	1	1	1	1	4	1	2	2	1	1	3	4	3	1	1	3	1	4	1	2	3	1
Rejection of authority	1	4	3	5	1	3	4	5	5	4	5	5	2	4	2	5	4	4	4	4	4	5	4	2	3	4
Lack of conservatism	4	4	3	5	4	4	4	5	5	4	5	5	5	4	4	4	4	4	4	5	4	4	5	4	4	5
Maturity, responsibility	5	4	3	5	5	4	5	5	5	4	4	5	4	5	5	5	3	5	4	5	5	4	5	4	4	5
Work ethic	5	4	4	5	5	4	5	4	5	5	5	5	4	4	3	5	4	4	3	5	4	4	5	3	3	5
Strong university infrastructure	5	5	5	5	5	5	5	4	5	5	5	5	3	5	4	5	4	5	4	5	4	5	5	4	5	5
High-level medical infrastructure	4	5	5	5	5	5	3	4	5	5	5	5	3	5	3	5	4	5	3	3	3	5	5	4	5	3
Availability of LT capital	2	4	4	5	4	3	3	5	5	1	5	5	4	4	3	5	5	4	4	4	4	3	5	5	4	5
Geopolitical instability spurs creativity	4	5	4	2	1	1	5	1	5	4	5	5	2	5	3	4	4	4	4	4	2	3	4	3	4	4
Defense industries	4	5	4	4	3	5	5	4	5	3	4	5	3	5	3	3	2	5	3	5	4	4	4	3	5	5
Large defense R&D budgets	4	5	4	3	3	5	5	4	5	3	5	5	4	5	3	3	2	5	3	5	4	3	4	3	5	5
Human capital formed by military	4	5	4	5	3	4	5	4	4	3	3	4	3	4	3	3	2	4	3	5	4	3	4	3	4	3

Processes

Strong positive link

Weak positive link

No link

Strong negative link

Weak negative link

2.2.2 Factor analysis Results for the Israeli Ecosystem

Factor analysis was employed on the list of processes (variables). The anchors serve as observations in order to group the processes into major factors according to the similarities in their linkages with the anchors. Tests of sample adequacy constituted the necessary preliminary conditions for conducting factor analysis and obtaining meaningful results. The Spearman correlation matrix among the processes provided the input for both the tests and the factor analysis. The linkage-pattern items obtained in the Israeli workshop demonstrate good sampling adequacy, both at the overall (KMO > 0.74) and at the single item level (KMO = 0.413 - 0.907). The Spearman correlation matrix contains correlations with absolute value between 0.002-0.686, and the value of its determinant is 0.001, hence the existence of correlations without multi-collinearity is established. The result of the Bartlett's sphericity test rejects the null hypothesis that the correlation matrix is an identity matrix (p = 0.000).

Exploratory principal axis factor analysis with subsequent orthogonal rotation (Varimax rotation with Kaiser normalization) produced six factors, that together explain 73.4% of the variance. The factor loadings are presented in ***Table 3***. In order to facilitate factor labeling, the dominant items, marked in bold in ***Table 3***, were defined as those with an absolute value of the loading greater than 0.46. Through the factor analysis we distilled the existing innovation process drivers down to six key factors. They are:

1. Government programs for supporting innovation: Constant government investment in basic research; Ministry of Defense programs for supporting technological innovation (TALPIOT, MAFAT); Dialogue and ties between industry and government; Globalization; Interdisciplinary programs in universities; Nanotechnology - targeted research that supports cooperation; The new Council for Higher Education model for the creation of human capital.

2. Private & public sector activities for supporting innovation: Private initiative programs for supporting innovation; International cooperation in business as a way of life; Independent financial infrastructure, Israeli Industry Center for R&D (MATIMOP) and the Israel Export Institute.

3. **Cooperation between the private and public sector in supporting technological innovation:** Chief Scientist programs for supporting technological innovation; Incentives for supporting foreign R&D centers of MNCs in Israel;

Technological incubators; Local policy for supporting entrepreneurship; Conducting research and implementing new methodologies in innovation.

Table 3: Factor Analysis Results for the Israeli Innovation Ecosystem

Factor name	Items (Processes)	Component					
		1	2	3	4	5	6
Government programs for supporting innovation	Nanotechnology - targeted research that supports cooperation	**.838**	.159	.097	.072	.162	.149
	Interdisciplinary programs in universities	**.814**	-.018	.086	.009	.217	.212
	Constant government investment in basic research	**.752**	-.058	.332	.385	-.141	.206
	Dialogue and ties between industry and government	**.742**	.263	.268	.247	.183	-.116
	Synergy between military and civilian R&D	**.699**	.395	.045	.155	.019	-.036
	Ministry of Defense programs for supporting technological innovation (TALPIOT, MAFAT)	**.573**	.201	.259	.351	-.316	.179
	The new Council for Higher Education model for the creation of human capital	**.546**	-.227	.415	.121	-.005	.333
	Supporting R&D and innovation in traditional industries	**.488**	.251	.202	.478	-.013	-.167
	Globalization	**.445**	.436	.263	-.131	.083	.353
Private & public sector activities for supporting innovation	International cooperation in business as a way of life	.163	**.828**	-.098	.097	.208	-.066
	Independent financial infrastructure	.003	**.821**	.244	.050	.069	-.215
	Israeli Industry Center for R&D (MATIMOP) and the Israel Export Institute	.241	**.694**	.337	.244	-.066	.186
	Private initiative programs for supporting innovation	.010	**.691**	.025	.066	.356	.423
Cooperation between the private and public sector in supporting technological innovation	Conducting research and implementing new methodologies in innovation	.406	.098	**.807**	-.088	.035	.131
	Local policy for supporting entrepreneurship	-.070	.105	**.666**	.453	.307	-.179
	Technology transfer companies in universities & technology transfer between the Academe and industry	.335	.452	**.604**	.136	-.054	.144
	Incentives for supporting foreign R&D centers of MNCs in Israel	.155	.398	**.573**	.304	.286	.232
	Technological incubators	.184	.065	**.565**	.414	.119	.197
	Chief Scientist programs for supporting technological innovation	.394	.149	**.503**	.437	-.084	.232
Government investments for the creation of human capital	Government support for colleges in the periphery that creates human capital infrastructure	.404	-.046	.060	**.735**	-.018	-.029
	Programs for incorporating the ultra-orthodox and Arab populations in the workforce	-.055	.130	.085	**.714**	.067	.094
	Government programs for strengthening scientific and technological education	.548	.044	.314	**.564**	.094	.059
	Creation of capital and infrastructure in 1990's	.400	.370	.205	**.516**	-.039	.157
Creating demand in the private sector	Weakened public sector	.053	.245	.211	-.089	**.838**	-.061
	increasing demand for technological development in biomedicine and biotechnology	.309	.126	.001	.270	**.753**	.348
National and international research funds	Government and international funds for research	.197	.006	.212	.106	.079	**.862**

4. **Government investments for the creation of human capital:** Programs for incorporating the ultra-orthodox and Arab populations in the workforce; Creation of capital and infrastructure in 1990's; Government support for colleges in the periphery that creates human capital infrastructure.

5. **Creating demand in the private sector:** Increasing demand for technological development in biomedicine and biotechnology; Weakening public sector.

6. **National and international research funds:** Government and international funds for research.

The second and third factors are both supply and demand driven, focusing on government and public policy measures, private sector activities and private-public initiatives for supporting innovation. The First the fourth and the sixth factors are mainly supply, concentrating on government investments and expenses on human capital and research. The fifth factor is demand driven.

Of the existing ***government programs and organizations*** that foster innovation and entrepreneurship, many are specific and unique to Israel. For instance, military support of R&D, including military intelligence and its investment in high technology. An example for this type of organization is MAFAT (Hebrew acronym for the Administration for the Development of Weapons and Technological Infrastructure), a governmental agency aimed at coordinating between the Ministry of Defense, the IDF, Israel Military Industries, Israel Aerospace Industries, Rafael Advanced Defense Systems, the Institute for Biological Research and the Space Agency.

Close synergy exists between military and civilian R&D in Israel. Israeli defense industries have traditionally focused on components, electronics, avionics and other systems. The development of these auxiliary systems has also given Israeli high-tech industries an edge in civilian spin-offs in security, electronics, computers, software and the internet sectors. Civilian applications of these skills in software, communications, imaging, process control, etc., derived from military industries, have become increasingly important. For example, the need for better night-vision equipment led to local engineers becoming trained in the field of image processing (Globes, 1997)[1].

Another program connected to military R&D is Talpiot - an elite Israel Defense Forces (IDF) training program for young people (high school graduates) who have demonstrated outstanding academic ability in the sciences, physics and

1 How Israeli High-Tech Happened, Globes newspaper

mathematics. Graduates of the Talpiot program pursue higher education while serving in the army, and then utilize their expertise in IDF's R&D projects. During their military service, these very young people develop considerable entrepreneurship skills and gain substantial work experience in a highly competitive and high-pressure environment. After the completion of their military service, Talpiot graduates easily assimilate into the Israeli labor market and occupy senior positions in the Israeli high-tech industry. Many of the startups established in Israel since the early 1990's were launched by Talpiot graduates. The Talpiot program is a particularly good example of how a supply-side government program can have significant spillovers effects on demand-driven innovation (e.g. startups) in the long-run, through human capital investments with an emphasis on the teaching and development of entrepreneurial and applied technological skills. Mandatory military service in Israel equips its young people with the connections, management skills and action-oriented entrepreneurial mindset critical for technological development[2].

An additional supply-side process, connected to government programs for supporting innovation, is the *new allocation model* of the Council for Higher Education (CHE). The CHE is a supervisory body for universities and colleges in Israel. The most important body of the council is the Planning and Budgeting Committee (PBC), which deals with the division of funding between the various universities and colleges. The total budget of the council for the 2011 academic year (funded by the government) was 7.4 billion NIS[3] (~1.5 billion €). The new budget allocation model places much higher emphasis on research excellence (especially on winning competitive foreign or bi-national research grants such as the EU framework program, BSF, NIH, GIF and others) in its budget allocation considerations. Research excellence strengthens the human capital factor, thus contributing to innovation and entrepreneurship (e.g. technology transfer, university incubators etc.).

One of the key **private-public sector cooperation frameworks** identified by Israeli experts as a factor in driving innovation is the Chief Scientist programs. The Office of the Chief Scientist (OCS) at the Ministry of Industry, Trade & Labor (MOIT) is responsible for carrying out government policy concerning support for industrial R&D. Firms submit proposals for R&D projects, which the OCS reviews according to set of criteria that include technological and commercial feasibility, merit and risks, as well as estimation of the extent to which these projects can be expected to generate spillovers (Getz and Segal, 2008). The OCS supports and administers a wide range

[2] http://www.isrealli.org/a-comprehensive-guide-to-israels-biotech-industry/

[3] http://www.mof.gov.il/BudgetSite/StateBudget/Budget2011_2012/MinisteriesBudget/socialBudget/Lists/List1/Attachments/1/haskala.pdf.

of programs, among them Magnet, Magneton, Nofar and the technological incubators program.

The Magnet program involves pre-competitive R&D within a consortium that includes a number of commercial companies together with research personnel from at least one academic or research institution. The R&D focuses on new generic technologies that will lead to the generation of new and advanced products. The industrial partners enjoy a grant amounting to 66% of approved R&D costs, whereas the academic partner will receive 80% of said costs. A foreign company may be included in the consortium if it can bring a unique contribution to the relationship[4].

The aim of the Magneton program is to further support an already existing relationship between a single industrial partner and an academic institution. The grant in this case amount to 66% of the approved R&D costs[5].

The Nofar program is a pure academic research program for basic and applied research in the areas of Bio and Nano Technologies. The goal is to achieve a milestone to allow encouragement of an industrial company access to enough information for investing in further R&D steps. The aim is to support advanced stages of applied academic research, not yet oriented towards a specific product, but already of interest to a business partner, and to bring the research to a maturity phase, enabling an Israeli business partner to invest in it in the future. A minimal requirement of this program is for a company or an incubator to invest 10% of the development costs, at this stage, complementing the 90% grant given by the government (Getz and Segal, 2008).

The Public Technological Incubator Program (PTIP) was initiated by the Office of the Chief Scientist in Israel's Ministry of Industry and Trade in the early 1990s in the wake of the large influx of immigrants from the former USSR, many of whom were scientists and engineers. Technological incubators are support organizations that give inexperienced entrepreneurs an opportunity to develop their innovative technological ideas and set up new businesses in order to commercialize them. The goal of the incubators is to support novice entrepreneurs at the earliest stage of technological entrepreneurship, and help them implement their ideas and form new business ventures. Each incubator is structured so as to handle 10 – 15 projects simultaneously, and provides assistance in the following areas: determining the

[4] Ministry of Industry, Trade and Labor website. http://www.tamas.gov.il/NR/exeres/111E3D45-56E4-4752-BD27-F544B171B19A.htm

[5] Source same as above

technological and marketing applicability of the idea, drawing up an R&D plan and organizing the R&D team, raising capital and preparing for marketing, provision of secretarial and administrative service, maintenance, procurements, accounting and legal advice (Frenkel et al., 2008). Other private-public sector cooperation schemes include government incentives for supporting foreign MNCs in Israel. Over the past two decades the Israeli government has provided substantial tax benefits for multinational firms for basing their R&D activities in Israel (e.g the R&D centers of Intel, HP Motorola and Microsoft).

An additional type of public-private cooperation is the technology transfer from academia to industry. Frenkel and Shefer (2012) present basic concepts of a technology-transfer production-function model in which human capital, investment capital, and Technology Transfer Office (TTO) staff interact to produce innovations or patent registration. Universities supply the most important players for the production and diffusion of knowledge and invention promoting economic growth. Universities constitute the major source of technological progress for industry (Henderson, et al., 1998; Mowery and Shane, 2002; Bercovitz and Feldman, 2009).

A notable example (one of many successful partnerships) for this type of cooperation is the collaboration between the Weizmann Institute of Science and Teva Pharmaceutical Industries in the discovering and development of the Copaxone drug for the treatment of multiple sclerosis. Copaxone is Teva's largest selling drug, with 1.86 billion dollars in sales in the first half of 2011[6]. Since 2001, Weizmann Institute of Science, through its commercialization arm Yeda Research and Development Company Ltd, has earned more than one billion NIS in royalties from the commercialization of its IP. Weizmann Institute's Yeda has been named the world's third most profitable technology transfer organization[7].

In recent years, ***increasing demand in the private sector***, especially in the fields of pharma, biomedicine and biotechnology, has significantly contributed to the strengthening of innovation and entrepreneurship. The pace of innovation, development and growth in Israel's biotechnology sector is unparalleled. Israel's biotech industry (consisting of 180 biotech companies) is the one of the most aggressive in the world, with more startups per capita than any other country. Notable pharmaceutical, biotechnological and biomedical firms are Teva, Compugen, Gamida Cell, D-Pharm, Given Imaging and many others. The increased demand in the private sector for high quality human capital is directly related to Israel's shrinking

[6] http://seekingalpha.com/news-article/1779491-copaxone-patent-court-hearing-opens-wednesday
[7] http://www.isrealli.org/a-comprehensive-guide-to-israels-biotech-industry/

public sector. Government-financed GERD (Gross Expenditure on R&D) as a percentage of GDP (not including defense expenditures) fell from 0.85% in 1991 to 0.67% in 2008, as the Business Sector expenditure on R&D (BERD) as a percentage of GDP rose from 1.3% to 3.8% in this time period (Getz et al., 2010).

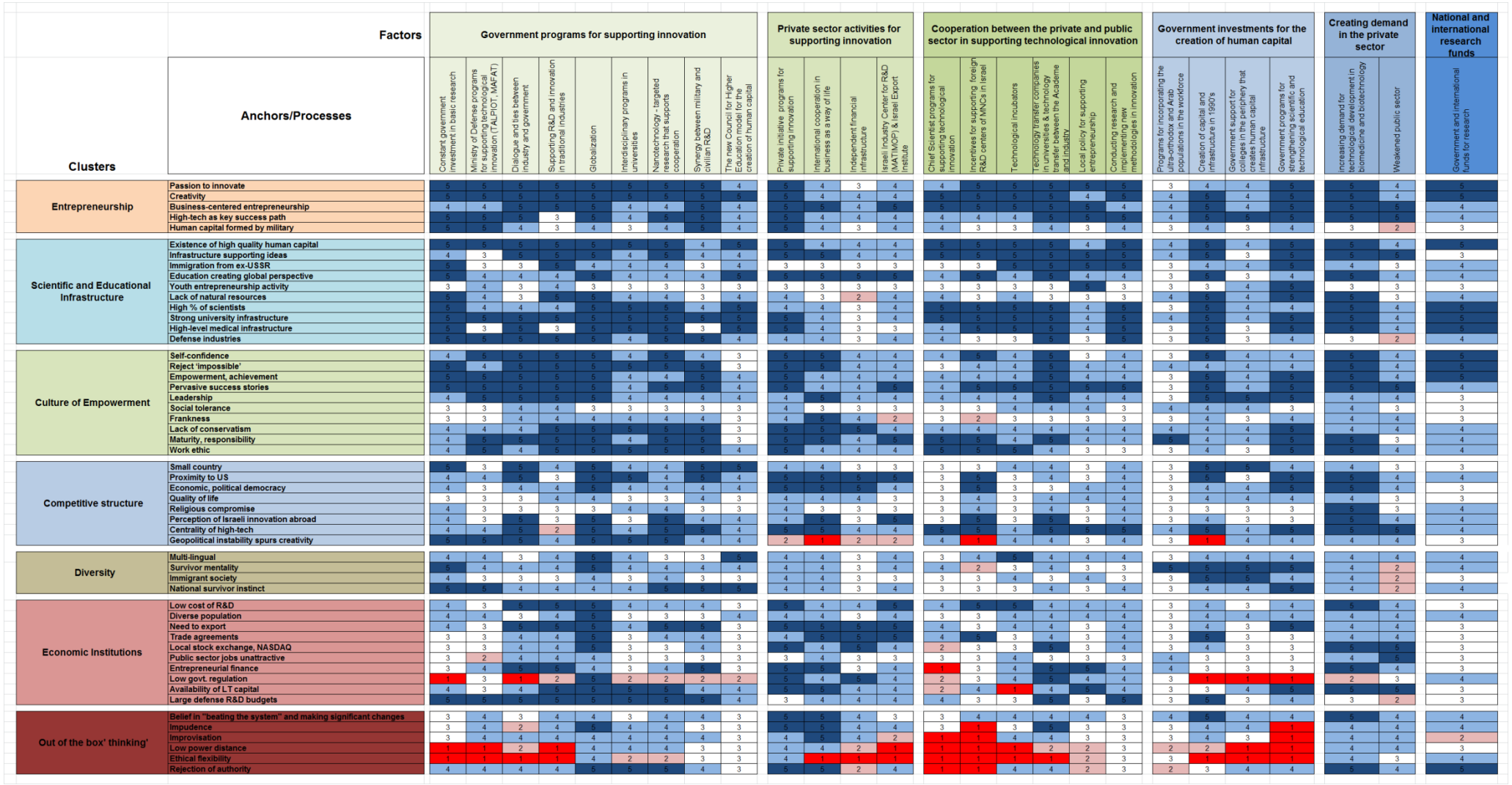
Support for **private sector activities for supporting innovation** is given by two public agencies: the Israeli Industry Center for R&D (MATIMOP) and the Israel Export Institute. MATIMOP, the executive agency of the Office of the Chief Scientist of the Ministry of Industry, Trade and Labor of Israel (OCS), is the official National Agency for industrial R&D cooperation charged with promoting highly supportive policies to build Israel's industrial infrastructure, and nurturing industrial innovation and entrepreneurship. This agency generates and implements international cooperative industrial R&D programs between Israeli and foreign enterprises. The Israel Export Institute is an Israeli governmental agency which operates under the Ministry of Trade and Labor to facilitate trade opportunities, joint ventures, and strategic alliances between international businesses and Israeli companies.

Targeted **government investments for the creation of human capital** were also identified by the experts as a potential for driving innovation and entrepreneurship. A great emphasis is placed in recent years in incorporating the ultra-orthodox (especially men) and Arab (especially women) populations in the workforce. These two populations possess low or irrelevant education (religious education in the case of the ultra-orthodox population) and are characterized by traditionally low participation rates in the Israeli workforce. Notable example for these targeted government investment is MAHAT (Government Institution for Technological and Scientific Training). Approximately 20% of the 600 employees in Intel's Jerusalem branch are ultra-orthodox graduates of the MAHAT institute.

2.2.3 Classification of Processes and Anchors

The next methodological step included the classification of processes and anchors into groups. The processes were grouped according to the results of the factor analysis. The classification of anchors into clusters did not involve a similar mathematical procedure and was based on logic. The anchors were grouped into seven clusters: **Entrepreneurship; Scientific and Educational Infrastructure; Culture of Empowerment; Competitive structure; Culture Diversity; Economic Institutions; Out of the box' thinking'.** ***Figure 3*** presents the new linkage matrix based on these classifications.

Figure 3: Linkages Matrix of the Cross Impact Results between Anchors and Processes for the Israeli Innovation Ecosystem



2.2.4 Construction of Innovation Ecosystem Map for Israel

In the final step of this methodological exercise, innovation maps were produced for the Israeli ecosystem. Most interactions between the anchor clusters and the process factors proved to be significant and positive. This can be seen in ***Figure 4***, describing the linkages between the two groups. The mathematical procedure for determining and weighting the direction and strength of link between the factors (group of processes) and clusters (group of anchors) is described in ***Annexes 1-3.***

The interactions between the group of anchors (clusters) and the group of processes The **entrepreneurship cluster** has strong positive association with three factors: ***government programs, private-public sector cooperation and the creation of demand in the private sector***. Weaker positive ties exist between this cluster and additional three factors: private & public sector activities for supporting innovation, government investments for the creation of human capital and national and international research funds.

The **scientific and educational infrastructure cluster** has strong positive interactions with two factors: government programs and private-public sector cooperation. The strong association between the scientific and educational infrastructure cluster and these two factors is mainly due to the contribution of Israel's seven main research universities[8]. These research institutions receive substantial government funding for conducting basic research and they are highly involved in Chief Scientist Programs (MAGNET, NOFAR, MAGNETON), aimed at establishing partnerships and technology transfer between the Academe and the industry. Weak positive ties exist between this cluster and four other factors: private & public sector activities for supporting innovation, government investments for the creation of human capital, creation of demand in the private sector and national and international research funds.

The **Culture of Empowerment cluster** has especially strong positive interaction with government programs. Weaker interactions exist between this cluster and five factors: private sector activities for supporting innovation, private-public sector cooperation, government investments for the creation of human capital, creation of demand in the private sector and national and international research funds. The unique leadership qualities (cultural aspects such as self-confidence, reject "impossible", lack of conservatism) that characterize the Israeli entrepreneur and the high-technology sector are especially important factors in the successes of

[8] Hebrew University of Jerusalem, Technion – Israel Institute of Technology, Weizmann Institute of Science, Tel-Aviv University, Bar-Ilan University, Ben-Gurion University of the Negev and the University of Haifa

government (Chief Scientist) programs, in establishing successful private-public partnerships and in promoting the activities of the private sector.

The **competitive structure cluster** has weak positive ties with all of the six factors.

The **diversity cluster** has strong positive linkage to the government investments for the creation of human capital factor. Weaker positive linkages exist between this cluster and four other factors: government programs, private sector activities for supporting innovation, private-public sector cooperation and international research funds. Israel is a multi-lingual immigrant society. Studies show that cultural diversity has a significant and positive impact on innovative activity. The differences in knowledge and capabilities of workers from diverse and heterogeneous cultural backgrounds enhance the performance of R&D activity. This is due to the fact that the nature of R&D activity calls for interaction between different workers and a pooling of different ideas and abilities. Diversity among highly qualified employees has the strongest impact on innovation output (Niebuhr, 2010; Alesina and La Ferrara, 2005; Fujita and Weber, 2004; Berliant and Fujita, 2004). Mixed linkages exist between the diversity cluster and the creation of demand in the private sector.

The **economic institutions cluster** has weak positive interactions with four factors: government programs, private & public sector activities for supporting innovation, private-public sector cooperation and the creation of demand in the private sector. No (neutral) linkages exist between this cluster and the government investments for the creation of human capital and the national and international funds factors. Possible explanation for the weak and neutral associations between this cluster and the various factor groups is that the economic institution cluster is mostly made up from pure demand-driven anchors (low cost of R&D, need to export, trade agreements, local stock exchange, public sector jobs unattractive, low government regulation, availability of LT capital, entrepreneurial finance), whereas factor groups are mostly made up from supply driven processes.

The "out of the box thinking" cluster has weak positive association with the creation of demand in the private sector and with the national and international research funds factors (academic sector). These two sectors often use bold and unconventional methods to solve problems and promote innovative solutions. Weaker negative ties exist between this sector and the private-public sector cooperation and the government investments for the creation of human capital clusters.

Mixed ties exist between the **"out of the box thinking" cluster** and the government program and private & public sector activities for supporting innovation factors. Government programs and private sector activities supported by public agencies (e.g. MATIMOP and Israel Export Institution processes) are much less likely to adopt "outside the box" thinking methods due to the conservative and bureaucratic nature of government agencies. Finally, Figures 4-6 present the innovation ecosystem maps for Israel.

Summary

In the course of the research, an innovation ecosystem map was constructed for Israel, based on the identified (and country-specific) linkages between key anchors and processes. The findings obtained from the analysis show that the Israeli ecosystem is a highly complex and interlinked network, exhibiting strong and significant linkages between its various components.

The results of the study reaffirm the important role of cultural characteristics and assets in driving and nurturing Israeli innovation. Evidence shows that strong ties exist between cultural anchors and supply and demand driven processes. Pure supply-side processes such as government support for the defense industries and the establishment of military R&D programs (e.g. Talpiot) were found to exert significant spillovers effects on innovation infrastructure (e.g. entrepreneurial and applied technological skills). The existence of strong scientific and technological base (e.g. research universities) and solid entrepreneurial infrastructure (e.g. emphasis on the teaching and development of entrepreneurial and applied technological skills at a young age) seems to be one of the key drivers of the Israeli innovation ecosystem.

The strongest catalysts of the Israeli innovation ecosystem are the joint demand and supply processes, focusing on government and public policy measures, private sector activities and dual private-public initiatives. Notable examples are the Chief Scientist programs (e.g. Magnet, Nofar, Magneton), aimed at establishing cooperation and technology transfer between the Industry and the Academia, and the support given by public sector agencies to private firms (MATIMOP and Israel Export Institute). Empirical support for these findings are provided by a recent study conducted by Applied Economics Ltd. (Lach et al., 2008). The research showed that Chief Scientist programs have two main effects on the Israeli economy: they create additional investment in R&D from the part of the firms (creation of new R&D that would not have been created without the support of the government) and they encourage technological spillovers between firms and industries (create additional GDP). The estimates show that a one million NIS government (Chief Scientist) grant in industry leads to an additional 1.28 million NIS investment by the firms in R&D. For

every additional 100,000 NIS government investment in R&D, there is 157,000-224,000 NIS growth in GDP.

Figure 4: Detailed Innovation Map for the Israeli Ecosystem

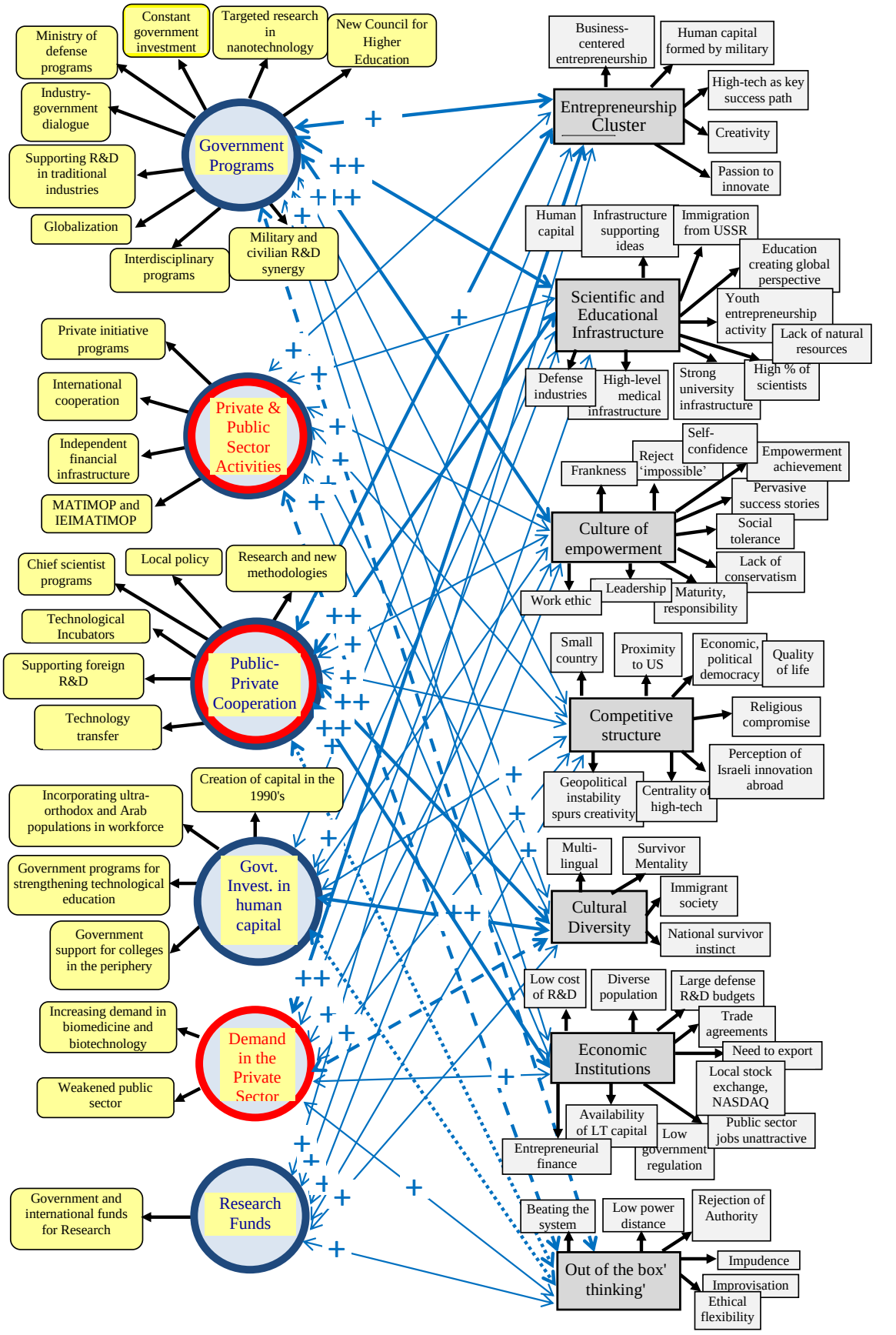


Figure 5: Schematic Linkages of the Israeli Ecosystem

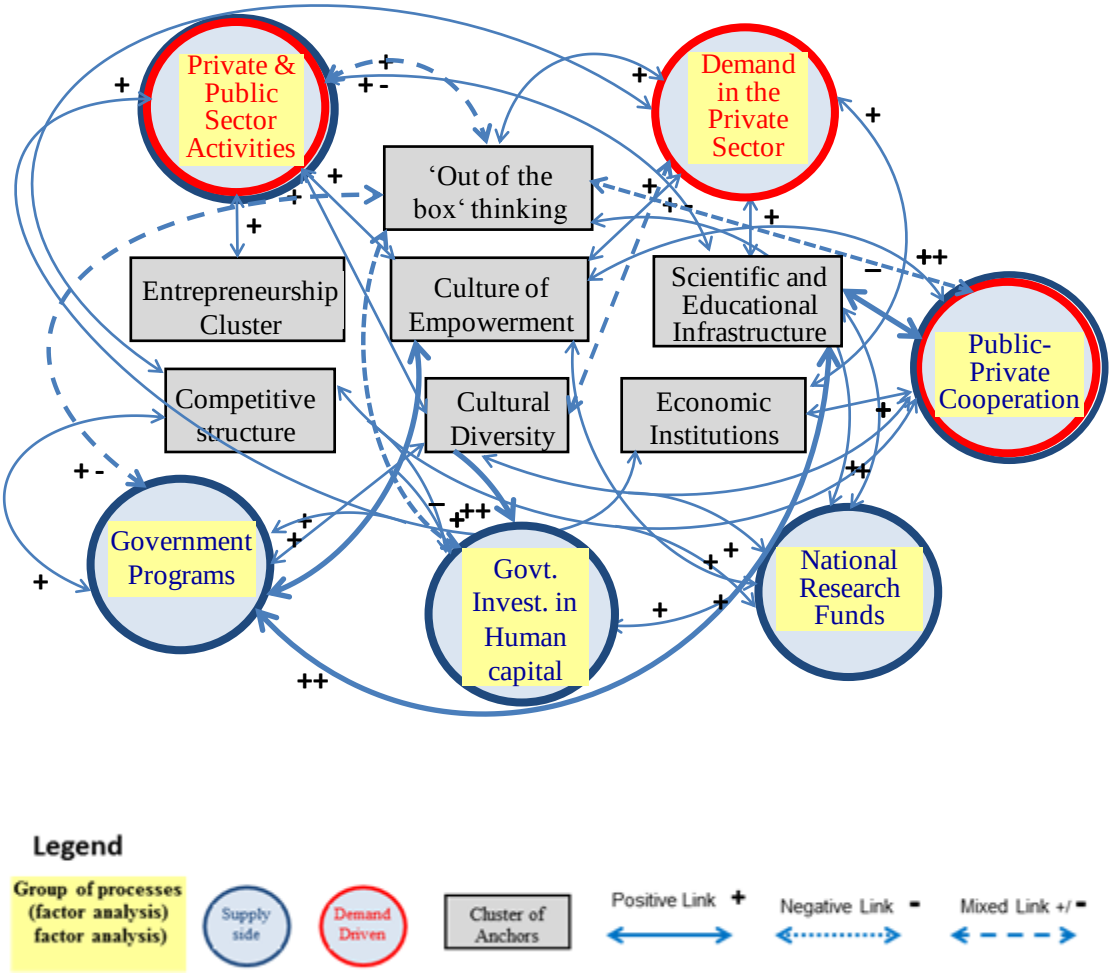


Figure 6: Schematic Linkages of the Israeli Ecosystem, Breakdown by Cluster

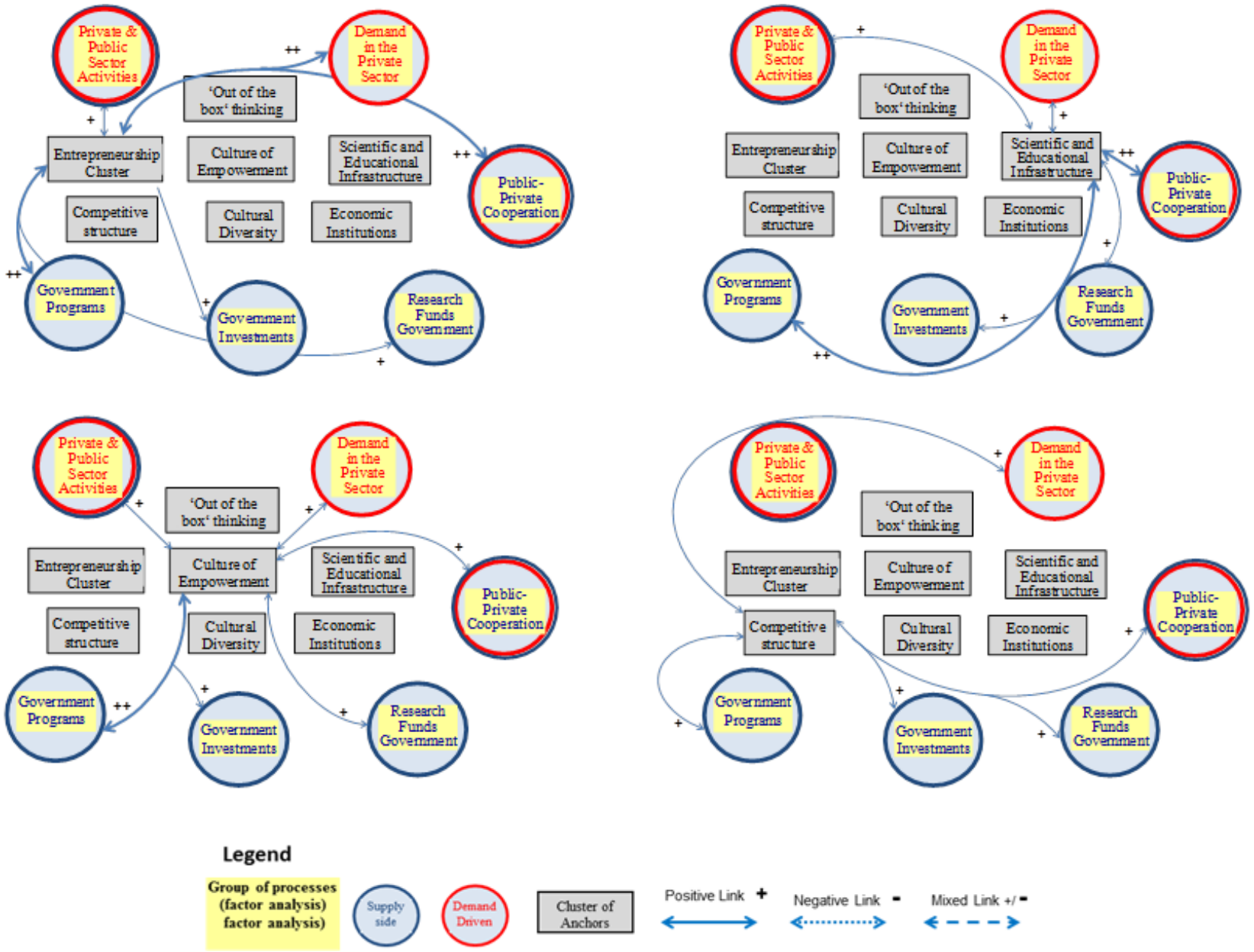
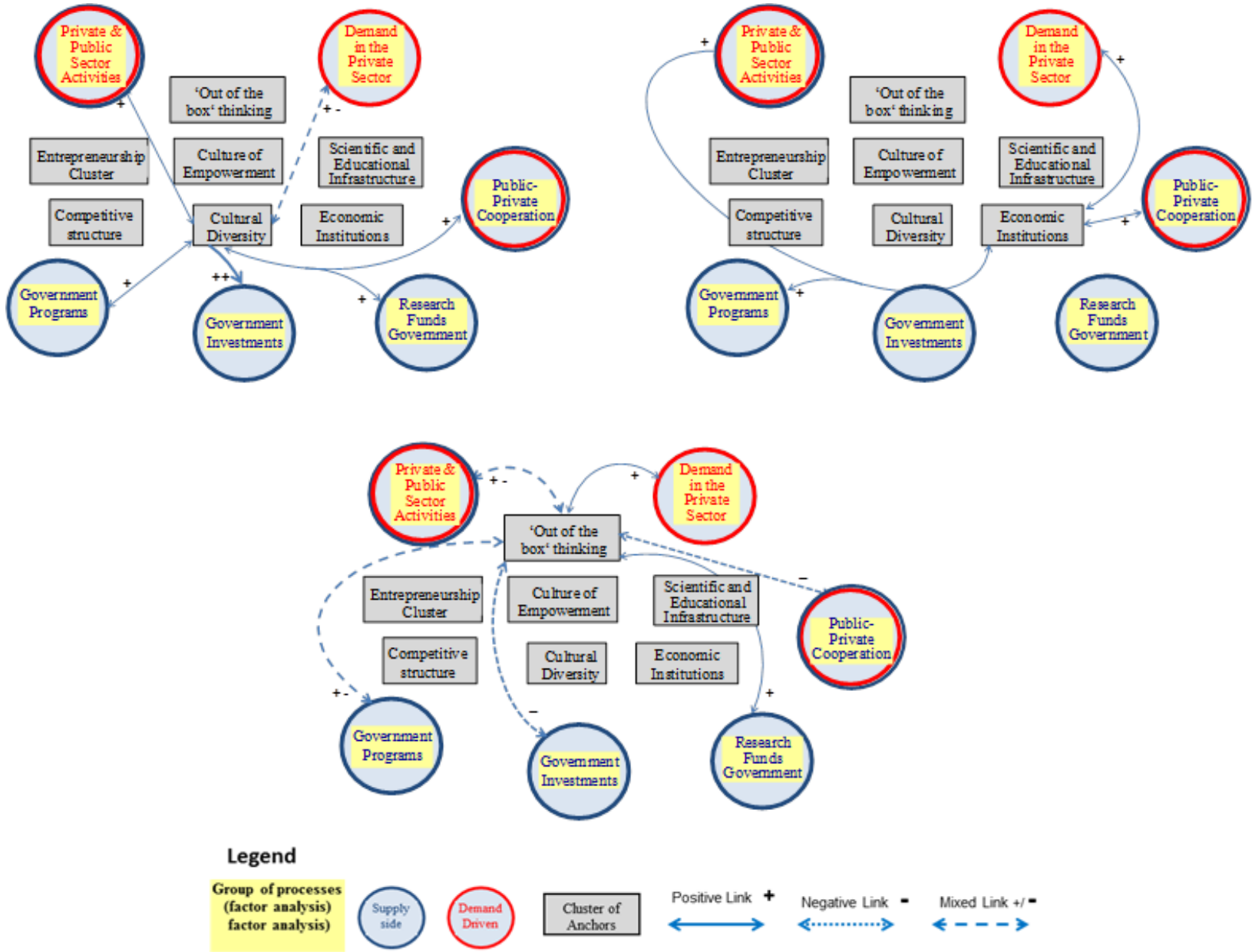


Figure 6 (continued): Schematic Linkages of the Israeli Ecosystem, Breakdown by Cluster



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ANNEX 1: Cell transformation

Clusters	Anchors/Processes	Government programs for supporting innovation									Private sector activities for supporting innovation				Cooperation between the private and public sector in supporting technological innovation						Government investments for the creation of human capital				Creating demand in the private sector		National and international research funds
		Constant government investment in basic research	Ministry of Defense programs for supporting technological innovation (TALPIOT, MAFAT)	Dialogue and ties between industry and government	Supporting R&D and innovation in traditional industries	Globalization	Interdisciplinary programs in universities	Nanotechnology - targeted research that supports cooperation	Synergy between military and civilian R&D	The new Council for Higher Education model for the creation of human capital	Private initiative programs for supporting innovation	International cooperation in business as a way of life	Independent financial infrastructure	Israeli Industry Center for R&D (MATIMOP) & Israel Export Institute	Chief Scientist programs for supporting technological innovation	Incentives for supporting foreign R&D centers of MNCs in Israel	Technological incubators	Technology transfer companies or universities & technology transfer between the Academe and industry	Local policy for supporting entrepreneurship	Conducting research and implementing new methodologies in innovation	Programs for incorporating the ultra-orthodox and Arab populations in the workforce	Creation of capital and infrastructure in 1990's	Government support for colleges in the periphery that creates human capital infrastructure	Government programs for strengthening scientific and technological education	increasing demand for technological development in biomedicine and biotechnology	Weakened public sector	Government and international funds for research
Entrepreneurship	Passion to innovate	4	4	4	4	4	4	4	4	3	4	3	n/a	3	3	4	4	4	4	4	n/a	3	3	4	4	3	4
	Creativity	4	4	4	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	3	3	4	3	4	4	3	4
	Business-centered entrepreneurship	3	3	4	4	4	3	3	4	3	4	4	3	4	4	4	4	4	4	3	3	4	3	4	4	4	3
	High-tech as key success path	4	4	4	n/a	4	3	4	4	3	4	3	3	3	3	3	3	4	4	4	3	4	4	4	4	4	3
	Human capital formed by military	4	4	3	n/a	3	n/a	3	4	3	4	3	n/a	3	3	n/a	n/a	3	n/a	3	n/a	3	n/a	3	n/a	2	n/a
Scientific and Educational Infrastructure	Existence of high quality human capital	4	4	4	4	4	4	4	3	4	4	3	3	3	4	4	4	4	3	4	3	4	3	4	4	3	4
	Infrastructure supporting ideas	3	n/a	4	4	4	3	4	3	3	4	4	3	3	4	4	4	4	4	4	3	4	n/a	4	4	4	n/a
	Immigration from ex-USSR	4	n/a	n/a	4	3	3	3	n/a	3	n/a	n/a	n/a	n/a	n/a	n/a	4	4	4	4	n/a	3	3	4	3	n/a	3
	Education creating global perspective	4	3	3	3	4	3	3	3	4	4	4	4	4	3	4	3	4	3	3	n/a	4	n/a	3	4	3	3
	Youth entrepreneurship activity	n/a	3	n/a	3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4	n/a	n/a	n/a	n/a	3	4	n/a	n/a	n/a
	Lack of natural resources	4	3	n/a	4	4	3	3	n/a	3	3	n/a	2	3	3	n/a	3	n/a	n/a	n/a	3	4	3	4	4	n/a	3
	High % of scientists	4	3	3	3	4	4	4	3	4	3	3	n/a	3	4	4	4	4	3	4	n/a	4	3	3	4	3	4
	Strong university infrastructure	4	4	4	4	4	4	4	4	4	4	3	n/a	3	4	4	4	4	3	4	3	4	3	4	4	3	4
	High-level medical infrastructure	4	n/a	4	n/a	4	4	4	n/a	4	4	3	n/a	n/a	3	4	4	4	3	4	n/a	4	n/a	4	4	3	4
	Defense industries	4	4	4	4	4	3	4	4	3	3	3	n/a	3	3	n/a	n/a	4	n/a	4	n/a	4	n/a	3	n/a	2	3
Culture of Empowerment	Self-confidence	3	4	4	4	4	3	4	3	n/a	4	4	3	3	3	4	3	4	n/a	3	n/a	4	3	3	4	3	4
	Reject 'impossible'	4	3	4	4	4	4	4	4	n/a	4	4	3	3	n/a	3	3	4	3	3	3	3	3	3	4	3	4
	Empowerment, achievement	4	4	4	4	4	3	3	4	3	4	3	3	3	3	3	3	4	3	3	n/a	4	3	4	4	3	4
	Pervasive success stories	4	4	4	4	4	3	4	4	3	4	3	3	4	3	4	4	4	4	4	n/a	4	3	4	4	4	3
	Leadership	3	4	4	4	4	3	3	3	3	3	4	3	3	3	3	3	4	3	3	n/a	4	4	4	3	3	n/a
	Social tolerance	n/a	n/a	3	3	n/a	n/a	n/a	n/a	n/a	3	n/a	n/a	n/a	n/a	n/a	3	3	3	n/a	3	3	3	n/a	3	n/a	n/a
	Frankness	n/a	n/a	3	3	3	3	3	3	n/a	3	4	3	2	n/a	2	n/a	n/a	n/a	n/a	n/a	3	n/a	3	3	3	n/a
	Lack of conservatism	3	3	3	4	4	4	4	4	n/a	4	4	4	3	3	3	3	3	3	3	3	3	3	4	3	3	3
	Maturity, responsibility	3	4	4	4	4	3	4	4	n/a	4	4	3	4	4	4	3	4	3	3	4	3	3	4	4	n/a	3
	Work ethic	3	4	3	4	4	4	4	4	3	4	3	3	3	4	4	4	3	n/a	n/a	n/a	3	n/a	4	3	3	3
Competitive structure	Small country	4	n/a	4	3	4	3	3	4	4	3	3	n/a	n/a	n/a	n/a	3	3	n/a	3	n/a	4	4	3	3	n/a	n/a
	Proximity to US	3	3	4	n/a	4	4	3	4	3	4	4	4	4	n/a	4	n/a	3	n/a	3	n/a	4	n/a	4	4	3	3
	Economic, political democracy	3	n/a	3	3	4	3	3	3	3	4	4	4	3	n/a	4	n/a	n/a	3	3	n/a	3	3	4	4	3	n/a
	Quality of life	n/a	n/a	n/a	3	3	n/a	n/a	3	n/a	3	3	3	n/a	n/a	3	n/a	3	3	3	n/a	3	3	3	3	n/a	n/a
	Religious compromise	3	n/a	n/a	n/a	n/a	3	3	n/a	n/a	3	n/a	n/a	n/a	n/a	3	n/a	3	n/a	3	n/a	n/a	n/a	n/a	4	n/a	3
	Perception of Israeli innovation abroad	3	n/a	4	n/a	4	n/a	4	3	3	3	4	n/a	4	n/a	4	n/a	4	n/a	3	n/a	3	n/a	n/a	4	3	3
	Centrality of high-tech	3	3	4	2	4	3	4	4	3	4	4	3	3	4	4	3	4	4	4	3	4	3	4	4	4	3
	Geopolitical instability spurs creativity	4	4	4	3	4	4	4	3	3	2	1	2	2	3	1	3	3	n/a	3	n/a	1	3	3	3	3	n/a
Diversity	Multi-lingual	3	3	n/a	3	4	3	n/a	n/a	4	3	3	n/a	3	n/a	3	4	3	3	3	n/a	3	3	3	3	3	3
	Survivor mentality	4	3	3	3	4	3	3	3	3	3	3	n/a	3	3	2	n/a	3	n/a	n/a	4	4	4	4	3	2	3
	Immigrant society	3	n/a	n/a	n/a	3	n/a	3	n/a	n/a	3	3	n/a	n/a	n/a	n/a	3	n/a	3	n/a	n/a	4	4	3	3	2	n/a
	National survivor instinct	4	4	3	3	3	3	4	4	4	3	3	n/a	3	n/a	n/a	n/a	3	n/a	3	n/a	3	3	4	3	2	3
Economic Institutions	Low cost of R&D	3	n/a	4	4	4	3	3	3	n/a	4	3	3	4	3	4	4	3	3	3	n/a	3	n/a	3	4	3	n/a
	Diverse population	3	3	n/a	3	4	n/a	n/a	n/a	3	3	3	n/a	3	n/a	n/a	3	3	3	3	n/a	3	3	3	3	3	3
	Need to export	3	n/a	4	4	4	3	4	4	n/a	4	4	4	4	3	n/a	3	3	n/a	3	n/a	3	n/a	4	3	3	n/a
	Trade agreements	n/a	n/a	3	3	4	n/a	3	3	n/a	3	4	4	4	3	4	n/a	3	n/a	3	n/a	4	n/a	n/a	3	3	n/a
	Local stock exchange, NASDAQ	n/a	n/a	3	3	4	n/a	n/a	3	n/a	4	3	4	3	2	n/a	n/a	4	n/a	3	n/a	3	n/a	n/a	4	4	n/a
	Public sector jobs unattractive	n/a	2	3	3	3	n/a	n/a	n/a	n/a	n/a	3	n/a	n/a	n/a	n/a	3	n/a	n/a	n/a	3	n/a	n/a	n/a	3	4	n/a
	Entrepreneurial finance	n/a	3	4	4	3	n/a	3	4	n/a	4	4	n/a	3	1	n/a	3	4	4	3	3	n/a	n/a	n/a	4	3	n/a
	Low govt. regulation	1	n/a	1	2	4	2	2	2	2	4	3	4	3	2	n/a	3	4	3	3	n/a	1	1	1	2	n/a	3
	Availability of LT capital	3	n/a	3	4	4	4	4	3	3	4	4	3	3	2	3	1	3	4	3	n/a	n/a	3	4	4	4	n/a
	Large defense R&D budgets	4	4	4	4	4	4	4	4	3	n/a	3	3	3	3	n/a	n/a	4	n/a	4	n/a	4	n/a	3	n/a	2	n/a
Out of the box' thinking'	Belief in "beating the system" and making significant changes	n/a	3	n/a	3	3	n/a	3	3	n/a	4	4	3	n/a	n/a	3	3	3	3	n/a	3	4	3	3	4	3	3
	Impudence	n/a	3	2	3	4	3	3	n/a	n/a	4	4	3	3	n/a	1	n/a	4	n/a	n/a	n/a	3	3	1	3	3	3
	Improvisation	n/a	3	3	3	3	3	3	3	n/a	3	4	3	2	1	1	3	3	n/a	n/a	n/a	3	n/a	1	3	3	2
	Low power distance	1	1	2	1	3	3	3	n/a	n/a	3	3	2	1	1	1	1	2	2	n/a	2	2	1	1	3	3	n/a
	Ethical flexibility	1	1	1	1	3	2	2	n/a	n/a	3	1	1	1	1	1	1	1	2	n/a	n/a	1	1	1	3	n/a	3
	Rejection of authority	3	3	3	3	4	4	4	3	n/a	4	4	2	3	1	1	3	3	2	n/a	2	n/a	3	3	4	3	4

Explanation for ANNEX 1

The cells in ***Figure 3*** were transformed using the following key:

Old value	New value
1	1
2	2
3	n/a
4	3
5	4

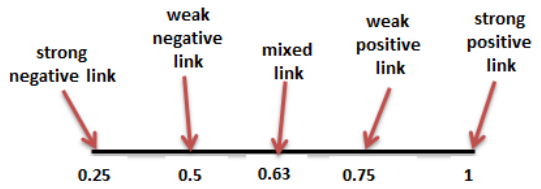
ANNEX 2: Weighted linkage and neutral linkage indicators

Clusters	Anchors/Processes	Government programs for supporting innovation: Constant government investment in basic research	Government programs for supporting innovation: Ministry of Defense programs for supporting technological innovation (TALPIOT, MAFAT)	Government programs for supporting innovation: Dialogue and ties between industry and government	Government programs for supporting innovation: Supporting R&D and innovation in traditional industries	Government programs for supporting innovation: Globalization	Government programs for supporting innovation: Interdisciplinary programs in universities	Government programs for supporting innovation: Nanotechnology - targeted research that supports cooperation	Government programs for supporting innovation: Synergy between military and civilian R&D	Government programs for supporting innovation: The new Council for Higher Education model for the creation of human capital	Private sector activities for supporting innovation: Private initiative programs for supporting innovation	Private sector activities for supporting innovation: International cooperation in business as a way of life	Private sector activities for supporting innovation: Independent financial infrastructure	Private sector activities for supporting innovation: Israeli Industry Center for R&D (MATIMOP) and the Israel Export Institute	Cooperation between the private and public sector in supporting technological innovation: Chief Scientist programs for supporting technological innovation	Cooperation between the private and public sector in supporting technological innovation: Incentives for supporting foreign R&D centers of MNCs in Israel	Cooperation between the private and public sector in supporting technological innovation: Technological incubators	Cooperation between the private and public sector in supporting technological innovation: Technology transfer companies in universities & technology transfer between the Academe and industry	Cooperation between the private and public sector in supporting technological innovation: Local policy for supporting entrepreneurship	Cooperation between the private and public sector in supporting technological innovation: Conducting research and implementing new methodologies in innovation	Government investments for the creation of human capital: Programs for incorporating the ultra-orthodox and Arab populations in the workforce	Government investments for the creation of human capital: Creation of capital and infrastructure in 1990's	Government investments for the creation of human capital: Government support for colleges in the periphery that creates human capital infrastructure	Government investments for the creation of human capital: Government programs for strengthening scientific and technological education	Creating demand in the private sector: increasing demand for technological development in biomedicine and biotechnology	Creating demand in the private sector: Weakened public sector	National and international research funds: Government and international funds for research
Entrepreneurship	Passion to innovate	0.93									0.85				0.92						0.87				0.89		0.88
	Creativity	0.07									0.10				0.10						0.15				0.10		0.20
	Business-centered entrepreneurship																										
	High-tech as key success path																										
	Human capital formed by military																										
Scientific and Educational Infrastructure	Existence of high quality human capital	0.91									0.83				0.93						0.88				0.87		0.88
	Infrastructure supporting ideas	0.18									0.35				0.23						0.28				0.25		0.20
	Immigration from ex-USSR																										
	Education creating global perspective																										
	Youth entrepreneurship activity																										
	Lack of natural resources																										
	High % of scientists																										
	Strong university infrastructure																										
	High-level medical infrastructure																										
	Defense industries																										
Culture of Empowerment	Self-confidence	0.90									0.85				0.83						0.85				0.85		0.86
	Reject 'impossible'	0.16									0.08				0.20						0.23				0.10		0.30
	Empowerment, achievement																										
	Pervasive success stories																										
	Leadership																										
	Social tolerance																										
	Frankness																										
	Lack of conservatism																										
	Maturity, responsibility																										
	Work ethic																										
Competitive structure	Small country	0.85									0.81				0.81						0.82				0.87		0.75
	Proximity to US	0.25									0.22				0.38						0.41				0.19		0.50
	Economic, political democracy																										
	Quality of life																										
	Religious compromise																										
	Perception of Israeli innovation abroad																										
	Centrality of high-tech																										
	Geopolitical instability spurs creativity																										
Diversity	Multi-lingual	0.83									0.75				0.75						0.88				0.66		0.75
	Survivor mentality	0.25									0.31				0.50						0.19				0.00		0.25
	Immigrant society																										
	National survivor instinct																										
Economic Institutions	Low cost of R&D	0.82									0.88				0.77						0.72				0.82		0.75
	Diverse population	0.30									0.15				0.32						0.55				0.10		0.80
	Need to export																										
	Trade agreements																										
	Local stock exchange, NASDAQ																										
	Public sector jobs unattractive																										
	Entrepreneurial finance																										
	Low govt. regulation																										
	Availability of LT capital																										
	Large defense R&D budgets																										
Out of the box' thinking'	Belief in "beating the system" and making significant changes	0.66									0.71				0.48						0.54				0.80		0.75
	Impudence	0.26									0.04				0.31						0.21				0.08		0.17
	Improvisation																										
	Low power distance																										
	Ethical flexibility																										
	Rejection of authority																										

Explanation for ANNEX 2:

Two indicators were computed for each cluster-factor combination:

1. **Weighted linkage indicator:** (Sum of values in combination)/(number of non n/a cells in combination * 4). We receive a value ranging from 0.25 to 1:



2. **Neutral linkage indicator:** (Number of n/a cells in combination)/(total number of cells in combination).

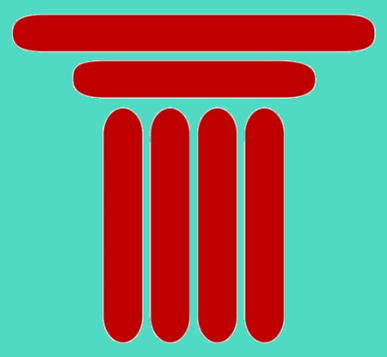
ANNEX 3: Decision rule for determining linkage between factors and clusters

Clusters	Anchors/Processes	Government programs for supporting innovation: Constant government investment in basic research	Government programs for supporting innovation: Ministry of Defense programs for supporting technological innovation (TALPIOT, MAFAT)	Government programs for supporting innovation: Dialogue and ties between industry and government	Government programs for supporting innovation: Supporting R&D and innovation in traditional industries	Government programs for supporting innovation: Globalization	Government programs for supporting innovation: Interdisciplinary programs in universities	Government programs for supporting innovation: Nanotechnology - targeted research that supports competitiveness	Government programs for supporting innovation: Synergy between military and civilian R&D	Government programs for supporting innovation: The new Council for Higher Education's role in the creation of human capital	Private sector activities for supporting innovation: Private initiative programs for supporting innovation	Private sector activities for supporting innovation: International cooperation in business as a way of life	Private sector activities for supporting innovation: Independent financial infrastructure	Private sector activities for supporting innovation: Israel Industry Center for R&D (MATIMOP) & Israel Export Institute	Cooperation between the private and public sector in supporting technological innovation: Chief Scientist programs for supporting technological innovation	Cooperation between the private and public sector in supporting technological innovation: Incentives for supporting foreign R&D centers of MNCs in Israel	Cooperation between the private and public sector in supporting technological innovation: Technological incubators	Cooperation between the private and public sector in supporting technological innovation: Technology transfer companies as channels for knowledge transfer between the Academe and industry	Cooperation between the private and public sector in supporting technological innovation: Local policy for supporting entrepreneurship	Cooperation between the private and public sector in supporting technological innovation: Conducting research and implementing new methodologies in innovation	Government investments for the creation of human capital: Programs for incorporating the ultra-orthodox and Arab populations in the workforce	Government investments for the creation of human capital: Creation of capital and infrastructure in 1990's	Government investments for the creation of human capital: Government support for colleges in the periphery that create local knowledge infrastructure	Government investments for the creation of human capital: Government programs for strengthening scientific and technological education	Creating demand in the private sector: Increasing demand for technological development in biomedicine and biotechnology	Creating demand in the private sector: Weakened public sector	National and international research funds: Government and international funds for research
Entrepreneurship	Passion to innovate Creativity Business-centered entrepreneurship High-tech as key success path Human capital formed by military	++									+				++						+				++	+
Scientific and Educational Infrastructure	Existence of high quality human capital Infrastructure supporting ideas Immigration from ex-USSR Education creating global perspective Youth entrepreneurship activity Lack of natural resources High % of scientists Strong university infrastructure High-level medical infrastructure Defense industries	++									+				++						+				+	+
Culture of Empowerment	Self-confidence Reject 'impossible' Empowerment, achievement Pervasive success stories Leadership Social tolerance Frankness Lack of conservatism Maturity, responsibility Work ethic	++									+				+						+				+	+
Competitive structure	Small country Proximity to US Economic, political democracy Quality of life Religious compromise Perception of Israeli innovation abroad Centrality of high-tech Geopolitical instability spurs creativity	+									+				+						+				+	+
Diversity	Multi-lingual Survivor mentality Immigrant society National survivor instinct	+									+				+						++				+/-	+
Economic Institutions	Low cost of R&D Diverse population Need to export Trade agreements Local stock exchange, NASDAQ Public sector jobs unattractive Entrepreneurial finance Low govt. regulation Availability of LT capital Large defense R&D budgets	+									+				+						NL				+	NL
Out of the box' thinking'	Belief in "beating the system" and making significant changes Impudence Improvisation Low power distance Ethical flexibility Rejection of authority	+/-									+/-				-						-				+	+

Explanation for ANNEX 3:

Decision rule: If the number of cells in a particular **factor** (processes) - **cluster** (anchors) **combination is greater than 50%,** than there is no linkage (NL) between the factor and the cluster; if else the **weighted linkage indicator** is used to determine the direction and strength of the linkage. The midpoint between each pair of values (0.25 and 0.5, 0.5 and 0.63, 0.63 and 0.75 and 0.75 and 1) used as a basis for calculating the minimum and maximum threshold.

0.82-1: strong positive linkage (++); **0.62-0.81:** weak positive linkage; **0.37-0.61:** mixed linkage (+-); **0.29-0.36:** weak negative linkage (-); **0.25-0.28:** strong negative linkage(--).



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