Variety, product quality and creative destruction

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Meaning of creative destruction

• Replacement of older, lower quality, capital goods by the newer, higher quality, ones (Aghion, Howitt)?
• But new sectors as well (Romer, 1990; Saviotti, Pyka, 2004, 2008)
• Increasing variety/differentiation: Aghion, Howitt empirically inaccurate
Meaning(s) of creative destruction (2)

• 1) Substitution of pre-existing goods/services/technologies with newer and higher quality ones

• 2) Gradual maturation of incumbent sectors by
  – (a) falling labour intensity of mature sectors,
  – (b) falling rate of growth of demand for mature sectors
  – (c) gradually increasing competencies/skills and wages as a consequence of the rising product quality within mature sectors

• 3) Growing competition from emerging countries which acquire the capability to make the same goods and services as in highly developed countries but at lower cost
Meaning(s) of creative destruction (3)

• Demand side: disappearance of older goods/services and emergence of new ones
• Substitution or co-existence?
• Survival of basic necessities (food, clothing shelter) and emergence of qualitatively new goods and services
• Coexistence: novelty/dissimilarity + usefulness + cognitive distance (Saviotti, 2001)
Structural change

• Economic development depends on
  – (i) growing efficiency in existing (incumbent) sectors,
  – (ii) the creation of new sectors,
  – (iii) increasing product quality and diversification in existing sectors
• But, in what combination?
• TEVECON, a model of economic development by the creation of new sectors, in which the N° of sectors is endogenously variable
Why demand?

• No innovation could have had an impact on economic growth if nobody had purchased it.

• Demand conditions:
  – (a) a high enough income to purchase the innovation and
  – (b) a preference system compatible with the purchase of the given innovation
Demand evolution

• Since the industrial revolution from necessities to imaginary worlds
Creation of disposable income (2)

• Growing productive efficiency in incumbent sectors +
• Investment for new sectors → employment, income, disposable income, demand

• But
  – (i) Same goods and services, or
  – (ii) goods and services of higher quality and price?

• Higher competencies → higher quality and price → higher salaries to workers (in rich countries) → disposable income required to purchase new goods and services + demand for education and salaries
Mechanism

- Higher product price
- Disposable income, demand
- Increasing Competencies
- Increasing Quality & Diff
- Higher wages
Demand function

\[ D_i^t = k_{pref,i} D_i^0 D_{disp,i} \frac{Y_i \Delta Y_i}{p_i} \]

\( D_i^0 \) = initial demand for the output of the new sector \( l \)

\( D_{disp,i} \) = the disposable income for new good or service \( l \)

\( Y_i \) and \( \Delta y_i \) = level of services supplied by the new product/service and degree of product differentiation,

\( p_i \) = the price of the new product/service

\( D_{disp,i} \) can be calculated by subtracting from total income the expenditures on all previous goods or services.

Evolution of demand *constrained* by the creation of disposable income
Demand, disposable income

Demand, new function (left); Demand, old function (right)
Effects of (low-high) product quality

Effect of product quality on sectoral demand, low (pink) and high (blue) case

Quality of human capital with low (pink) or high (blue) product quality

Output with low (pink) and high (blue) product quality

Wages with low (pink) and high (blue) product quality
Effects of (low-high) product quality 

(3)

Disposable income (low product quality)

Disposable income (high product quality)

Aggregate income (low product quality, pink, high product quality blue)

Aggregate employment (low product quality, pink, high product quality blue)
Efficiency, product quality

• Low product quality:
• Faster creation of new sectors and of employment, shorter industry life cycles
• Lower sectoral output, lower sectoral demand, lower wages, lower quality of human capital
• Would the higher rate of creation of employment actually existed? (see preferences) Or did it exist in LDCs?
Demand saturation (2)

• No saturation in the strict sense implied by Pasinetti, but
• There would be saturation if the N° of sectors remained constant
• The saturation level of incumbent sectors grows with the emergence of new sectors (see empirical Engel curves by Chai, Moneta)
• But compensation by emergence of new sectors can still work if the rate of growth of demand slow down with income.
Preferences

\[ D_i^t = k_{\text{pref},i} D_i^0 D_{\text{Disp},i} \frac{Y_i \ast \Delta Y_i}{p_i} \]

- Progressive preference system: \( k_{\text{pref},i+1} > k_{\text{pref},i} \)
- Random preference system: \( k_{\text{pref},i+1} > k_{\text{pref},i} \)
- Conservative preference system: \( k_{\text{pref},i+1} < k_{\text{pref},i} \)
Preferences vs employment growth
Co-evolution of innovation and demand

• Investment for new sectors → employment, income, disposable income, demand

• But
  – (i) Same goods and services, or
  – (ii) goods and services of higher quality and price?

• Higher quality and price → higher competencies (Requiring higher education levels) → higher salaries to workers (in rich countries) → disposable income required to purchase new goods and services
Summary and conclusions

• Emergence of new sectors + increasing product quality → creation of disposable income to purchase output of new sectors

• Low product quality:
  – Faster creation of new sectors and of employment, shorter industry life cycles
  – Lower sectoral output, lower sectoral demand, lower wages, lower quality of human capital
Summary and conclusions (2)

• Different preference systems affect the rates of income growth and of employment growth.

• Creative destruction is not just the substitution of the old by the new but
  – (i) there is more creation than destruction (growing variety)
  – (ii) compression of the old to allow the emergence of the new

– Differential effects in different countries/environments and for different people.
Seventh Framework Programme
PICK-ME - Policy Incentives for the Creation of Knowledge: Methods & Evidence
Pick-Me Meeting, November 3rd and 4th, 2011
Universite de Nice, Sophia Antipolis, France

Work Package 2 – Towards Mapping National Innovation Ecosystems

Prof. Amnon Frenkel, Prof. Shlomo, Dr Daphne Getz, Dr. Eran Lack
with the assistance of the German, France, Spanish and Polish Pick-Me teams

Samuel Neaman Institute
FOR NATIONAL POLICY RESEARCH
Outline

1. Background: Objectives, Methodology

2. National Innovation Ecosystems:
   - Israel – SNI - Samuel Neaman Institute
   - Germany – UHOU - Universitaet Hohenheim
   - Spain – CSIC – Agencia Estatal Consejo Superior De Investigaciones Cientificas
   - Poland – Centrum Analiz Spoleczno- Ekonomicznych-Fundacja-Naukowa
   - France – Universite De Nice - Sophia Antipolis

3. A Comparison of Five National Innovation Ecosystems

4. Time-table – Next Steps

5. Discussion
Objectives:

- Build a consensual visual map of a nation’s dynamic innovation ecosystem

- Capturing the crucial elements of the system, as the basis for building effective pro-innovation policies, with emphasis on demand-side aspects.

- Produce a comprehensive annotated bibliography of the scholarly literature on demand side and supply-side innovation
WP2 - Review and taxonomy of supply-side and demand-side innovation policies

Methodology:

A. Experts Workshop to list key a) “anchors” and b) “processes”

B. Research team evaluate causal links (+, -) between the processes and anchors.

C. Factor analysis reduces and simplifies.

D. ‘Visual map’ is constructed based on the preceding analysis.
WP2 - Review and taxonomy of supply-side and demand-side innovation policies

Methodology:

A. Experts Workshop to list key a) “anchors” and b) “processes”

“Quality anchors”: strengths, or core competencies, of the nation, on which innovation can be built

“Innovation Processes”: generate innovation or overcome innovation weakness”

B. Cross Impact Analysis

C. Factor analysis reduces and simplifies.

D. ‘Visual map’ is constructed based on the preceding analysis.
**Stage A: List of Anchor and Processes**

### List of Anchors

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<td>1</td>
<td>Holistic &quot;systems&quot; view of the private sector</td>
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<td>Culture that fosters constant innovation, specifically, transforming basic scientific research into innovative products and services.</td>
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<td>3</td>
<td>Belief in the ability to invade successfully new markets.</td>
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<td>National resilience</td>
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6. Business-centered entrepreneurship

8. Empowerment, Achievement

12. Existence of high-level research universities

13. Infrastructure supporting ideas

17. Threatening external environment, causing a sense of uncertainty

18. Low power-distance ("sergeant is willing to contradict the general")

19. Frameworks that encourage social networking (e.g., IDF)

20. Willingness to solve problems independently

21. ICT capability

22. Creativity, knowledge and capability in business development

23. Ability to create strong interpersonal relationships, feeling of "family"

24. Constructive competition

25. Education creating global perspective

**List of Processes**

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<td>1</td>
<td>Private sector entrepreneurship support innovation</td>
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2. Constant government investment in basic research

3. Private initiative programs for supporting innovation

7. Encouragement of university-industry collaboration

8. Govt. support of applied research in universities

9. Education to foster entrepreneurship

10. Govt. tax incentives for innovation

11. Office of Chief Scientist forums for fostering R&D coordination

13. Interdisciplinary programs in universities

14. Government programs for strengthening scientific and technological education

17. Office of Chief Scientist for supporting innovation

18. Low power-distance ("sergeant is willing to contradict the general")

19. Frameworks that encourage social networking (e.g., IDF)

20. Willingness to solve problems independently

21. ICT capability

22. Creativity, knowledge and capability in business development

23. Ability to create strong interpersonal relationships, feeling of "family"

24. Constructive competition

25. Education creating global perspective

29. National admiration of technology-intensive entrepreneurship that creates wealth
WP2 - Review and taxonomy of supply-side and demand-side innovation policies

Methodology:

A. Experts Workshop to list key a) “anchors” and b) “processes”

B. Cross Impact Analysis

   Research team evaluate causal links (+, -) between the anchors and processes

C. Factor analysis reduces and simplifies.

D. ‘Visual map’ is constructed based on the preceding analysis.
### Stage B: Cross-impact analysis

#### Anchors/Processes

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#### Incentives encouraging entry of multinational corporations

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Methodology:

A. Experts Workshop to list key a) “anchors” and b) “processes”

B. Cross Impact Analysis

C. Classification of processes and anchors into groups
   • The processes were grouped by employing the factor analysis procedure on the cross impact matrix.
   • The classification of anchors into clusters did not involve a similar mathematical procedure and was based on logic

D. ‘Visual map’ is constructed based on the preceding analysis.
# Stage C: Classification of processes and anchors into groups

<table>
<thead>
<tr>
<th>Factors</th>
<th>Local and Regional Incentives Supporting Innovation</th>
<th>Targeted Public Programs</th>
<th>Joint Public-Private Initiatives for Supporting Innovation</th>
<th>Public Funding of Private Entities and Programs</th>
<th>Development of Human Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchors/Processes</td>
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<tr>
<td>Clusters</td>
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<tr>
<td>Technological infrastructure</td>
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<tr>
<td>Valorization of intangible assets</td>
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<tr>
<td>Wide range of improvement in the innovation system</td>
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<tr>
<td>Strong presence of SMEs stimulate entrepreneurship attitude among young generations</td>
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<tr>
<td>Human resources competences (public &amp; private sector)</td>
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<tr>
<td>Development potential of Spanish Innovation System</td>
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<tr>
<td>Quality of innovation (ratio Science/recourses)</td>
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<tr>
<td>Leading positions of technological sectors</td>
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<tr>
<td>Creativity (Mediterranean special features)</td>
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<tr>
<td>Entrepreneurship attitude</td>
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<tr>
<td>Positive political attitude towards innovation</td>
<td></td>
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</tbody>
</table>

The table above categorizes various factors and processes into groups, with each cell indicating the level of support or influence each process has on the different factors. The numbers represent the level of importance or impact, with higher numbers indicating a greater influence.
WP2 - Review and taxonomy of supply-side and demand-side innovation policies

Methodology:

A. Experts Workshop to list key a) “anchors” and b) “processes”
B. Cross Impact Analysis
C. Classification of processes and anchors into groups
D. ‘Visual map’ is constructed based on the preceding analysis
   • A mathematical procedure for determining and weighting the direction and strength of link between the factors (group of processes) and clusters (group of anchors)
Stage D: ‘Visual map’ is constructed

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Anchors/Processes</td>
<td>Regional strategic plan</td>
<td>Enhancement of third mission of universities &amp; related infrastructure</td>
<td>Multilevel innovation programs</td>
<td>Public procurement supporting innovation</td>
<td>AVANZA plan (TICS)</td>
</tr>
</tbody>
</table>
| Clusters | Technological infrastructure | + | + | ++ | ++ | ++ | + | Technical infrastructure &&&
|          | Valorization of intangible assets | | | | | | | &
|          | Wide range of improvement in the innovation system | | | | | | | &
|          | Strong presence of SMEs stimulate entrepreneurship attitude among young generations | | | | | | | &
|          | Human resources competences (public & private sector) | + | + | + | + | + | + | Human resources competences &
|          | Development potential of Spanish Innovation System | | | | | | | Leadership &
|          | Quality of innovation (ratio Science/recourses) | | | | | | | &
|          | Leading positions of technological sectors | | | | | | | &
|          | Creativity (Mediterranean special features) | | | | | | | &
|          | Entrepreneurship attitude | ++ | ++ | ++ | + | ++ | + | Entrepreneurship attitude &
|          | Positive political attitude towards innovation | ++ | ++ | ++ | + | ++ | + | Positive political attitude &

Strong positive link ++

Weak positive link +
D. Stage D: `Visual Map’ of the Nations’ Innovation Ecosystem
For every nation, it is crucial to:

• Understand how its innovation ecosystem works

• What the components are, and

• How they interact
II. Five National Innovation Ecosystems
Israel Innovation ecosystem

Experts’ Workshop

• 32 experts participated in 2 Workshops that were conducted by the SNI team.

• 53 main anchors were identified by the Israeli experts as the pillars of the Israeli Innovation system

• 26 processes were recognized by the experts as key elements driving and fostering Israel’s innovation

• Through cross impact analysis the SNI research team identified the linkages between each anchor and processes via a bipolar five-point Likert scale
## Linkages between Anchors and Processes in the Israeli Innovation Ecosystem

| Anchors/Processes | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| 1. Strong positive link | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. Weak positive link | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. No link | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. Strong negative link | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. Weak negative link | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

- **Anchors**
  - Existence of high-quality human capital
  - Belief in "leading the system" and seeking significant changes
  - Passionate visionaries
  - Trust
  - Creativity
  - Business-oriented entrepreneurship
  - Rapid responsiveness
  - Entrepreneurship, achievement
  - High-tech as key success pillar
  - Perseverance, success-driven
  - Small country
  - Proximity to US
  - Infrastructure supporting ideas
  - Economic, political and cultural
  - Local need of R&D
  - Immigration from abroad
  - Multilingual
  - Social capital
  - Quality of life
  - Need to export
  - Religious complementarity
  - Leadership
  - Strategic alliances
  - Perpetual self-innovation ability
  - Innovation capacity and global perspective
  - Social tolerance
  - Trade-enforcement activity
  - Engagement on EU
  - Flexibility
  - Skew of human capital
  - Local stock exchange, NASDAQ
  - Public, social and urban life
  - High KPI motivation
  - Intellectual property protection
  - Environmental issues
  - Low-cost location
  - Technological
  - Knowledge innovation
  - Innovation
  - Low access to resources
  - Innovation-friendly environment
  - Technological infrastructure
  - High-level education
  - Intellectual property protection
  - Innovation-friendly environment
  - Technological infrastructure
  - High-level education
  - Intellectual property protection
  - Innovation-friendly environment
  - Technological infrastructure
  - High-level education

- **Processes**
  - 1. Core capital acquired for R&D
  - 2. Core capital acquired for R&D
  - 3. Business plan for core capital
  - 4. Business plan for core capital
  - 5. Business plan for core capital
  - 6. Business plan for core capital
  - 7. Business plan for core capital
  - 8. Business plan for core capital
  - 9. Business plan for core capital
  - 10. Business plan for core capital
  - 11. Business plan for core capital
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  - 42. Business plan for core capital
  - 43. Business plan for core capital
  - 44. Business plan for core capital
  - 45. Business plan for core capital
Classification of processes and anchors into groups

The 26 processes were grouped into 6 factor (key processes) by employing the factor analysis procedure on the cross impact matrix:

1. Government programs for supporting innovation - S
2. Private & public sector activities for supporting innovation – S/D
3. Cooperation between the private and public sector in supporting technological innovation - S/D
4. Government investments for the creation of human capital - S
5. Creating demand in the private sector - D
6. National and international research funds - S
The 53 anchors were grouped into 7 clusters (key anchors) based on logic:

1. Entrepreneurship;
2. Scientific and Educational Infrastructure;
3. Culture of Empowerment;
4. Competitive structure;
5. Culture Diversity;
6. Economic Institutions;
7. ‘Out of the box thinking’
Israel’s Innovation Ecosystem

Private & Public Sector Activities

Entrepreneurship Cluster

Competitive structure

‘Out of the box‘ thinking

Culture of Empowerment

Cultural Diversity

Scientific and Educational Infrastructure

Economic Institutions

Government Programs

Govt. Invest. in Human capital

National Research Funds

Demand in the Private Sector

Public-Private Cooperation

Legend

Group of processes (factor analysis) factor analysis

Supply side

Demand Driven

Cluster of Anchors

Positive Link + Negative Link - Mixed Link +/-
Israel’s Innovation Ecosystem

- **Private & Public Sector Activities**
- **Entrepreneurship Cluster**
- **Competitive structure**
- **Culture of Empowerment**
- **Culture of Diversity**
- **Demand in the Private Sector**
- **Scientific and Educational Infrastructure**
- **Economic Institutions**
- **Public-Private Cooperation**
- **Government Programs**
- **Govt. Invest. in Human capital**
- **National Research Funds**

Legend:
- **Positive Link +**
- **Negative Link -**
- **Mixed Link +/-**
- **Group of processes (factor analysis)**
- **Supply side**
- **Demand Driven**
- **Cluster of Anchors**

+ ‘Out of the box’ thinking

Group of processes (factor analysis)
Government Programs

Examples:

1. **Military support of R&D**, including military intelligence and its investment in high technology.

   Israeli defense industries have traditionally focused on components, electronics, avionics and other systems gives Israeli high-tech industries an edge in civilian spin-offs in security, electronics, computers, software and the internet sectors.

2. **Talpiot** - an elite Israel Defense Forces training program for young people (high school graduates) who have demonstrated outstanding academic ability in the sciences, physics and mathematics.

   During their military service, Tapiot graduates develop considerable entrepreneurship skills

   They 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.
Increasing Demand in the Private Sector

Examples:

1. **The fields of pharma, biomedicine and biotechnology**, that significantly contributed to the strengthening of innovation and entrepreneurship.

   Israel’s biotech industry is one of the most aggressive in the world, with more startups per capita than any other country.

2. **The increased demand in the private sector for high quality human capital** is directly related to Israel's shrinking public sector.

   Government 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 as a percentage of GDP rose from 1.3% to 3.8% in this time period.
Private-Public Sector Cooperation

Examples of programs initiated by The Office of the Chief Scientist (OCS) at the Ministry of Industry:

1. **Magnet Program** - 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.

2. **Nofar** - a pure academic research program for basic and applied research in the areas of Bio and Nano Technologies.
   
support advanced stages of applied academic research, not yet oriented towards a specific product, but already of interest to a business partner.

3. **The Public Technological Incubator Program** - support organizations that give inexperienced entrepreneurs an opportunity to develop their innovative technological ideas and set up new businesses in order to commercialize them.
III. “Like Some, Like All, Like None”
A Comparison of Five National Innovation Ecosystems, With Emphasis on Markets & Demand

Prof. Amnon Frenkel, Prof. Shlomo, Dr. Eran Lack
Towards Innovation Ecosystem Theory

An innovation ecosystem similarly reflects the relationships among: firms, government bodies, universities, researchers, consumers, owners of capital and workers.

An innovation ecosystem generates increased innovative output in two ways:

• Through an increase in the quantity of inputs (capital and labor) in the system, and

• Through an improvement in the efficiency with which existing inputs are used to generate innovation.