The Aerospace Cluster in Israel: Take Off in the Startup Nation

Microeconomics of Competitiveness: Firms, Clusters, and Economic Development
Winter 2015

Omar Aziz
Zhuldyz Bakytzhanova
Sara Greenberg
A. M.

May 2015
Table of Contents

Executive Summary ........................................................................................................................................... 3

I. Israel: Country Overview ................................................................................................................................. 4
   Background: Hostile Environment a Major Driver of Industry ................................................................. 4
   Model of Economic Development: Endowments and Processes ............................................................ 4
      Limited Natural Resources but High Potential for Gas Export ........................................................... 4
      Favorable Geographic Position with Access to Two Oceans ................................................................. 5
      Human Capital is a Major Economic Development Factor ............................................................... 5
      Impact of the Global Jewish Diaspora ...................................................................................................... 6
      Economic Transformation: From Socialism to a Start-up Economy .................................................. 7

Framework for Assessment of Competitiveness ......................................................................................... 10

Macroeconomic Competitiveness ..................................................................................................................... 11
   Human Development and Effective Political Institutions ................................................................. 11
   Monetary and Fiscal Policies ...................................................................................................................... 13

Microeconomic Competitiveness .................................................................................................................... 14
   National Business Environment .............................................................................................................. 15
   Company Operations and Strategy ........................................................................................................... 15
   State of Cluster Development: What Sets Israel up for Success in High-Tech Clusters .......................... 16

II. Israel’s Aerospace Cluster: A Leading Exporter of Technology ............................................................ 17
   The Emergence and Evolution of the Aerospace Cluster in Israel ......................................................... 17
   Cluster Analysis ........................................................................................................................................... 23
      Factor Conditions .................................................................................................................................. 23
      Demand Conditions ............................................................................................................................... 25
      Context for Firm Strategy and Rivalry ..................................................................................................... 26
      Related and Supporting Industries ......................................................................................................... 27

III. Strengthening Israel’s Aerospace Cluster ............................................................................................... 28
   Country Level Recommendations ............................................................................................................. 28
   Cluster Level Recommendations .............................................................................................................. 28
Executive Summary

Israel is a highly industrialized economy with a competitive landscape of macro and microeconomic factors. While limited in its endowment of natural resources, it has relied on its favorable geographic location, the assistance of the global Jewish diaspora and a concerted investment in knowledge intensive human capital development to create one of the most innovative economies in the world. Human development factors and the state of its regulatory and political institutions pose a drag on what is otherwise a very favorable environment for business and innovation.

Israel's aerospace exports represent 4% of the country’s total exports. The aerospace cluster of Israel is both state and export driven: three fourths of the cluster’s production and services are dedicated to the international market, while the state of Israel remains the main owner, customer and partner of the cluster. Israel aerospace cluster was built upon a clear strategy: to provide technological solutions to sustain Israel’s air supremacy over potential enemies. Israel does not aim to become a prime integrator of large commercial aircraft, nor does it aim to compete with large OEM in the commercial and military aircraft sector. Israel has developed a strong position in niche markets within the aerospace cluster for which it has a competitive edge. Israel’s leadership in the unmanned autonomous vehicles, radar and missile systems are some examples of the cluster’s strategic choices. The cluster’s proximity with the military institution and the Ben Gurion airport enables it to test and adapt its aerospace solutions in a time-efficient way.
I. Israel: Country Overview

Background: Hostile Environment a Major Driver of Industry

Israel was established in May 14, 1948. In its Basic Laws, Israel identifies itself as a Jewish and democratic state. It is a parliamentary democracy. The government of Israel is headed by Prime Minister Benjamin Netanyahhu from the right wing Likud party, who was re-elected in March 2015 for another 4-year term.

Since establishment, development of the country has been significantly affected by a number of wars and large-scale military operations involving Israel and Arab states. Located in the Middle East and being the world’s only Jewish-majority state\(^1\), Israel is surrounded by the nations that have historically been the opponents in past wars (e.g. Syria, Jordan, Palestine, Egypt, Lebanon) and radical terrorist organizations located in the neighboring countries (e.g. Hamas, Hezbollah, ISIL)\(^2\). This drives high levels of investment in the defense and related industries, which in turn motivate the development of high-tech industries and clusters.

Model of Economic Development: Endowments and Processes

Limited Natural Resources but High Potential for Gas Export

Israel's endowment of natural resources, particularly, energy sources, was traditionally considered limited compared to other countries in the Middle East. The proven reserves of oil are estimated at 11.5 million barrels and proven natural gas reserves are approximately 10.1 trillion cubic feet (for comparison, in the UAE it is 97.8 billion

---

\(^1\) Jewish represent 75% of total population, followed by Arabs (21%) and other backgrounds (4%) (Source: Wikipedia)
barrels and 215 trillion cubic feet, respectively)\(^3\). It is expected that with the discoveries of the Tamar and Leviathan fields (among several others) Israel could become a significant exporter of natural gas in the next decade\(^4\). Other natural resources of Israel include copper ore, timber, and sand, as well as Dead Sea resources such as potash (used in fertilizers), magnesium bromide (used in sedatives and anti-convulsion medications), phosphate rocks (used in industry and agriculture), and mud (used in the beauty industry)\(^5\).

**Favorable Geographic Position with Access to Two Oceans**

The State of Israel is located at the southeastern shore of the Mediterranean Sea with the coastline of 273 km and has a small coastline on the Red Sea in the south. Access to two oceans endows Israel with opportunities for trade with relatively cheap sea transportation costs and development of such industries like fishing, tourism, transportation and logistics.

**Human Capital is a Major Economic Development Factor**

Israel's population grew almost ten fold over the years from approximately 800,000 at the end of 1948 to almost 8 million people (2014)\(^6\). This rise is mostly attributed to the main waves of immigration of diaspora Jews to Israel (Aliyah) in 1950s (from all over the world) and in the beginning of the 1990s (mainly from the former Soviet Union). Over 700 thousand Russian Jews immigrated to Israel during 1989 – 1997, increasing Israel's working-age population by 15%. Despite high educational levels of the Russian

---


immigrants, the relative supply of skilled workers in Israel did not change due to substantial occupational downgrading of the immigrants in Israel. The short term implication of the immigration shock on the economy in 1990s was reflected in reduction of average effective wages of native Israelis.

Labor productivity in Israel is 24% lower than that of all the OECD countries (2013). According to Bank of Israel, this could be explained by the relatively low investment rate in Israel between 2000 and 2011, relatively high volume of work hours per employed person, growth in the labor force and the low level of competition in the business environment. OECD notes that comparatively lower labor productivity in Israel could be attributed also to the lower participation levels of ultra-Orthodox (which employment rate was 45% in 2012), Arab Israelis and residents of outlying towns and cities far from the center of the country in the workforce.

**Impact of the Global Jewish Diaspora**

The total global Jewish population is approximately 17.9 million people (2013), of which close to 5.9 million Jews are located in Israel. The network of Jewish communities acts as an action arm for Jewish values around the world. Israel is supported financially mainly by the Jewish communities located in the US. Representing 151 Jewish

---

9 Note: Core Jewish population – all, who (1) identify themselves as Jews, or (2) have no religious identification, have at least one Jewish parent, and have no other religion
Federations, they raise and distribute more than $3 billion annually for social welfare and educational needs of Jewish globally\textsuperscript{11}.

**Economic Transformation: From Socialism to a Start-up Economy**

During 1948 – 1977 Israel was ruled by the socialist-dominant policy-makers with the state-owned companies being a major actors in the economy. High dependence of the Israeli economy from foreign financial support, mainly from the capitalistic countries, such as US, France, impacted transformation of the socialistic country to the start-up nation with the liberalized and open economy via privatizations executed mainly during 1980 – 1990\textsuperscript{12} and other reforms. Israel receives a significant amount of FDI inflows, notably from the US and Europe. In 2013 it pulled in the fourth highest level of FDI in relation to the size of its economy (around $11.8 billion or 4% of GDP)\textsuperscript{13}. Nowadays Israel is one of the most technologically-advanced market economies in the world. In 2013 the United Nations Development Program ranked it as a country with very high human development placing it as 19 out of 187 countries in the Human Development Index rank\textsuperscript{14}. It is an OECD member since 2010 and is ranked 22 out of 34 OECD countries in terms of GDP per capita PPP of $32,309 (2013)\textsuperscript{15}. Israel's GDP annual growth rate averaged 8.9% until 1973 and 3.8% per year since 1973\textsuperscript{16} with the highest growth rate of 10.25% in the 3d quarter of 2000 and the lowest record of -4% in the

\textsuperscript{11} The Jewish Federations of North America, http://www.jewishfederations.org/page.aspx?id=59304
fourth quarter of 2001\textsuperscript{17}. The economic growth of Israel corresponded with the growth in population. GDP per capita grew at the average rate of 4.9\% annually until 1973 and 1.6\% after. Israel’s GDP comprised $291 billion in 2013. Israel’s exports are divided roughly among the US, Europe and Emerging Asia. It has free trade agreements with the European Union, the United States, the European Free Trade Association, Mercosur, Turkey, Mexico, Canada, Jordan and Egypt. Israel is considered a start-up nation with the innovative economy characterized by excelling in share of R&D expenditures in GDP, share of skilled labor, entrepreneurship (as of 2011, Israel has the largest number of companies listed on the NASDAQ after the United States and Canada, and more than 60 Israeli companies are traded on various European exchanges\textsuperscript{18}), venture capital availability and utility patents per million. The biggest sector of the economy is services, accounting for nearly 80\% of GDP. As part of the World Economic Forum Global Competitiveness Index, Israel was ranked 1\textsuperscript{st} at the “Resilience of the Economy” Index in 2010\textsuperscript{19}.

\textbf{Silicon Wadi}

The Silicon Wadi, Israel’s high-tech industry, is a result of the software boom of the late 1980s and early 1990s, through business support system firms such as AmDocs and Magic Software, and security solutions such as Checkpoint and NICE Systems. Development of the Israel’s high-tech industry is closely related to its fractious relationships with larger neighbors and heavy investments in military innovative technologies. Success with military R&D along with the government incentives for R&D

investments attracted the private sector. Silicon Wadi is currently home for a number of international tech firms setting up R&D units in Israel and driving the high-tech industry of Israel up along with the local start-up companies\textsuperscript{20}. As of 2011, there were 240 foreign R&D centers in Israel, representing IT and enterprise software (30%), communication (17%), life sciences (16%), semiconductors (16%), Internet (8%) and other sectors, 66% out of which are from the US. R&D is supported by the government of Israel via competitive grant programs and tax incentives\textsuperscript{21}.


A country's competitiveness is determined by its endowments, its macroeconomic competitiveness which includes responsible monetary and fiscal policies and effective indicators of human development and credible, transparent and accountable public institutions. It also depends on the competitiveness of a country's microeconomic environment. A discussion of Israel's endowments was discussed in the earlier section. In this section we discuss the various elements of its macroeconomic and microeconomic competitiveness. An overall assessment of Israel's competitiveness in 2013 showed that it created a favorable microeconomic environment for cluster development but that this was offset by less than ideal macroeconomic outcomes. This section analyzes these results in greater detail in an attempt to identify and diagnose which particular elements of Israel's macro and microeconomic environment present the best opportunities and greatest challenges to the future of its high-tech clusters.

---

**Macroeconomic Competitiveness**

“Macroeconomic competitiveness sets the economy-wide context for productivity to emerge, but is not sufficient to ensure productivity”\(^23\). Macroeconomic competitiveness is determined by many factors, but there are two broad dimensions to it: human development and effective institutions and effective monetary and fiscal policies.

**Human Development and Effective Political Institutions**

Globally, Israel ranks relatively high on measures of human development but comparatively lower on the strengths of its political institutions. It is however comparatively weaker than most advanced OECD countries on both these measures. The strengths of Israel’s human development institutions are reflected in the high average life expectancy of its population (average for men: 79 years, women: 84 years), though as with most countries there significant disparities among its different ethnic groups.\(^24\) The quality and accessibility of healthcare services is high (Rank: 20), despite the relatively low level of expenditure on health as a percentage of GDP (Rank 34, 7.3%)\(^25\). It also has a good primary and secondary education system. The overall literacy of its population stands at 97.8% (men: 98.7%, women: 96.8%), which is in large part due to the country having the highest rate of secondary school enrollment in the world (Rank 1). Gender inequality is low and unlike many other Middle Eastern countries, women in Israel are an already active and fast growing proportion of the labor force. As discussed earlier, while Israel’s overall labor force participation is lower than the most advanced

---


\(^24\) Source: [https://www.cia.gov/library/publications/resources/the-world-factbook/geos/is.html](https://www.cia.gov/library/publications/resources/the-world-factbook/geos/is.html)

economies in the OECD, it outperforms other Middle Eastern countries on this measure. The Gini coefficient, a measure of income inequality, is however amongst the highest in the OECD, “only surpassed by Chile, Mexico, the United States and Turkey”. This is partly due to comparatively low social spending (15.8% of GDP vs. 21.9% OECD average). The Social Progress Index uses a set of 52 indicators to rank a country’s potential to fulfill the basic human needs of its citizens, ensure their wellbeing and provide them with the right opportunities of rights, freedoms, choice, tolerance and inclusion. While its overall performance on social progress is at the higher end of the index (rank 40/133), Israel performs significantly lower compared to other OECD countries on measures of personal choice, personal freedoms and choice and tolerance and inclusion, but especially when compared to countries with a similar GDP per capita. This analysis converges with an assessment of the comparative quality of Israel’s political institutions and its and those that implement rule of law. Government effectiveness in reducing poverty and inequality is especially an area of concern, as are the transparency of policymaking processes, safety and wastefulness of government spending and low trust in politicians. Private property rights could also be improved. On the other hand, Israel gets a more favorable assessment for having low business costs of corruption and high judicial independence.

28 Social progress is defined as the capacity of a society to meet the basic human needs of its citizens, establish the building blocks that allow citizens and communities to enhance and sustain the quality of their lives, and create the conditions for all individuals to reach their full potential. (http://www.isc.hbs.edu/research-areas/Pages/social-progress-index.aspx)
29 Social progress index 2015 covers 133 countries covering 94% of the world’s population: http://www.socialprogressimperative.org/data/spi
data/spi/countries/ISR
Monetary and Fiscal Policies

Israel has historically been a stable economy with prudent management of fiscal and monetary policies. Its public debt as a % of GDP (68.9%) is lower than that of other OECD countries, the Euro area and the United States. The spending-to-GDP ratio (currently at 41.5%) and tax-to-GDP ratio (currently at 37.5%) have both historically been inline with OECD averages (2015). The fiscal balance has been steadily decreasing since 2010 and currently stands at -3.6% of GDP, close to the OECD average of -3.2%.\(^\text{31}\)

In the aftermath of the global financial crisis, “Israel introduced a range of guarantees to the financial markets, tax provisions and spending measures...[h]owever, the fiscal cost of these measures has been modest...no more than 0.5% of GDP...this small stimulus package, combined with subsequent healthy recovery in GDP and tax revenues, accounts for the relatively small increase in the debt-to-GDP ratio. Hence there have been no significant fiscal stimuli to unwind, or a pressing need for exceptionally deep cuts in public spending”\(^\text{32}\). Inflation was stable at about 1% till the start of 2014, but has been


decreasing since then. In response interest rates have been cut in the hope of stimulating the economy and avoiding unemployment. The output gap has been close to zero till recently however it is projected to rise over the next 12 months which will likely lead to an increase in inflation.

With a positive current account, unemployment projected to decrease, GDP that is expected to grow at a consistent rate in the medium-term (3% in 2015 and 3.5% in 2016) and the continued implementation of the 2010 institutional reforms that set “limitations on both the deficit level and the rate of growth of government expenditure”, Israel is likely to remain a stable macroeconomic environment for the foreseeable future.

Microeconomic Competitiveness

Microeconomic Competitiveness and National Diamond Analysis (Source: Team Analysis)

![Microeconomic Competitiveness and National Diamond Analysis](https://www.gfmag.com/global-data/country-data/israel-gdp-country-report)


The microeconomic competitiveness of a country is determined by the quality of its business environment, the state of cluster development and the sophistication of company operations and strategy. The strength of Israel’s industrial competitiveness lies in the world-class microeconomic environment that exists for cluster development.

**National Business Environment**

The competitiveness of its national business environment is driven by highly ranked factor (input) conditions (overall #23), which in turn are determined by highly developed and efficient logistical, communications, administrative, capital market and innovation infrastructure. Highly qualified “knowledge workers” are also of great benefit to the development of knowledge intensive clusters. Rules and regulations for trading across borders, the easy availability of credit and most importantly, adequate legal protection for investors are features that give Israel’s business environment a comparative advantage. However, the challenges that Israel faces in creating an even more successful business environment lie in its less than ideal regulatory and institutional regimes.

**Company Operations and Strategy**

Company operations and strategy also an area in which Israeli industries are highly ranked (overall rank 21). This is driven mainly by world-class strategy and operational effectiveness, organizational practices, and the rate at which firms are internationalized. A highly competitive local and international environment for high-tech industries also
helps because it raises the barriers to entry and only cutting edge firms that realize a true competitive advantage are able to successfully operate.

State of Cluster Development: What Sets Israel up for Success in High-Tech Clusters

The two areas in which Israel is near unrivalled in the world in terms of high-tech cluster development are: first, the extent of and pathways through which funding is channeled from the public to the private sector and second, the rate at which Israel trains highly skilled knowledge workers. Funding: Israel spends close to 4% of GDP on R&D activities and has the second highest proportion of researchers in its workforce, behind Finland. Its funding model is unique for the level of Gross Expenditure on R&D that is contributed by the private sector (3.3% out of a total of 4% of the national expenditure). Due to the level of investor protection it provides, it is also ranked # 1 in the world for the level of venture capital investment it attracts. A significant amount of public sector R&D is indirectly channeled to the private sector through university funds. This facilitates close collaboration between universities and training institutes and the knowledge intensive sector. This funding model also allows the private sector to communicate with universities about the
Naturally such a model also puts a high emphasis on engineering and technical disciplines at the tertiary level and allows Israel, alongside Finland and Korea, to produce the highest percentage of tertiary graduates with engineering or technical degrees. Israel however has the highest percentage of knowledge workers in its labor force, of any country, which suggests that not only does it train engineers, scientists and technical workers in great numbers, they are of high quality as well.

II. Israel’s Aerospace Cluster: A Leading Exporter of Technology

The Emergence and Evolution of the Aerospace Cluster in Israel

Israel’s aerospace cluster had its official beginning in 1948 with the establishment of the Israel Air Force (IAF) using donated civilian aircraft and obsolete WWII combat aircraft. El Al, the country’s national airline, was also established in 1948. In 1953, the Government of Israel established Israel Aerospace Industries (IAI). IAI was founded as a maintenance facility in 1952 by the Ministry of Defense (MOD) to maintain IAF aircraft. Based at Lod Airport, IAI originally had 70 employees with American expatriate Al Schwimmer at its helm. IAI began manufacturing aircraft six years later. The first aircraft
to be designed and built by IAI, the Arava STOL (short take off and landing) transport aircraft flew in 1969 after three years of development.\textsuperscript{35}

At the same time as IAI was beginning to grow, other private aerospace companies began to pop up. Bet-Shemesh Engines, for example, established in 1968, specialized in manufacturing jet engine parts. Elbit Systems began to focus on upgrading integration systems and avionic activities, Cyclone Aviation specialized in “build-to-specification” aero-structures, Silver Arrow developed an expertise in small jet engine manufacturing and maintenance activities, and Radom Aviation Services provided services in engineering design and prototypes manufacturing.

In addition to the entrance of private firms, the rapid development of institutions of collaboration to support the aerospace cluster further contributed to vast strides in research and development. In 1951, the Israeli Society of Aeronautics was established, later merging in 1968 with the Israel Astronautical Society to become the Israeli Society of Aeronautics and Astronautics. In 1954, The Israel Institute of Technology (Technion) established the faculty of aeronautical engineering to support public and private aerospace research efforts.

The Ministry of Defense (MOD) also played a crucial role in driving investment in research and development efforts across the entire defense industry, and in particular in aerospace technologies. Since the early days of Israel’s establishment, the MAFAT division of the MOD invested money into academic institutions and private firms to promote development of new technologies. In cases where the research activity

succeeded, the resulting technologies were converted into products and the State of
Israel was paid a percentage of the proceeds from government-to-government sales.

Despite new entrants into the market, the IAI, a beneficiary of much of the
external R&D efforts supporting the cluster, continued to lead much of the development
in aerospace technologies and in response to a French embargo in 1968, IAI began
developing its own fighter aircraft, a derivative of the Mirage 5 called the Nesher
(“eagle”). The Nesher entered service in 1971, and was followed by the Kfir (“lion cub”) in 1975. According to the history on IAI’s web site, the number of employees had grown from 4000 in 1968 to 14,000 in 1970. Since IAI worked on engines as well as airframes and interiors, IAI could provide more comprehensive refurbishments than even the aircraft manufacturers themselves, according to a New York Times profile in 1973.36 By 1972, IAI had bought 13 Boeing 707 airliners from TWA to refurbish and sell. During the 1970s, IAI developed relationships with companies in the United States, which replaced France as Israel’s main foreign arms supplier. Exports grew to account for 50% of sales in 1976. IAI also began to expand beyond the military market, creating the Westwind business jet. By the 1980s, civilian products accounted for 10% of sales.

Nevertheless, Israel’s aerospace cluster remained predominantly focused on the defense market and the growing sophistication of Israel’s defense industry gave the government confidence to attempt to develop an all-Israeli military aircraft, the Lavi. Over the first half of the 1980s, IAI developed avionics, electronics and weapons systems for the aircraft, and by 1986 the first prototype had taken to the air. However, the

36 “Israel Aircraft Industries, Ltd. – Company Profile.” Reference for Business.
http://www.referenceforbusiness.com/history2/25/Israel-Aircraft-Industries-Ltd.html
government concluded that it was unable to finance such an ambitious undertaking, and the project was cancelled a year later.

While employees were laid off in the mid-1980s due to the failure of expensive aircraft development program, several IAI business lines continued to thrive: the Elta electronic warfare unit and the Bedek MRO (maintenance, repair, and overhaul) division. It is therefore no surprise that after the cancellation of the Lavi project, IAI began to focus more on upgrading aircraft and became a world leader in this. The Lahav division carried out this work and upgraded planes such as the Vietnam-era McDonnell Douglas Phantom II with modernized and advanced avionics and weaponry.

Without the Lavi project, in addition to focusing on upgrading aircrafts, the Israeli aerospace cluster also began to develop a variety of products in the military and civilian spheres, such as advanced radar systems, precision weapon systems, and unmanned air vehicles (UAVs). Of course, much of this was led by IAI and in 1986, IAI was the largest company in Israel. As a point of reference, in 1986, Israel exported $950 million worth of military goods, and IAI accounted for two thirds of this total.37

Over the last two decades, Israel’s aerospace industry has evolved to become a leading exporter of technology, with a turnover of more than US $ 5 billion, $3.5 billion of which is derived from sales abroad to more than 60 countries. The cluster also employs over 50,000 people and has continued to develop a reputation as a worldwide leader in providing a broad range of cutting edge components, accessories, materials and technologies to the world’s major aircraft manufacturers. In particular, Israeli aerospace

---

firms are known for their expertise in upgrading a broad range of commercial and military aircraft.

Israel is also known to be one of only ten countries in the world that has an independent space-launch capability and Israeli aerospace firms have become world leaders in unmanned aircrafts (UAVs). According to a report by the consulting firm Frost & Sullivan, the sales turnover generated by the Israeli UAV industry was US $4.6 billion over the last eight years and more than 20 companies manufacture UAVs in Israel today. Some of these companies like IAI, Elbit Systems and Aeronautics, are capable of manufacturing a complete UAV system including the unmanned vehicle and its support systems. Other companies manufacture auxiliary and complementary systems such as payloads, control systems or specialized capabilities such as imagery analysis.

Like other components of the Israeli aerospace cluster, the UAV sub-cluster also relies primarily on sales to overseas clients, with a ratio of about 20% sales to the local market and 80% to foreign countries. In comparison, the US has four major UAV manufacturers (General Atomics, Northrop-Grunman, Lockheed-Martin, and a partnership between Boeing and AAI Textron) and most of these companies sell directly to the US military, with only 20% of their sales going abroad.

As Israel’s aerospace cluster continues to grow and evolve, an additional marker of success is the participation of Israeli aerospace companies in several large international projects, either as prime contractors and system integrators, or as team members and sub-contractors. BAE Systems, Boeing, CAE, EADS, Embraer, General Dynamics, General Electric, HAL, Lockheed Martin, Northrop Grumman, Pratt & Whitney,  

Raytheon, Rheinmetall Defense, Rolls-Royce-BMW, Saab group, Siemens, Snecma, Thales and many other firms are among those currently partnering with Israel's aerospace companies.

**Israel's Supply Chain with Detailed Products and Services**

<table>
<thead>
<tr>
<th>Design &amp; Avionics</th>
<th>Components and Assembly</th>
<th>Upgrading</th>
<th>MRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Requirement and assessment</td>
<td>• Large aircraft structural assemblies</td>
<td>• Aircraft modification and conversion</td>
<td>• Wide body and narrow body maintenance</td>
</tr>
<tr>
<td>• Cockpit architecture and displays</td>
<td>• Complex airfoils</td>
<td>• Civil to military conversions</td>
<td>• Engine MRO</td>
</tr>
<tr>
<td>• Real-time systems</td>
<td>• Ultra lightweight structures</td>
<td>• Passenger to cargo conversion</td>
<td>• Parts and components overhaul</td>
</tr>
<tr>
<td>• Aircraft environmental control</td>
<td>• Engine assemblies and components</td>
<td>• Aircraft and helicopter upgrading</td>
<td>• Logistics support and spare parts</td>
</tr>
<tr>
<td>• Navigation systems</td>
<td>• Aircraft Flooring</td>
<td>• Special mission adaptation</td>
<td>• Planning and optimization applications</td>
</tr>
<tr>
<td>• Cockpit architecture and displays</td>
<td>• Passenger &amp; cargo floor grid subassemblies</td>
<td>• Self protection enhancement</td>
<td>• Fuels and lubricants</td>
</tr>
<tr>
<td>• Lasers and EO systems</td>
<td>• Aircraft Structural Components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Obstacle avoidance and vision enhancement</td>
<td>• Door surround assemblies; pivot bulkheads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communications, data links, satcom</td>
<td>• Wings - Wing pairs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• In-flight entertainment</td>
<td>• Fuselage Sections – Fuselage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Testing and certification</td>
<td>• Prime integration of UAVs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Israel's aerospace cluster

Cluster Analysis

Factor Conditions

Israel's aerospace industry has the advantage of a highly skilled and experienced workforce, many of who are former IAF personnel and remain in the IAF reserves.
In addition, new aerospace systems developed in Israel have the advantage of being immediately tested by the IAF, sometimes in real-time missions.

However, due to the highly sensitive nature of exporting defense technologies, unlike other industries that also focus on exports (like agriculture, textiles, etc.), the operations of Israeli aerospace manufacturers focused on military components are subject to the supervision of the Israeli Ministry of Defense. Sources in the industry claim that the State of Israel, through the three MOD agencies, fails to manage the aerospace market in a manner that would maintain Israel’s advantage and export procedures are too burdensome.\textsuperscript{39} The export permit, for instance, allows a company to fulfill deals that have been closed, namely – to actually export the product or knowledge to the foreign client. From that moment on, every activity the company initiates in order to carry out a sale overseas must be reported to and sanctioned by the Ministry of Defense.\textsuperscript{40}

Sources in the industry claim that this procedure is nothing but over-complicated and burdensome red tape, while MOD officials claim that these mechanisms are intended to prevent classified technologies from reaching countries that are hostile to Israel, which could undermine the qualitative advantage of the IDF or cause diplomatic problems for Israel vis-à-vis friendly countries.\textsuperscript{41}

While the MOD needs to monitor the export of military technologies (and uphold certain treaties like the MTCR Treaty intended to prevent the proliferation of


platforms capable of carrying nuclear weapons), sources in the industry expressed frustration over having to go through the MOD even when the technologies are not for being sold for defense purposes. For example, when selling UAVs for agricultural, energy or homeland security purposes, UAV manufacturers are required to go through the same approval processed with the MOD. According to one source in the industry: “Today, all UAV elements may be obtained through the civilian market worldwide,...[in Israel] we still have to cope with the same supervision as for military systems. If we fail to see that the rules are changed, we will not be able to compete in the future world and our technological superiority will vanish.”

**Demand Conditions**

Due to the hostility of its neighbors, the IDF and IAF provide a constant and continuous demand for aerospace technologies and equipment in order to protect civilian interests. Nevertheless, much of Israel’s aerospace cluster revenue comes from abroad. US $3.5 billion out of US $5 billion in turnover was derived from overseas sales.

Israeli aerospace firms are limited, however, in their ability to sell directly to many foreign countries and firms. Notwithstanding the inability of Israeli firms to sell defense capabilities to hostile countries, Israel also imposes tight restrictions on sales to allied countries like China of defense equipment and technologies that have both civilian and military applications. The reason for this is that the US government
places restrictions on Israel’s ability to export military technology and equipment to China. As an example of the gravity of this agreement, Meir Shalit had to resign from his position as head of defense exports at the MOD for selling military equipment to China. Under pressure from the United States, Israel also must regulate arms sales to India, Russia, and many other East European countries. In 2010, the United States blocked state-owned Israel Aerospace Industries from bidding on a contract to upgrade India’s jet fighters despite the fact that U.S. firms were bidding as well.43

Faced with limitations on their ability to export defense technologies, and due to a shrinking market for military hardware over the last two decades, Israeli aerospace companies have made concerted efforts to employ their research and development teams to devise products for non-military markets and to adapt defense technology for civilian applications but more can and should be done in this area.

**Context for Firm Strategy and Rivalry**

By investing in research programs at academic institutions, the Government of Israel avoids picking winners and creates a competitive process whereby grants are administered based on the strength of application. The Government of Israel also relies on the private sector to commercialize the various technologies, which are forced to compete on the local and international market.

Because Israel’s aerospace cluster is export driven, the strong competition within the local cluster for international contracts counters the possible

---

inefficiencies that could result from the state ownership over Israel’s main aerospace firms.

While the prominence of the IDF and the MOD’s involvement in R&D in Israel has many advantages and despite the fact that state ownership of large companies has not led to inefficient company practices, state-involvement does not come without drawbacks, particularly for small private firms. Sources in the industry say that often times the first question international buyers ask is whether the technology is used by the IDF. The IDF’s seal of approval is a “big sell.” In this context, however, it becomes difficult for Israeli manufacturers to sell products that are not used by the IDF. In addition, because most of the products used by the IDF come from the larger manufacturers (like IAI), it is often times difficult for the smaller manufacturers to win international tenders.

Many small firms also complain that the IDF and MOF favor IAI and Rafael (state-owned companies) and also do not encourage collaboration among firms, resulting in “every company attempt[ing] to eliminate the others in the war over tenders” and many small firms opting out of the process before it even begins.

**Related and Supporting Industries**

The aerospace cluster consists of a strong net of suppliers and service providers. Although it lacks the necessary scale to become a large prime integration site for large aircrafts, it has an edge in other aerospace products and services such as the

---

UAVs. It benefits from strong connections with the defense cluster, the ICT and logistics cluster. Because defense capabilities are a top priority for Israel, ties between both clusters explain Israel’s progress in this aerospace sector. Israel’s aerospace cluster benefits first from the use of Israel airbases as testing centers as well. Moreover, the cluster is adapting military solutions to civilian use to diversify its production away from military only products and services. The strong ties with the high tech cluster in Tel Aviv enable the aerospace cluster to be an efficient provider of avionics solutions. Because Israel’s leading aerospace firms are state owned, they lack the ability to raise capital and attract private funding to develop new capabilities. Although Israel benefits from a large financial sector and a wide spectrum of financial funding, Israel’s state owned companies in the aerospace cluster do not benefit from this existing cluster to bolster their development and enforce large M&A strategies.

III. Strengthening Israel’s Aerospace Cluster

Country Level Recommendations

Priority 1: Continue and reinforce efforts towards decreasing the hostile environment and build economic relations with the neighboring countries

Hostile relationships between Israel and the Arab countries is an obstacle for Israel to use its full potential in trade with neighboring countries. This is the responsibility of the foreign office of Israel with help of the allies.

Priority 2: Reduce the number of ministries and improve transparency in government decision-making
The World Bank ranks Israel 81st in tax bureaucracy, 94th in contract enforcement and 139th in obtaining construction permits. This negatively impacts productivity, growth potential and business environment overall. As of 2013, there were 67,000 government employees. It is recommended to revisit the previous attempts of administrative reforms, identify weaknesses in approaches and consider adapting the balance scorecards or other performance management techniques being widely used in the corporate world to the public sector. The revisited administrative reform should cover both organizational design of the government and specific policies and regulations such as housing and building regulations to expedite land and construction permits.

Priority 3: Improve vocational training program to increase the number of specialists and further integrate the minority populations

The Ultra-Orthodox, Arab Israeli and other minority groups need to be trained to increase labor productivity overall in the country. This is the responsibility of the Ministry of Internal Affairs.

Cluster Level Recommendations

Priority 1: Improve the Ministry of Defense’s export authorization procedures for aerospace technologies. The MOD must streamline and improve the efficiency of its approval processes. Manufacturers need to be able to respond and adapt to client demands and cannot be delayed by red tape and long approval processes imposed by the MOD. Supervision and involvement of the MOD in the export process

---

needs to be adapted to the changes that are taking place in the global market-place (for example, restrictions imposed on UAV exports), and there should be different approval standards for defense technologies that are being used for civilian purposes. As a start, the Government of Israel should create a commission to encourage an open dialogue between the industry and the Ministry of Defense. This forum will allow manufactures to present their frustrations and ideas for improving regulatory processes, while the MOD will have the opportunity to explain its business, political and security considerations and priorities. The goal of the Commission should be to reach a compromise on processes that will work for both the MOD and the industry. The Government of Israel should also consider incorporating the Ministry of Economy into the MOD export control process.

Currently, decisions related to the export of military technologies falls solely to the Ministry of Defense (SIBAT, DECA, and MAFAT). Adding a body with an economic perspective and ties to foreign countries could help balance the decision between commercial and political interests.

**Priority 2: Reevaluate export restrictions to foreign countries imposed by the United States.** Israel should place gaining permission from the United States to sell weapon systems to “sensitive countries” like China and India on the top of the diplomatic agenda. Given the importance of the defense industry to Israel, and its reliance on exports, opening up new markets in Asia will create an enormous new source of revenue and jobs for Israel’s economy. While a best-case scenario would be the loosening of all restrictions, Israel can start with asking for permission to export “dual-use” technologies that can be used by both civilians and the military.
**Priority 3:** Encourage more emphasis on the commercialization of aerospace technologies for civilian use through a dedicated R&D grant. As the defense market worldwide is experiencing a decline, Israel’s aerospace cluster should strengthen its offer for the civilian use aerospace. We suggest dedicated grants for Research and Development on civilian adaptation of existing military solutions. Israel aerospace cluster’s R&D centers would focus part of their work on adapting existing military aerospace solutions to civilian use. One area of emphasis could be the development of non-military UAV. The cluster could exploit its worldwide leadership in the drones market to seize the growing market of non-military drones.

**Priority 4:** Consider privatizing IAI and/or Rafael, and at the very least level the playing field for all firms. One prediction from the Ministry of Finance stated that offering 25-49% shares of each company to private investors could deliver $4-5.4 billion in a few years. The Government of Israel should initiate a comprehensive study of the pros/cons associated with privatization of IAI and Rafael to form the basis of strategic ownership structures going forward. Regardless of the outcome of the study, the Ministry of Defense should encourage smaller companies to participate in tenders and create opportunities for firms to collaborate on projects, particularly small and large firms together. The Government of Israel should also consider getting of the Law for the Encouragement of Capital Investment, which favors big companies and also makes it more difficult for state-owned companies, like IAI (that cannot receive benefits from the law by virtue of

---

being state-owned) to compete. Finally, the IDF should consider not disclosing which technologies it uses for its own purposes, in order to avoid the “signaling” effect that leads to problems for small firms that do not sell to the IDF to win international projects.

*Priority 5:* Explore opportunities to build industrial zones in the periphery of the cluster, particularly in the Negev where IDF headquarters are relocating over the next decade. Beginning in late 2014, the IDF began relocating soldiers (~10,000) to a new training base south of Beer Sheva. The $650 million construction project of a new base is the IDF’s largest in three decades and the project is part of a broader move to relocate military facilities to the Negev. This creates an opportunity for the industry to relocate some of its efforts away from the center of the country where real estate is more expensive to the desert where real estate is cheap, and maintain strong relationships with the IDF.