



Israel's Defense Industry and US Security Aid

Sasson Hadad, Tomer Fadlon, and Shmuel Even, Editors



Memorandum
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Institute for National Security Studies

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Memorandum No. 202

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Executive Summary

The defense industries in Israel are essential in a number of respects. For one thing, Israel cannot always rely exclusively on external procurement sources. Domestic production is thus an integral part of research and development. It makes it possible to adapt unique weapons systems to the changing needs of the Israel Defense Forces (IDF) – systems that provide a critical edge to the IDF on the battlefield. Independent production capability is particularly important during a conflict in which the supply chain is affected, or when there are political restrictions on the use of certain types of arms. In the economic sphere, although the defense industry does not account for an especially large slice of Israel's GDP, it is one of the country's high-tech engines and a source of quality work for thousands of employees. In the political sphere, its ability to supply advanced military solutions to other countries contributes to those countries' support for Israel.

In the summer of 2018, a research team on the subject of Israel's defense industries was assembled at the Institute for National Security Studies (INSS) to focus on ways of dealing with a major change in the most recent US aid agreement: the end of the conversion of dollar aid into shekels.¹ In the discussions conducted by the team, a number of negative effects of this change on the defense industries in Israel were highlighted. The first is a drop in the revenue of companies resulting from the expected reduction in local IDF procurement. Less IDF procurement is also likely to have a negative impact on arms exports, both because the viability of production rests on economies of scale and because part of Israel's defense exports depends on the IDF's reputation and experience. Some companies in the domestic supply chain may face the risk of closure. Furthermore, some local technological knowhow may well be lost when companies close down or relocate overseas with their employees. Employment will also be negatively affected – anywhere between several thousand and 20,000 of the 80,000

jobs in the defense industries in Israel will be lost. The Ministry of Defense believes that the higher number is more accurate, while the Ministry of Finance holds that the lower number is a better reflection of the situation and also believes that most of those who lose their jobs in this field will quickly find work elsewhere. Another consequence of the change is a negative effect on employment in communities that depend on factories selling to the Ministry of Defense. In addition to all these factors, it should be acknowledged that it is easy to dismantle defense industries, but far more difficult to rebuild them if and when they are needed.

Principal Policy Recommendations

The Israeli government must prepare now for the drastic change in the conversion of aid dollars into shekels scheduled for 2025. This should include the following simultaneous efforts:

1. Prioritizing the allocation of local funding for the survival and development of special defense industries, maintaining strategically important R&D, and retaining key personnel in the field. The defense industries should be mapped and criteria set for this purpose;
2. Granting aid to local companies in order to increase exports;
3. Consideration of mergers in the industry, mainly of small companies into large ones, in order to achieve economies of scale;
4. Efficiently using aid in foreign currency that also takes the defense industries into account. Examples range from the inclusion of Israeli companies in procurement orders from American companies to closer cooperation with American companies, and moving some production and subsidiaries of Israeli companies to the United States.
5. Encouraging reciprocal procurement by American companies (although the aid agreement does not require any reciprocal procurement by these companies);
6. Extending aid for the conversion of companies, units in companies, and personnel from defense production to civilian production; and
7. Offering advice and assistance, especially for small companies in the defense industry.

In addition to the recommendations specifically referring to the state of the defense industry in Israel, the team contends that the aid agreement

constitutes a key element in the special relationship between Israel and the United States. Future changes in the agreement must therefore be gradual and include the consent of both parties to avoid giving the mistaken impression of substantial damage to this relationship. The team emphasizes that the special relationship between the two countries must be preserved, even at the cost of short-term damage to the Israeli defense industry, because in the long run, adopting the recommendations listed above is likely to prevent long-term damage. The special relationship and the American aid, which began during the Yom Kippur War, were very important when the Israeli economy was not strong, and are still important now, when Israel is one of the world's most developed countries.

Note

- 1 The US aid agreement pertaining to Israel's defense industries, signed anew in 2016, includes a clause that gradually ends Israel's option of annually converting 25 percent of the aid from dollars to shekels, which was hitherto used for the procurement of equipment from Israeli defense companies.

Preface

The Israeli defense industry is one of the most prosperous industries in Israel. It originally emerged as a response to the country's immediate military needs and to cope with restrictions on arms procurement from abroad. Today, the Israeli defense industry manufactures advanced weapons systems for the Israel Defense Forces (IDF) and enjoys a high rating in the global arms market. According to the Stockholm International Peace Research Institute (SIPRI), Israel is in eighth place in the world in arms exports, and in first place in defense exports in relation to its size.

Despite the capabilities of the local defense industry, most of the IDF's military procurement is from the United States through US Foreign Military Financing (FMF). At the end of the previous American aid plan, which covered the years 2009-2018, defense aid amounted to \$3.1 billion annually, not including contributions to joint projects by the US Department of Defense. Since 1985, all American defense aid to Israel has been in the form of grants, due to Israel's economic difficulties. In addition, since the 1980s, Israel has been allowed to systematically convert part of the aid into shekels ("conversions") for the purpose of procurement from local industries. This money was used to fund the Lavi project and, since that project was shut down, to finance IDF procurement from local industries. For example, in the last five years of the previous aid program, 2013-2018, the amount converted was \$815 million a year (26.3 percent of the \$3.1 billion FMF total). The conversions were and remain a key source of income for the defense industries.

In September 2016, Israel signed a memorandum of understanding (MOU) with US President Barack Obama for an aid program for 2019-2028, starting in October 2018. The framework of the program was \$33 billion in FMF and \$5 billion more in financing for joint projects (mostly anti-missile defense programs) – a total of \$38 billion over 10 years. The new aid

program stipulates a gradual decrease in the conversion option, until its total elimination in 2028. A steep decrease in the proportion of conversions was set for the period after 2025, and this is likely to have serious consequences for the local defense industries.

In view of this situation, in the summer of 2018, Brigadier General (res.) Dr. Sasson Hadad, head of the INSS program for Economics and Security, assembled a research team on the subject of the defense industries and ways for Israel to deal with the expected decline in conversions. The team members were:

- INSS senior research fellow Colonel (res.) Dr. Shmuel Even, a consultant for corporations and government ministries,
- Dr. Tomer Fadlon, a researcher in the INSS economic program,
- Former Tel Aviv Stock Exchange managing director and chairman Saul Bronfeld, and
- Lior Mertens, who worked with the defense industries in Israel for several decades.

Other people who contributed to the team's work were economist and entrepreneur Prof. Moshe Gerstenhaber, Colonel (res.) Tzachi Segev, Rafael Advanced Defense Systems CFO David Vaish, INSS research assistant Liran Dostov. Representatives of the Ministry of Finance and the Ministry of Defense also joined the team.

The team held meetings with senior representatives from the IDF, the Ministry of Defense, the Ministry of Finance, the Bank of Israel, the Administration for the Development of Weapons and Technological Infrastructure (MAFAT), the defense industries in Israel, and academic researchers dealing with the subject. Meetings were held with former Minister of Defense and IDF Chief of Staff Lieutenant General (res.) Moshe (Bogie) Ya'alon, Major General (res.) Yaakov Amidror, former Governor of the Bank of Israel Dr. Karnit Flug, MAFAT head Brigadier General (res.) Dr. Danny Gold, former US Ambassador to Israel Daniel Shapiro, and others.* The team also held a seminar on March 31, 2019, with the participation of Ministry of Defense director general Major General (res.) Udi Adam, Israel

* Other people who made presentations and held discussions with the INSS team were Ministry of Defense chief economist Ze'ev Zilber, Prof. Asher Tishler, Dr. Yaacov Lifshitz, Brigadier General Guy Paglin, Colonel Gil Pinchas, Lieutenant Colonel Guy Elfassy, and Manufacturers Association of Israel President Shruga Brosh.

Aerospace Industries (IAI) president and CEO Major General (res.) Nimrod Sheffer, Elbit Systems president and CEO Bezahel (Butzi) Machlis, and Rafael Advanced Defense Systems CEO Major General (res.) Yoav Har-Even.** All of the participants emphasized Israel's strategic need to continue its development of independent weapons production capabilities. Vaish said at the seminar that the elimination of the conversions would have a greater effect on Rafael than on Elbit Systems and IAI, because the proportion of Rafael's sales to the Ministry of Defense was double that of the other two large companies.

This memorandum contains a diverse collection of views presented by the team. The first part includes two articles that provide a broad perspective of the defense industries in Israel and worldwide. In the first of these, Dr. Yaacov Lifshitz, a lecturer in defense economics and former economic consultant to the Ministry of Defense and Ministry of Finance director-general, outlines the role that Israel's defense industry can and should play in the coming years. According to him, the balance of the global defense industry's roles changed in the aftermath of the Cold War. Gaps have emerged in various areas between the capabilities required to optimally meet the revised strategic needs, while at the same time the industries' economic importance has waned. Lifshitz finds that the defense industry fulfills no important macroeconomic function at the present time. Therefore, he posits, the character of the defense industry that Israel needs should be molded by weighing the security threats it faces, on the one hand, and its potential contribution to reducing them, on the other.

In the next article, Prof. Asher Tishler and Colonel Gil Pinchas address the challenges facing the Israeli defense industry in the competitive context of the global defense market. Tishler and Pinchas note that the Israeli defense companies serve a very small defense establishment in comparison with

** In addition to this list, former National Security Council head Major General (res.) Yaakov Amidror, former chief Israeli negotiator Brigadier General (res.) Prof. Jacob Nagel, Ministry of Defense chief economist Ze'ev Zilber, Rafael Advanced Defense Systems CFO David Vaish, Ministry of Finance deputy budget director Eli Bing, former Ministry of Defense head of R&D Brigadier General (res.) Nir Halamish, Prof. Asher Tishler, MAFAT head Brigadier General (res.) Dr. Danny Gold, Dr. Yaacov Lifshitz, Colonel Gil Pinchas, and Lieutenant Colonel Guy Elfassy also made presentations at the seminar.

those of the United States, Russia, and Western Europe. The lion's share of their production is therefore designated for export. According to the authors' findings, private defense firms are more efficient and have better marketing capabilities than government-owned companies.

The second part of the collection presents the viewpoints of officials who conducted the negotiations that led to the MOU, signed in September 2016, that is being applied in the current American aid program (2019-2028). Brigadier General (res.) Prof. Jacob Nagel outlines the Israeli viewpoint. He describes the ups and downs in the dialogue between Israel and the United States during a tense period in their relations, especially in view of the dispute over the nuclear agreement with Iran supported by President Obama and the speech by Prime Minister Benjamin Netanyahu to the American Congress in March 2015. The two sides nevertheless signed the MOU for a further decade of aid, which reflects the US' longstanding commitment to Israel's security. Nagel deems the MOU an excellent agreement that (nominally) increases the amount of aid granted to Israel by the United States and facilitates long-term planning by the IDF. From the other side, US Ambassador to Israel Daniel Shapiro explains the American viewpoint. Shapiro, now a Distinguished Visiting Fellow at the Institute for National Security Studies, holds that the MOU achieved the core goals of both countries. It extended their defense cooperation by setting levels for American military aid over the coming decade, guaranteed Israel's ability to maintain a qualitative military edge, provided stable and predictable financing for joint anti-missile programs, and revised the aid program in the US in order to maximize its influence and effectiveness. Shapiro adds that the agreement took Israel's impressive growth and development into account. He emphasizes that as in any negotiations, there was a need to resolve differences of opinion and attempt to attain harmony on disputed points, but nevertheless the negotiations were conducted professionally and with mutual good will. The result was an agreement that serves the interests of both parties.

The third part of the collection deals with the new agreement's effect on the defense industries in Israel. Lieutenant Colonel Guy Elfassy, Dr. Ronny Manos, and Prof. Asher Tishler hold that the new agreement dramatically changes the conditions for receiving defense aid in comparison with the previous agreement. Their article has two main objectives: to present a database with information from the mapping of 603 defense companies

operating in Israel, and to develop a model for estimating the vulnerability (or resilience) of an Israeli defense company to the new MOU. The article compares the model's results to questionnaires sent to 50 senior executives at defense companies. According to the results, a defense company's resilience depends on its level of technology, the industrial sector in which it operates, its location in Israel, and its ability to cooperate with companies in the United States.

The sixth article in the collection addresses the budgetary challenge. Here, former Tel Aviv Stock Exchange managing director and chairman Saul Bronfeld notes the growing needs posed by the Iranian threat, on the one hand, and the anticipated gradual elimination of shekel resources from US aid money, on the other. Bronfeld cites three areas in which the defense budget's effectiveness can be enhanced. First, he says, there is a need to better align the directions of research and development and force building with the defense concept and the IDF's strategy. The second is the need to remove obstacles to realizing the technological potential, so that the IDF and the defense industries can supply effective weapons systems in rapid development cycles at low cost. The third is awareness of the human and command factor.

The final article in this section is by Brigadier General Guy Paglin, head of the Ministry of Defense's Merkava and Armored Vehicles Directorate. Paglin analyzes a number of trends now influencing the defense innovation apparatus in Israel in general, and the defense industry in particular. He lists a number of trends: the technologies transfer revolution and the use of shelf products in weapons; the changing character of warfare, the threats, and the weapons required; the information revolution and the emergence of the cyber dimension; the relative decline in investment in defense research and development (in comparison with commercial R&D); and the expected decrease in orders resulting from the changes in the new aid agreement with the US. In Paglin's opinion, these trends pose major challenges to the defense establishment, and require an effort involving multiple government ministries that will enable Israel to maintain the IDF's relative advantage through the Israeli defense industries and preserve the attractiveness of their exports.

The fourth and final part of this collection offers a broad perspective of the aid agreement and American aid to Israel. The two articles in this section were written by two scholars in the INSS Economics and National

Security Program. Dr. Shmuel Even claims that the indisputable great benefit of American aid to Israel outweighs the disadvantage of dependence on the United States. First of all, even without the aid, he argues, Israel's political and security dependence on the US is very high, due to its willingness to sell the most advanced weapons to Israel and especially its support for Israel in decisions by international bodies. On December 23, 2016, this was highlighted by an event in which this support was withheld, when the Obama administration refrained from vetoing an anti-Israel resolution in the UN Security Council. It is difficult to envision strategic scenarios in which forgoing aid will increase Israel's freedom of action vis-à-vis the United States. Second, the aid does not consist only of grants for procurement purposes; it also provides regular access on preferential terms to the purchase of advanced weapons in the rest of the world. The aid makes an enormous contribution to IDF force building. In the test of time, the American weaponry received by Israel outperformed the Soviet weaponry in the hands of Israel's enemies. The aid was granted in 10-year programs, thereby enabling the IDF to make long-term force-building plans (Israel would have difficulty undertaking such programs from its own resources). The aid is also augmented in difficult defense crises. Third, without the aid, Israel would have to devote more of its own resources to defense at the expense of essential civilian needs and/or accept a much higher level of security risk. In the political sphere, the aid is a concrete expression of great and continuous commitment by the US to Israel's security, which too is of great significance in deterring Israel's enemies. Additionally, the aid is accompanied by the principle of the preservation of Israel's qualitative military edge in the Middle East, which restricts American arms exports that are liable to contravene this principle. Finally, even after the conversion option is drastically cut in 2025 and later eliminated, Israeli industry will benefit from involvement in the production of American weapons that will be purchased with FMF aid, from funding by the US Department of Defense for joint projects, and possibly also from reciprocal procurement by American companies and joint exports to other countries. Future changes in the aid terms, if any, will require reconsideration.

The concluding article in the collection presents an opinion that differs slightly from Even's. Here, Brigadier General (res.) Sasson Hadad presents a cost-benefit analysis of the aid agreement. His main contention is that in the overall balance between cost and benefit, it appears that most of the benefit

can be obtained regardless of the amount or existence of the aid agreement, in comparison with the drawbacks, which become mostly irrelevant with cancellation of the agreement. Hadad contends that the aid, which amounts to approximately 1 percent of Israel's GDP, 2.5 percent of the state budget, and 20 percent of the defense budget, is important, and brings considerable advantages, including direct access to the political and defense establishment in the United States. The agreement does have major drawbacks, however, reflected in Israeli dependence on the US. These drawbacks are highlighted in trade with China, the possibility of political conditions recently advocated by some representatives of the Democratic Party in the Palestinian context, legitimacy for aid and advanced weapon sales to Arab countries, and an absolute preference for American technology and weaponry in the IDF force build-up, a preference that has intensified with the elimination of the ability to convert the aid in the new agreement.

This memorandum, which is very diverse in terms of its authors and the topics they cover, sheds light on both the defense industries in Israel and the agreement for US aid to the Israeli defense establishment. Its goal is to bring these topics into the public discourse and to encourage discussion on these matters.

One closing point: the articles that appear here were written in 2019, that is, before the coronavirus crisis hit Israel and, indeed, the whole world. If anything, the ongoing pandemic has highlighted the need for an independent, strong security industry that can adapt to a range of situations: in Israel, the industry quickly mobilized to apply its resources to produce ventilators, for example. This is an angle for future research. For now, we hope that you will find the articles that appear here to be interesting and beneficial.

Sasson Hadad, Tomer Fadlon, and Shmuel Even
Editors
Tel Aviv, July 2020

Part 1

The Security Industries in Israel and the World

The Strategic Importance of the Defense Industries in Israel

Yaacov Lifshitz

The development of the defense industries in Israel has been characterized by radical and sometimes contradictory changes. They were built to serve local military needs, yet in recent decades the bulk of their activity does not involve supplying the Israel Defense Forces (IDF). Initially, the defense industries' role was derived from restrictions imposed by foreign governments on the supply of weapons systems and military equipment to the IDF. Later, however, following the United States' willingness to extend military assistance to Israel, including monetary grants to pay for the imported goods, that role changed and its development took a different course. Defense exports began as a secondary business, mainly in order to balance domestic demand fluctuations and to lower research and development (R&D) and production costs for the IDF. In time, exports grew so rapidly as to place Israel among the world's largest defense exporters. Somewhat paradoxically, the earlier dependence on foreign suppliers has been replaced by a dependence on overseas customers. Up until the 1980s, the defense industries retained important direct influence on the development and structure of the Israeli economy, but since then their relative share has declined and they no longer constitute an influential economic actor.

Now, at the beginning of the third decade of the 21st century, it would be appropriate to open-mindedly re-examine what role Israel's defense industries can and should fulfill in the coming years.

Dr. Yaacov Lifshitz specializes in Defense Economics. He is a former director-general of the Ministry of Finance and former economic adviser to the Ministry of Defense.

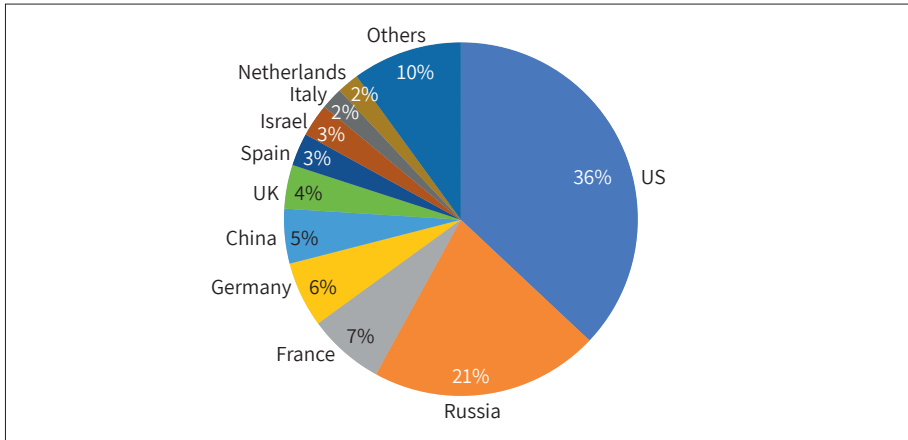


Figure 1: Global Defense Exports 2014-2018

Transforming the Balance between Roles

The mainstream explanation of defense economics for the development of defense industries¹ is that at early stages countries invest in the building and development of their defense-industrial base (DIB) for strategic and political reasons, i.e., to meet genuine and perceived defense needs, to avoid dependence on military supplies from other countries, and to obtain leverage in political bargaining and promote the country's position in the international theater. With time, however, strategic and political motives are supplemented by economic and technological incentives. Countries consider the defense industry as a stimulus for economic growth, a focus of industrial development, a framework for professional training of the local labor force, and a source of technological innovation for other sectors in the economy. Countries have also expanded their defense production to provide high-quality employment and strengthen their balance of payments. The economic role gradually gained standing in the national order of priorities, and the original defense production was no longer seen as merely fulfilling a strategic role. Indeed, strategic needs and economic considerations are not always compatible; there is sometimes inherent tension, and even contradictions, between them. The policy set by countries concerning the size of their DIB, its composition, and the directions of its development therefore aims at achieving an appropriate balance between fulfilling defense requirements and favorably contributing to the economy.

In the post-Cold War era, certain processes emerged that altered the balance between roles that characterized the defense industry in previous decades. Reduced defense spending and decreasing demand for security products and services led to an unprecedented wave of mergers in the industry, mainly in the 1990s, leading to increased concentration and less competition. In some countries, this consolidation was accompanied by privatization. The new corporate giants were large in comparison with government procurement budgets (except in the United States), and soon became eager to expand their foreign sales. For their part, governments had to accept some corrosion of their traditional influence on the domestic DIB.

Another major process, the internationalization of the defense industry, had similar consequences. Defense industries once operated within national boundaries. After the Cold War and in the globalization era, however, borders – even of the DIB – became blurred. Internationalization manifested itself in the growing share of export sales, and also in acquiring holdings and/or establishing subsidiaries overseas, in globalization of the supply chain, joint ventures, and other forms of collaboration between firms from different countries. For companies, internationalization creates opportunities, but at the same time it can have an eroding effect on their dominance in the domestic market. In any case, linkages between companies and their home economy become looser. For governments, most of them admittedly view internationalization as an inevitable development, even though it further diminishes their influence on the DIB in their countries.

Additional trends that influenced the balance between the two competing roles of the defense industry were a narrowing of the distance between defense and civilian industries and the growing reliance of the defense establishment on outsourcing and on purchasing services from private military companies. In recent decades, defense production has increasingly relied on dual-use technologies developed in the civilian sector and on commercial off-the-shelf components. One of the motives for this was to find ways to curb the ongoing rise in the unit costs of weapons systems and other military products. A no-less-important catalyst, however, was a change in the direction of interrelations between civilian and military technologies. Up until the 1980s, developments in military technology spearheaded technological developments in the civilian sector, and the defense industry was perceived as a source of technological innovations spilling over and benefiting the entire

economy. Later, the pace of innovation in the civilian sector accelerated, and in certain areas – particularly electronics, communications, and information technologies – the roles were reversed: the civilian sector took the lead in cutting-edge technologies, prompting the defense industry to focus on “spill-ins” – that is, on ways to exploit civilian technologies for military uses.² Under these circumstances, one of the main channels through which defense R&D and production contributed to the economy lost much of its importance. Furthermore, the civilian high-tech industry knows no borders, and the supervision of technology transfers between countries, including civilian-developed technologies that are used for military purposes, is very difficult, and sometimes impossible. Consequently, the defense industry might lose some of its strategic importance too. Indeed, its adoption of civilian-developed technologies that cannot be kept away from foreigners’ reach considerably restricts the ability to fulfill strategic roles.

The magnitude of outsourcing has grown rapidly. This has been coupled by extraordinary diversification in purchased services, extending even to services supporting actual combat that are provided in conflict zones. The accelerated growth of outsourcing was mainly a response to the downward trend in defense budgets, the assumption being that outsourcing would make it possible to release budget resources, whether by spreading spending over a longer period or through savings achieved due to the greater efficiency of commercial enterprises. In any event, it added new actors to the circle of defense ministries’ suppliers and brought about significant change in the traditional features of the DIB. The relatively restricted club of well-established companies developing and manufacturing complex and technology-intensive systems and equipment, while maintaining special symbiotic relationships with the military customer, is giving way to a diverse assortment of entities, including ad hoc combinations of firms with different expertise,³ having looser relations with the military customer, on the one hand, and offering non-typical elements – e.g., long-term financing – on the other.

The balance of the defense industry’s roles is naturally also greatly affected by changes to the “threat map.” A nuclear conflict between rival powers or large-scale conventional interstate wars have become far less likely than ever before; they have been replaced by the threat of low-intensity conflicts of various types, intrastate and transnational, most of which are asymmetric in nature, between sovereign states and non-state entities. In parallel, concerns

regarding the proliferation of weapons of mass destruction – the development of nuclear capabilities by countries and the spread of non-conventional weapons to various organizations – have grown. Due to these changing threats, a large proportion of the arsenal accumulated during the Cold War is unsuitable for today's tasks, and correspondingly capabilities that formerly gave leading companies advantages have become completely irrelevant. Meanwhile, demand has risen for the R&D and production of new products, some of them based on technologies rarely applied previously to military uses, and for other products that are available from small manufacturers operating under competitive conditions.⁴ The strategic role, responding to unclear threats and diverse possible scenarios, and to rapidly changing operational requirements, has thus dictated a different approach to that which prevailed during the Cold War. In particular, a new approach to R&D and production was needed that would significantly shorten the time lag between an emerging idea and its realization through full deployment in the order of battle. Priority has been given to flexible R&D and production systems offered by “lean” companies that rely to a large extent on outside suppliers and subcontractors.

In short, developments in the past three decades have led to two main conclusions about the defense industries' roles, and the balance between them. One is that their economic role has waned, particularly due to the looser ties between them and their home economy, because of the reversal of technological innovation flows, and as a result of the erosion in governments' influence on the DIB in their countries. The second conclusion is that, in certain areas, gaps have emerged between the desired and the actual capabilities of the DIB, possibly impairing the ability to provide an optimal response to current strategic needs.

The Defense Industry in Israel: Milestones

Over the years, the balance between the strategic and economic roles performed by the defense industry has changed in Israel, as it has elsewhere. Furthermore, significant changes have also occurred within the strategic roles.

In Israel's early years, it encountered political difficulties in acquiring military weapons and equipment from abroad,⁵ and so adopted a dual approach to procurement: maximizing opportunities for overseas procurement, if any, on the one hand, and investing extensive resources in building a local

defense industry, on the other. The domestic defense industry was thus perceived primarily as a release from absolute dependence on foreign supply sources. An inverse relationship therefore existed between the availability of procurement opportunities from abroad and the importance attributed to strategic independence, and hence to the domestic defense industry and the tasks it was called on to perform. Up until the Six Day War in 1967, in addition to production of light weapons, ammunition, and spare parts and maintenance work, Israel developed an impressive production capacity in renovating, converting, and upgrading weapons, successfully applying it also to new weapons systems procured overseas. As long as Israel had regular supply ties with France, however, local production for defense remained relatively limited in scope. But the situation completely changed when France ceased to provide supplies, and imposed an embargo on arms transfers to Israel. No alternative sources of procurement could be found, the defense industry's tasks expanded substantially, and domestically its importance in ensuring strategic independence grew. In particular, the domestic defense industries were called upon to supply the IDF with major weapons systems, and they began to develop and produce a fighter aircraft, a main battle tank, missile boats, and various types of missiles. Yet later, when Israel was offered the option of buying arms and military equipment in the United States, the importance of independence gradually waned again, and the priorities in the strategic roles of the defense industry changed. An important moment was the decision in 1987 to halt the development and production of the new Lavi aircraft and to reallocate some of the resources to substitute programs. This reflected a policy that assigned secondary importance to independence, especially where platforms for major weapons systems were concerned, emphasizing instead the notion that the domestic defense industries should supply the IDF with a range of "force multipliers" by means of original and unique technological solutions.

The use of advanced technologies and original development was not new in itself. Indeed, domestic R&D and production had always followed the IDF's actual operational needs, attempting to respond to them with original solutions. At first, technology and original developments were regarded as a way of attaining arms with superior, or at least equal, capabilities to those of the enemy. Starting in the 1970s, technological options also assumed a central role in implementing doctrinal changes: not merely improving

arms performance within the framework of existing military doctrines, but influencing the way military forces conduct operations, which in turn affected force structure, the type of equipment to be used, and eventually the scope of operational objectives that might be accomplished.⁶ The growing reliance on advanced technologies and innovative self-development was supported by two complementary trends. The first was the diversified industrial base that meanwhile was expanding in Israel, demonstrating advanced technological skills, thereby dispelling earlier doubts and reinforcing recognition of the industry's ability to offer innovations that might serve the IDF as force multipliers. The second trend was revealed in the global arms market; it turned into a buyers' market, making weapons manufacturers more willing to offer innovative systems, including systems based on advanced technologies. Apparently, only unique self-development of products not available for sale in the global arms market that could be concealed until used on the battlefield was capable of granting surprise advantages, which could prove to be decisive.

Table 1: Ranking of the world's 100 leading defense companies and their sales volume in millions of dollars, according to the Stockholm International Peace Research Institute (SIPRI)

Company	2002	2010	2017
Elbit Systems	45 (860)	40 (2,480)	28 (3,220)
Israel Aerospace Industries	27 (1,260)	41 (2,400)	41 (2,480)
Rafael	51 (720)	55 (1,780)	45 (2,210)
IMI	92 (350)	–	–
Elisra	93 (350)	–	–

Source: SIPRI

Significant changes have also taken place over the years in the defense industry's contributions to the Israeli economy. Domestic defense production expanded rapidly after the Six Day War, thus establishing the defense industry as an important factor that had tremendous influence on macroeconomic

developments and structural processes in the economy over the ensuing two decades. Among other things, its accelerated growth played a key role in the exit from the mid-1960s recession in Israel; in creating employment opportunities for scientists and engineers who immigrated to Israel in the early 1970s, mainly from Western advanced industrial countries; in launching structural changes by raising the share of high-tech industries in the economy; in promoting geographic distribution of the industry through the establishment of new plants in development areas; and in improving the quality of manufacturing industries to meet the high standards required in defense production. During this period, the share of defense exports in overall industrial exports quadrupled. In other words, defense exports became a significant component of Israel's balance of payments, and a valuable source of foreign currency for the economy. But in the 1990s things changed: growth in the defense industries came to a halt and their activity declined, while the economy as a whole grew relatively quickly, at extraordinary rates in some years. The balance of payments improved, with Israel becoming a creditor rather than a debtor economy, accumulating large foreign currency reserves in the first decade of the 21st century. By all measures the share of the defense industry in the economy fell, and it no longer can be perceived as maintaining any special macroeconomic importance.

Where structural effects are concerned, it would be impossible to exaggerate the importance of the contribution made by the defense sector – the IDF and the defense industries – to Israel's moniker as the “start-up nation.” But, as in other developed countries, things have also changed in Israel, and most of the civilian high-tech industry is no longer linked to or currently influenced by defense-related activities.

What Kind of Defense Industry Does Israel Need?

Based on the relative weight of the defense industry in the economy and in industry in the 2020s, it is still an important economic sector, but it is not expected to play a significant macroeconomic role. In other words, economic growth, the level of employment or soundness of the balance of payments are unlikely to be greatly affected for better or worse by contemporary trends in the defense industry. Defining the desirable DIB is therefore free of macroeconomic considerations, or at least does not have to regard such considerations as decisive, especially when they conflict with defense needs.

The parameters of the defense industry that Israel needs at this time should be determined by an in-depth assessment of the security threats facing Israel, on the one hand, and the industry's potential contribution to reducing them, on the other. Security threats are often divided into three categories: terrorist threats against the home front and against overseas targets identified with Israel; conventional conflicts at varying levels of intensity with neighboring enemies, both state and non-state; and remote threats from an enemy with which Israel has no common border (threats that are liable to include the use of non-conventional weapons). The defense industry may contribute to dealing with the various threats in several ways: guaranteeing the IDF's technological superiority through the development and production of force multipliers based on advanced technology; promoting independence, continuity of supply, and a degree of freedom in the use of military systems; and enhancing deterrence. The threats are all serious, but their degree of severity varies. Similarly, all the contributions that the domestic industry is likely to offer are important, but their relative effectiveness against each type of threat is not the same. Also, the technological and industrial capabilities for offering solutions for dealing with the threats – whether existing capabilities or those that can be developed within a reasonable time and at reasonable cost – are not necessarily identical.⁷

A systematic review of the above array of considerations may lead to surprising conclusions, namely, a not obvious ranking of the roles that the domestic defense industry must fulfill. For example, remote threats (mainly the Iranian nuclear program) are regarded as extremely grave, yet the potential contribution of the domestic defense industries for coping with these particular threats is limited. Although technological superiority and independence in the supply and use of military systems rank relatively high on the scale of effectiveness, with respect to capabilities, despite considerable progress in anti-missile defenses, satellites, etc., there are still wide gaps. Essentially, these capabilities belong to the playing field of major powers, and narrowing the gaps, if at all possible, involves enormous cost and time. In addition, lack of adequate capabilities renders the deterrent effect ineffective. All in all, the severity of the remote threats notwithstanding, coping with them cannot be ranked as a top priority of the domestic defense industry, and thus this remains a secondary consideration in shaping the desirable DIB.

Terrorist threats, on the other hand, may be regarded as less severe, but taking into account effectiveness and capabilities, the roles of the domestic defense industry in coping with them are of the greatest importance. The industry's existing technological level and industrial skills can offer solutions that will limit such threats to bearable proportions. At the same time, terrorism is elusive and unpredictable, and is liable to appear in new unknown forms. A rapid response capability is therefore needed, and no less important, the option to use counter-terrorism means free of restrictions that foreign supplies might include. Evidently, the domestic defense industry has clear advantages in this regard.

To summarize, the roles that the domestic defense industry must fulfill and their relative importance are derived from the gravity of the threats, the effectiveness of the response, and existing capabilities or capabilities that can be developed within a feasible time and at a reasonable cost. Naturally, different people may have different assessments of each of the variables in the equation, thereby reaching different conclusions regarding the desirable DIB. Furthermore, the gravity of the various threats is liable to change from time to time, as is an evaluation of the relative effectiveness of the defense industry's potential contribution to dealing with them. Finally, all these variables should be reassessed periodically to better understand the shifting role of the defense industries in Israel.

Notes

- 1 The mainstream school of defense economics follows the neoclassical approach, which perceives the development of the defense industry as an outcome of rational choice and optimal allocation of resources. Another interpretation, the "military-industrial complex," adopts the political economy line of thought, attributing the development of the defense industry to the effect of the overlapping interests of the armed forces, the civilian bureaucracy of the defense establishment, politicians, arms manufacturers, defense industry employees, and even the scientific community.
- 2 An important milestone was in the early 1990s, when the US Department of Defense allowed military projects to use civilian components, stating that adjustments to military environment requirements would be made mainly at the system level, rather than at the individual component level.
- 3 In many cases, outsourcing agreements demand comprehensive solutions, including systemic planning, production and maintenance of equipment, construction, logistics services, training, etc.

- 4 For example, combating terrorism and initiatives to enhance homeland security have boosted the demand for technologies such as life science, pharmaceutical etc., as well as for security scanning machines, various alarm devices, and so forth, that can be readily acquired in civilian markets.
- 5 In 1947, the UN Security Council imposed an embargo on weapons deliveries to the Middle East. This embargo was replaced by the “Tripartite Declaration” of 1950 whereby the US, the UK, and France undertook to refrain from supplying arms to the rival countries in the region.
- 6 The pioneering example belongs to the navy. The missile boat, which combines precision-guided armaments (the Gabriel sea-to-sea missile) and various electronic warfare systems, was a new technological development that fundamentally altered the navy’s combat doctrine and expanded its operational objectives. Thanks to the missile boats, Israel attained naval supremacy in the Yom Kippur War. Later, following lessons learned from that war, mainly about attaining air supremacy, the air force developed a new operating concept that also relied on innovative technological developments that included precision-guided armaments, electronic warfare, and command and control systems. The complex combination of all these advanced measures made a decisive contribution to the destruction of the Syrian ground-to-air missile batteries in Operation Peace for Galilee (the First Lebanon War) in 1982.
- 7 The industry’s potential contribution is measured by multiplying the attributed degree of effectiveness and the level of technological and industrial capabilities for each category of threats.

Challenges of the Israeli Defense Industry in the Global Security Market

Asher Tishler and Gil Pinchas

The size, development, and ownership structure of the Israeli defense industry depend on Israel's defense needs, geopolitical changes in the Middle East, the size and power of the Israeli economy, and various aspects of Israeli society. Developments in the global defense industries and market also have a direct impact on the industry in Israel.

While most of the world's large defense companies are privately owned, a number of large Israeli defense companies are owned fully or partially by the government (Israel Aerospace Industries [IAI] and Rafael Advanced Weapons Systems, for example). Furthermore, the Israeli government is the Israeli defense industry's main customer, procuring various platforms and many types of weapons systems for the different branches of the IDF. This procurement is usually an essential condition for exporting Israeli military weapon systems and platforms to other countries around the world. The long-term close relationship between Israel's defense companies and its defense establishment has furthered the development of high-quality, effective, and unique weapons systems tailored to the IDF's needs, and has greatly contributed to improving production processes for these systems by both reducing development and production times and cutting production costs.¹

The technological development of the Israeli defense industry took place simultaneously with similar developments in the global defense industry in a wide variety of technological spheres. It encompassed computer and

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communications systems, electronic systems, electro-optics, mechanical and chemical engineering, software engineering, special materials, etc. The acceleration of technological development in Israel and worldwide enabled the Israeli defense companies to develop and manufacture unique and advanced weapons systems and military platforms of various types, such as unmanned aerial vehicles, tanks (variants of the Merkava), armored fighting vehicles (Namer and Eitan), active air defense systems (variants of Iron Dome, David's Sling, and different versions of the Arrow), defense systems against land-based kinetic threats (Trophy, Iron Fist), communications systems, satellites, precision-guided armaments, cyber systems, sensors in various sectors, and more.²

This article reviews the main developments in the global defense market and the Israeli defense industries in the past three decades. It addresses the uniqueness of the Israeli defense industry, with an emphasis on its size and structure in comparison with the global defense industry, and takes note of present and future challenges. The final part of the article presents the results of a study analyzing the size and structure of the Israeli defense industry.

The Global Security Market

Figure 1 shows that global defense spending in 2016 totaled \$1.7 trillion (in 2015 prices). Of this, 40 percent was spent in America, 28 percent in Asia, 20 percent in Europe, 10 percent in the Middle East, and 2 percent in Africa. Global defense spending grew 17 percent in real terms in 1998-2016, and a material change occurred in its composition as a result of the following geopolitical, economic, and technological changes:

1. The end of the Cold War in the 1980s was the main catalyst for a substantial reduction in defense spending by the Eastern and Western bloc countries.
2. Concentration increased in the defense sector in the United States and Western Europe in the 1990s as a result of rapid technological progress, which led to a steep rise in the quality, complexity, and cost of weapons platforms and systems during this period. A small number of huge companies now have a significant share of global arms sales. The world's 10 largest defense companies accounted for 50 percent of the sales of the world's 100 largest defense companies in 2017.³
3. Terrorism events throughout the world at the beginning of the first decade of the 21st century (including the 9/11 attacks in the US in 2001

and later terrorist attacks in Madrid, London, and Mumbai) accelerated development of state-initiated home front defense systems, remotely piloted aerial vehicles, guided and precision armaments, and intelligence and communications systems. These events resulted in a striking increase in demand for security products throughout the world, and particularly in Western countries.

4. The involvement of the United States in wars in Iraq and Afghanistan in 2001-2011 sharply increased US defense spending during these years.
5. China's accelerated economic growth was also accompanied by an accelerated increase in Chinese defense spending over the past decade.
6. Concern about growing Russian intervention in its neighboring countries and the results of the crisis between Russia and Ukraine boosted the demand for weapons systems in the countries bordering Russia.
7. Terrorist attacks in various places around the world and the growing threat of terrorist activities by ISIS and other extremist Islamic organizations in Western countries in recent years have greatly increased sales of homeland security goods and services.

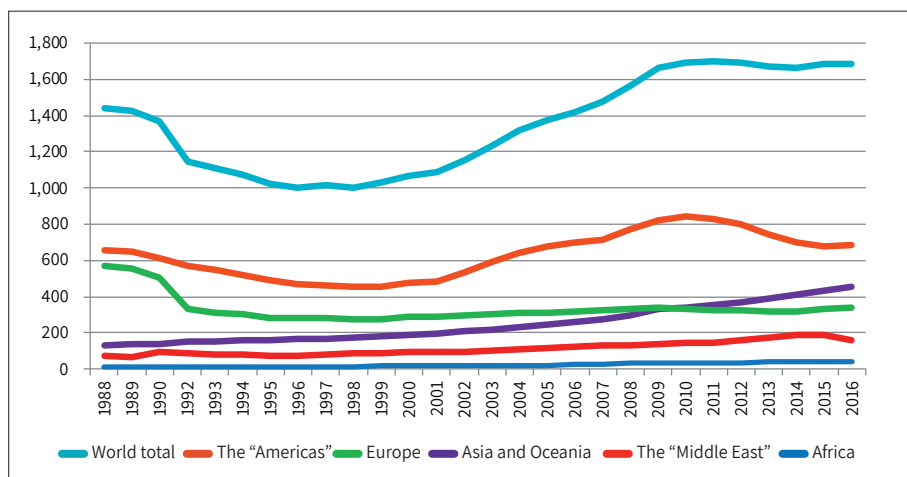


Figure 1: Total defense spending according to geographic regions: 1988-2016 (US\$ billions, 2015 prices)⁴

Agreements for the sale and transfer of weapons systems between countries and exports of arms to various customers are quantitatively and qualitatively dominated by the United States and a small number of Western European

countries. For example, exports of weapons systems by the US and Western European countries accounted for approximately 70 percent of global arms exports in 2017.⁵ At the same time, the proportion of global defense exports accounted for by China and Russia has increased in recent years, although the dimensions of this increase are not threatening American hegemony in defense exports. An examination of the composition of exports in 2018 shows that 47 percent of defense exports consisted of aircraft, 18 percent ships, 16 percent armaments and missiles, and 11 percent armored vehicles. The rest consisted of communications, computer, and intelligence systems, air defense systems, etc. While exports of weapons systems are dominated by a small number of countries, a large number of countries (over 100 in 2017) import these systems. The main customers for weapons systems are Asian countries (37 percent) and Middle Eastern countries (36 percent), with Saudi Arabia and India being the biggest importers of weapons systems and military platforms at this time.

Simultaneously with changes in the volume of defense spending and changes in the global demand for weapons systems, the world's defense companies have been facing many structural, cultural, and technological changes in recent decades that have affected their economic performance, as listed here:

1. Concentration and globalization increased – the volume of defense sales by the world's 100 largest defense companies totaled \$400 billion in 2017, with the nine largest companies accounting for half of this sum.
2. The prices of weapons systems and products have greatly risen in the past two decades. This trend is a result of technological improvements all over the world, especially in weapons systems. For example, the price of an F-35 aircraft in 2019 was over 530 percent higher than the price of an F-16 aircraft two or three decades ago (in 2019 prices). Figure 2 shows that the rise in the prices of weapons systems is a broad phenomenon that extends to a large proportion of the different types of military platforms and weapons systems.
3. The demand for military technologies in civilian systems rose. For example, the use of drones, which were initially produced solely for military use, has recently expanded to the civilian sector. Drones are now used for both security and civilian purposes. This is illustrated by the fact that 110,000 drones were sold for commercial use in 2016.⁶

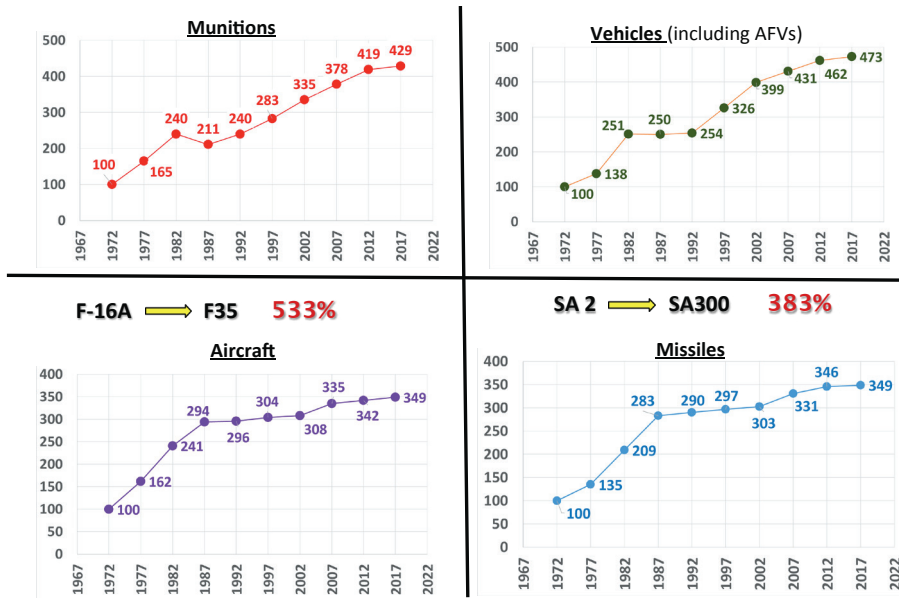


Figure 2: Development of the price indices of selected defense products in the past 45 years⁷

4. Commercialization and privatization – in recent years, many armies around the world have civilianized and privatized military activities for which military establishments were previously responsible, and which they previously operated. The American army is leading this change for economic cost-benefit reasons. In recent years, it has privatized and civilianized many activities, including those supporting trans-border military operations in Afghanistan and Iraq and combat forces in various locations, mainly in logistics, educational, and training missions.⁸ The trend towards civilianizing activities supporting the army and in other security agencies is taking place at a slower pace in other armies. It is important to note that while all of the defense companies in the United States are private, there are still a number of large fully or partly government-owned defense companies in Europe and the rest of the world. For example, the Russian government controls the country's large defense companies (91 percent of the national aerospace industry and 100 percent of the national warship building industry). The Italian government holds 30 percent of the shares in Italian defense company Leonardo, the French

government holds 26 percent of the shares in French defense company Thales, and the Indian government wholly controls the shares in the Indian aerospace industry.

The Israeli Defense Industry

The Israeli defense industry currently includes about 600 companies, some of them subcontractors taking part in the production chain of Israeli weapons systems. Over 45,000 workers are employed in the industry, and sales totaled \$10.3 billion in 2017, with sales of defense equipment and services accounting for approximately 90 percent of this total. Approximately 95 percent of the Israeli defense industry's sales are by the four largest Israeli defense companies (IAI, Rafael, Elbit Systems, and IMI Systems [formerly Israel Military Industries]). Part of IMI Systems was privatized in 2018 and sold to Elbit Systems; another part, Tomer Systems, remained under government ownership. The Israeli defense industry exports over 70 percent of its output to overseas customers, as shown in Figure 3. This phenomenon is unique to the Israeli defense industry. For the sake of comparison, the American defense industry exports approximately 24 percent of its output, and the Russian defense industry exports approximately 55 percent of its total sales.

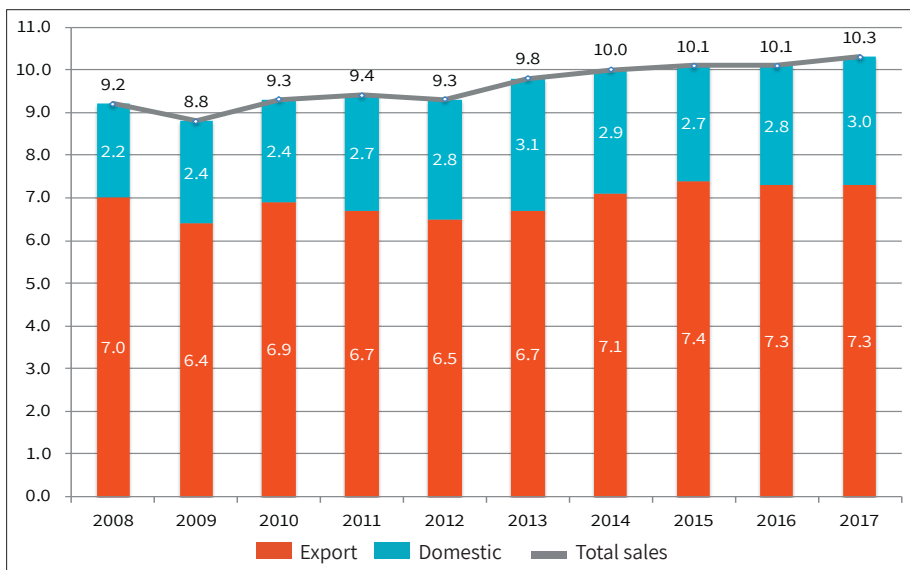


Figure 3: Sales by the Israeli defense industry to the domestic market and for export (2008-2017, US\$ billions, 2015 prices)⁹

Although the large Israeli defense companies account for less than 3 percent of total global defense sales, they frequently compete with each other in the same market segments. The Israeli Ministry of Defense and the Ministry of Finance are therefore inclined to employ regulatory intervention in competition between the defense companies in the Israel and global markets. For example, in 2013, the Ministry of Defense suspended an important tender for the sale of unmanned aerial vehicles to Poland in which two companies publicly attacked each other. Another dimension of the intense competition between the Israeli defense companies was expressed in the privatization and sale of part of IMI Systems to Elbit Systems. IAI and Rafael expressed concern during this process that acquisition of a major part of IMI Systems by Elbit Systems would make the latter the dominant company in the local defense market, and would detract from their ability to compete. These claims were examined by the Israeli government in the course of IMI Systems' privatization process. The process of selling part of IMI Systems to Elbit Systems, however, was eventually approved in 2018 by the relevant Israeli authorities. This competition is expected to intensify in the coming years, given the changes that have occurred in the 2016 MOU governing US defense aid to the Israeli government in 2019-2028.¹⁰ This agreement will gradually reduce conversion of part of the American aid into shekels (\$815 million of US aid in 2019 could be converted into shekels. This amount will be gradually reduced over the years of the agreement, until it is completely eliminated in 2028). This change is expected to boost Israeli use of American weapons systems and military platforms, a trend that will intensify competition between the Israeli companies for the shekel part of the defense budget. Furthermore, this change is likely to have a negative impact on the state of the small- and medium-sized defense companies, because these companies currently derive their livelihood mainly from sales in the domestic market, while the sale of the large Israeli defense companies are export-oriented, and the latter companies have overseas subsidiaries and/or partners. A more thorough examination of the question of Israeli defense exports shows that there is also a difference in the proportion of sales to foreign customers between the three largest Israeli companies. While Elbit Systems and IAI export some 80 percent of their total output, Rafael exports only approximately 60 percent of its output.

An understanding of the performances, strengths, and weaknesses of the large Israeli defense companies can be gained by perusing the values

of a number of important parameters in their financial performances in recent decades, including the real change in sales, spending on research and development, marketing and sales expenses, and gross and net profit (see Figures 4-5 and Table 1).

The figures show a steady rise in the volume of sales of the three largest defense companies in the first decade of the 21st century and stable sales in the past decade (corresponding to the period in which most American forces withdrew from Iraq and Afghanistan). Sales by Elbit Systems grew substantially in 1996-2009, and by an annual average of approximately 17 percent in the past two decades. Rafael's sales also grew steadily from 2005 onwards, and by an annual average of around 5 percent from 1990 until the present time. IAI's sales have increased very slightly over the years, by an annual average of only 1 percent a year from 1990 until the present, while sales by IMI Systems, which focused on conventional defense products and did not develop new products and markets during the period under review, declined steadily. It can also be seen that Elbit Systems and Rafael maintained their profit margins in the past 15 years, while IAI reported a substantial decline in its profits during this period, especially in recent years, during which the company's profit was negligible. IMI Systems reported a loss during the entire period under review, a trend that brought the Israeli government to complete the process of the company's privatization and sale to Elbit Systems in 2018.

A comparison of the data for Elbit Systems, Rafael, and IAI over the past decade highlights the difference between the government-owned defense companies and the privately or publicly owned ones. The figures show that Elbit Systems, a public company, is more profitable (by a ratio of 1.5-2:1) and invests more in marketing its products (2-3 times as much) than Rafael and IAI, which are government-owned companies. These figures for Elbit Systems are similar to the corresponding figures for other large private defense companies around the world. A slightly different picture is obtained with respect to spending on research and development. Elbit Systems spends 1.75 times as much (as a proportion of revenue from sales) as IAI and a sum comparable to that of Rafael. This pattern can be explained by the fact that Rafael was initially founded as an authority for developing weapons, and maintained its basic purpose as a research laboratory of the Israeli defense establishment, in addition to being an arms manufacturer. The figures in

Table 1 and Figures 4-5 support the argument that private/public companies have a greater incentive than government companies to increase the quantity, quality, and diversity of the goods and services supplied to their various customers, and are therefore more export-oriented than government-owned companies.¹¹

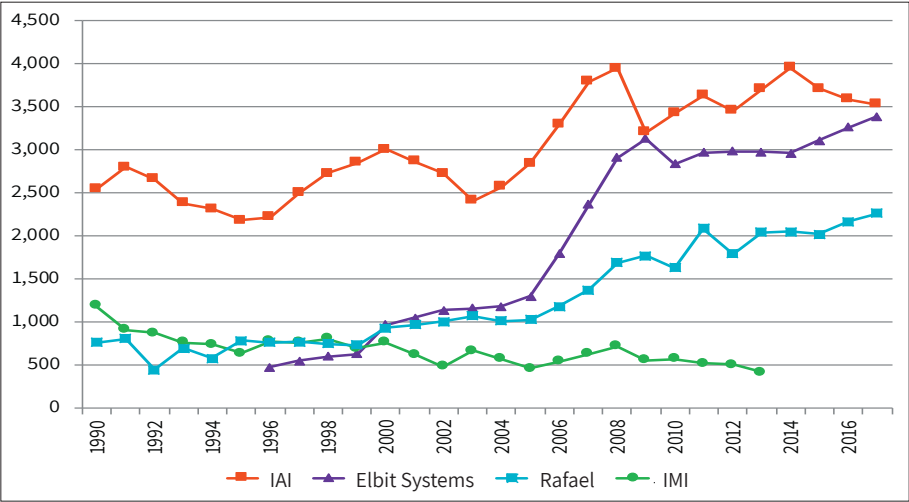


Figure 4: Sales of the large Israeli defense companies (1990-2017, US\$ millions, 2014 prices)¹²

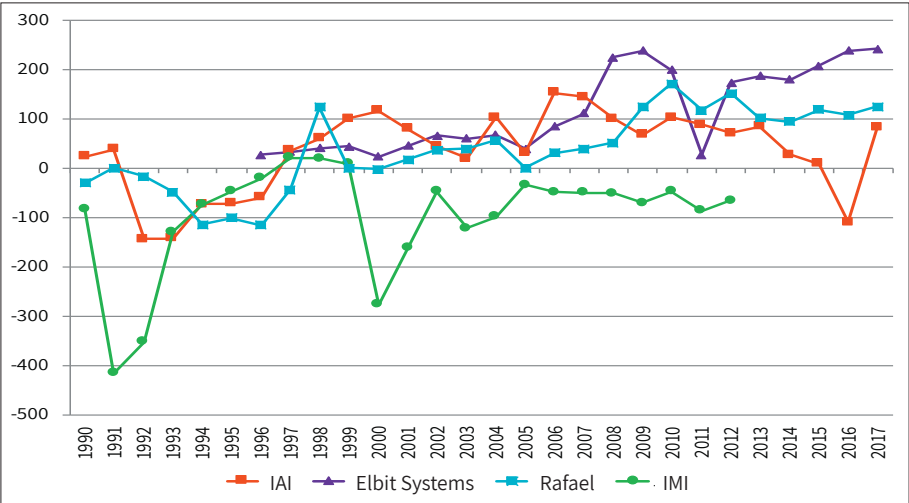


Figure 5: Profits of the large Israeli defense companies (1990-2017, US\$ millions, 2014 prices)¹³

Table 1: Gross profit, R&D spending, and marketing and sales expenses of the Israeli defense companies (2008-2017, as a percentage of sales)¹⁴

Year	Gross profit			Marketing and selling expenses			Research and development		
	Elbit Systems	IAI	Rafael	Elbit Systems	IAI	Rafael	Elbit Systems	IAI	Rafael
2008	29.1	14.2	20.8	7.5	2.0	4.3	7.0	3.5	6.6
2009	30.0	15.1	21.9	8.9	2.4	3.8	7.7	4.2	7.3
2010	29.9	14.5	20.2	8.6	2.3	4.3	8.8	4.4	7.8
2011	26.0	15.1	21.7	8.4	2.3	4.7	8.6	4.5	7.0
2012	28.2	15.2	22.8	8.4	2.7	5.2	8.1	4.7	7.7
2013	28.2	14.3	20.0	8.1	2.4	4.0	7.5	4.9	7.6
2014	27.9	14.9	22.7	7.3	2.6	4.1	7.7	4.3	7.4
2015	28.9	13.3	21.	7.7	2.6	3.7	7.8	4.8	7.0
2016	29.4	13.3	20.9	8.3	2.7	3.9	7.8	4.6	7.2
2017	29.5	15.3	22.1	8.3	2.6	4.0	7.8	5.2	8.1
Average	28.7	14.5	21.4	8.1	2.4	4.2	7.9	4.5	7.4

Future Challenges Facing the Israeli Industry

Maintaining a high level of national security is one of the Israeli government's principal tasks. The frequent changes in the geopolitical environment and the character of the regimes in Middle East countries, combined with the difficulty in achieving progress in a peace process between Israel and the Palestinian Authority, require Israel to maintain a powerful, high-quality, and innovative defense establishment that constantly changes in accordance with the rapidly changing environment of threats against it. The defense industry must accordingly remain large (relative to Israel's size), modern, and above all, innovative, and entrepreneurial, with an emphasis on the retaining and development of excellent and entrepreneurial personnel (human capital). Furthermore, in contrast to the large Western countries (where some of the world's largest defense companies operate), whose potential enemies are distant, Israel's existing and potential enemies are located in close proximity to it. In any case, Israel must develop unique weapons systems, intelligence, and computer capabilities (some of which must respond very quickly to activity by Israel's enemies) that are not developed by the world's largest weapons manufacturers (because they have no immediate need for them).

The adaptation of weapons systems to the Middle East, and to Israel's special needs, is made even more essential by the recent developments in the Iranian nuclear program and the consolidation of the Iran-Syria-Hezbollah-Hamas coalition in recent years in the framework of the civil war in Syria, which has greatly heightened the security tension in the Middle East and has accelerated the arms race in general, and between Israel and its enemies in particular.

The challenges facing the Israeli defense industry are accordingly as follows:

1. The aid MOU between Israel and the United States for 2019-2028 gradually eliminates the option to convert the aid in foreign currency into local currency (this option will cease completely in the final year of the agreement). This will require the Israeli defense companies, including those taking part in the production chain for weapons systems and military platforms, to allocate more resources to entering new markets and expanding their marketing activities so as to bolster exports of Israeli weapons systems to existing and new customers. In order to maximize the benefit from the new MOU, the Israeli defense companies will have to consolidate and institutionalize partnerships with American defense companies, and institute new production lines in the United States or divert existing production lines from Israel to the US. It is likely that these measures will cause Israeli employees to be laid off, and are liable to severely affect small- and medium-sized defense companies in Israel, unless wise advance preparations are made to offset the end of the conversion option.
2. Preserving technological independence and leadership: the Israeli defense industries feature the development and manufacture of high-quality defense products at the forefront of technology, with great complexity in various spheres. Examples include munitions, defense systems (Iron Dome, David's Sling, the different versions of the Arrow, Trophy, and Iron Fist), unmanned aerial vehicles, communications systems, command and control systems, intelligence systems, satellites, robotics, electronic warfare, etc. In order to maintain these industries' leading position in technology, in comparison with large overseas companies, and given the expansion trend among large American and European defense companies into new markets and countries, the Israeli defense industries must continue increasing their investment in R&D and their recruitment of top-level

human capital, and strengthen their close relations with security agencies in Israel and throughout the world.

3. Expanding cooperation between Israeli defense companies: the tension created by intense competition between the Israeli companies sometimes causes damage to the companies themselves. In view of the globalization taking place in the world market, combined with Israel's policy of preference for procurement from the domestic industry over overseas options (the same policy exists in the US and India), it is essential for Israeli companies to step up their mutual cooperation in tenders in Israel and overseas in order to maximize their profits in the long term.
4. The optimal structure of the Israeli defense industry: the Israeli defense companies are export-oriented, and must compete against huge companies from the United States, Western Europe, and Russia in defense tenders all over the world, in addition to internal competition for domestic procurement by the IDF and other security agencies in Israel. Changes in the global defense market, together with the geopolitical changes and the strategic environment in the Middle East, are posing a number of dilemmas to decision-makers in Israel. These include questions such as whether it is correct to privatize the defense industries in full, only partially, or not at all, and what the optimal number of defense companies in Israel is.

The answers to these questions are complex. Among other things, they depend on the policy of other countries all around the world; the development of the business market in general, especially in Israel; and others. The study conducted by Pinchas¹⁵ presents analytical and empirical tools for assessing the conditions under which private ownership of defense companies in Israel is preferable to government ownership, and facilitates evaluation and analysis of the Israeli defense industry's behavior, including interactions between the defense companies and the government under conditions of an arms race between Israel and Syria and Iran.

A number of models describing how Israel's social welfare and national security are affected by country's economic characteristics, together with the features of the Israel defense industry, were developed and applied in this study. The models developed stress the following interactions:

1. Between the countries active in the defense market;
2. Between the defense companies in Israel and elsewhere in the world;

3. Between the countries in an arms race (Israel against Iran and Syria, for example); and
4. Between two types of defense products and weapons systems (platforms versus all other weapons systems).

This study shows that social welfare, national security, and the economic performance of the Israeli defense industry are affected by the type of ownership found in the industry. For example, a government-owned Israeli defense company can sometimes bring greater benefit for the government and a higher level of security than a privately owned firm. At the same time, privately owned defense companies have higher profits than their government-owned counterparts, because they are more efficient at production, are export-oriented, and invest more in marketing and R&D. In most cases, privately-owned Israeli defense firms will bring about slightly higher general welfare (from government activity and from the defense companies' profits) than government-owned companies.

The relatively small size of the Israeli defense companies greatly affects their efficiency and marketing capabilities in comparison with the large companies abroad. This is because the Israeli defense firms operate in a relatively small country, and serve a very small defense establishment, in comparison with, say, defense firms of the United States, Russia, and Western Europe. In this situation, private companies, which are more efficient and have better marketing capabilities than government-owned Israel companies, have an advantage.

In addition, the study findings support the argument that a lower degree of concentration of the defense industry in a small country like Israel will lead to a higher aggregate profit (see the analysis by Shefi and Tishler, for example).¹⁶

In summary, the challenges facing the Israeli defense industry are substantial, and are likely to have a significant effect on the country's level of national security. At the same time, thorough and extensive preparation by local defense firms and cooperation between them and with the defense and government sectors in Israel can preserve, and under certain circumstances also improve, the standing of the defense industry in Israel.

Notes

- 1 Alex Mintz, "Military-Industrial Linkages in Israel," *Armed Forces and Society* 12 (1985): 9-27; Ori Swed and John Sibley Butler "Military Capital in the Israeli Hi-Tech Industry," *Armed Forces and Society* 41, no. 1 (2015): 123-41.
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Part 2

**MOU Negotiators on Both Sides
Share Their Perspectives**

Negotiating the MOU from the Perspective of the Head of the Israeli Negotiating Team

Jacob Nagel

The latest memorandum of understanding (MOU) on US foreign defense aid to Israel was signed in September 2016 after over three years of negotiations. The negotiations went through ups and downs, and were even temporarily suspended at one point. The new agreement covers 10 years (2019-2028), during which total American aid will be increased to \$38 billion: \$33 billion in ordinary defense aid (foreign military financing – FMF), compared with \$30 billion in the previous agreement, and \$5 billion in a new multi-year agreement for ballistic missiles defense (BMD), compared with \$400 million annually with no multi-year commitment in the preceding decade.

The process began in March 2013 during US President Barack Obama's visit to Israel. The visit was designed mainly to soften the Israeli position on two issues: the agreement with Iran and relations with Turkey, following the *Marmara* incident. As is customary with visits by a US president to Israel, Obama realized that he had to give something in return for the compromise that was achieved on the Turkish issue, and for his wish for progress on the Iranian issue (although the messages that he received during the visit were clear: Israel is against a deal with Iran if it does not include a total closure of the nuclear program and all its derivatives). It appears that in the absence of alternatives for a possible gesture to Israel, Obama announced that he had

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instructed his staff to form a joint committee for the purpose of reaching a new agreement on aid to Israel – five years before the current agreement expired. This instruction surprised everyone, because the agreement was in effect until the end of 2018, and renewal negotiations usually begin only two years before the end of an existing agreement.

The talks between the parties began in the summer of 2013. At the time, I was head of the Division for Strategic Development and Organization and deputy head at the National Security Council (then headed by Major General [res.] Yaakov Amidror). The interministerial team formed to accompany me included representatives of all of the relevant agencies (Ministry of Defense – the Defense-Political Branch and the Budget Department, Ministry of Foreign Affairs, Ministry of Finance – Accountant General's Department and Budget Department, IDF – Planning Directorate and the Chief of Staff financial advisor, the Israeli embassy in Washington – Ambassador Ron Dermer and Defense Attaché to the United States Yaacob Ayish). The team worked with complete synergy and cooperation; even if there were initially disagreements on a number of issues, they were usually resolved without becoming publicly known. The American team was led by Special Assistant to the President and White House Coordinator for the Middle East, North Africa, and the Gulf Region on the US National Security Council, Philip Gordon, under US National Security Advisor Susan Rice.

Despite the tension between President Obama and Prime Minister Benjamin Netanyahu at the time, the two sides wanted to reach an agreement that would meet the needs of both countries and continue the special relationship and strategic alliance between them.

For about a year, a number of work meetings between the teams took place in Israel and Washington. During those meetings, the Israeli position was presented to the American team in four separate sections. The first section, for which the Defense-Political Branch in the Ministry of Defense was responsible, included an analysis of the general state of the Middle East and the potential threats to Israel in 2023. The second section, prepared by the Ministry of Defense budget department and the Ministry of Finance, was devoted to a macroeconomic analysis of the Israeli economy and the defense budget within the state budget. The third (and largest) section, for which the IDF, led by its Planning Directorate, was responsible, focused on the IDF's needs and force building. In this section, a detailed theoretical

model was constructed, excluding budgetary constraints, showing the needs of the defense establishment in shekels and foreign currency. In the fourth section, the National Security Council presented the process for continuing the negotiations and the desirable structure for the aid agreement, in light of the preceding sections.

The budget for assistance in ballistic missile defense was not included in the discussions at this stage. Most of the early talks concerned the dire state of the American economy, Israel's needs, and the amount of assistance that could be given to Israel as part of FMF. The basic American position was that aid had to be the same or less than in the existing agreement. In order to justify a requested increase in the amount of aid, the Israeli team presented economic analyses of the decline in the dollar's purchasing power and the rising cost of maintaining and owning the main battle systems, adjustments needed for inflation in Israel and the US, macroeconomic assessments of both countries, and the projected Israeli defense budget.

After about a year of discussions, we presented a draft agreement, but we had not yet reached the stage at which it was acceptable to our American colleagues. In the background, progress was being made in American contacts with Iran aimed at reaching the nuclear agreement, to which Prime Minister Netanyahu was strongly opposed. To President Obama's dismay, Netanyahu spoke to the US Congress in March 2015. In his speech, Netanyahu thanked the United States for its ongoing support for Israel, but did not conceal his determined opposition to the emerging agreement with Iran. The speech exacerbated the rift between the two leaders; as a result, the talks on the new aid agreement were suspended for an extended period.

Paradoxically, the talks were renewed after the nuclear agreement was signed with Iran in the summer of 2015. It is possible that Obama wanted to leave a positive impression in his relations with Israel, and it was also possible that considerations pertaining to the US presidential election campaign, which was just beginning, played a role. Obama may also have been responding to Hillary Clinton's effort to restart the negotiations on the aid agreement (Clinton had been Obama's secretary of state and now was running for the presidency). The Israeli policy dictated by the prime minister was to accept the American offer to renew the talks separately from the Iranian nuclear issue in order to highlight the depth of the strategic relations between the

countries (stronger than the dispute), and to enable the IDF to go ahead with its multi-year plan.

Obama appointed US National Security Council Senior Director for the Levant, Israel, and Egypt Yael Lempert to head the American team, which included senior officials from the Departments of Defense, State, and the Treasury, with very active involvement by US Ambassador to Israel Daniel Shapiro. The team was constantly guided by Susan Rice, who was involved in every detail in the negotiations. The Israeli team was composed of the same agencies that constituted the original team (with different people in some cases, as expected). When I was appointed as acting Israel National Security Council head in early 2016, Susan Rice asked me in our first meeting whether I was attending the meeting as head of the negotiating team or as head of National Security Council responsible for it. I smiled and answered that I was fulfilling both functions.

Behind the scenes and discretely, the team heads established a number of clear “game rules,” especially regarding two matters that all agreed would not be included in the discussions: the Iranian nuclear agreement (not as a factor that should increase the amount of aid because of a greater threat, and not as a factor that should reduce the aid because of a lesser threat) and the Palestinian question, which would not be raised under any circumstances as a condition for signing the aid agreement. At this stage, the Americans asked that aid for BMD be included in the negotiations.

When the talks were renewed, the Americans presented four basic demands, which we did not fully accept:

1. Complete termination of conversion of part of the aid (26.4 percent) to shekels for the purpose of off-shore procurement (OSP) of systems and equipment to the systems purchased in the United States with the aid money. The unequivocal position by Susan Rice presented to me in a face-to-face meeting was “*no conversion from the first year of the agreement.*”
2. A halt in the use of the aid budget to purchase fuel from American companies.
3. Preserving the balance between an increase in the amount of aid and the increase in the defense budget. The unequivocal position was that every nominal increase in the aid agreement would be accompanied by an increase in the defense budget. From the American perspective, it was unacceptable for Israel’s defense budget to be decreased (this was

reported at the time in the Israeli media) when the American aid budget was increased.

4. Most of the money in the agreement was to be earmarked in advance for procurement of specific American weapons systems (type and quantity), and no general agreement would be signed on the annual amount of aid; the precise content would be determined each year. The American team planned to demand that Israel state which systems would be procured with the aid money, according to the team's analysis of the threat in a given theater, and the Israeli response needed in order to preserve Israel's relative advantage.

In the second round of talks, the Israeli team returned to the same four (revised) professional sections established in the first round. We set for ourselves two main principles, according to which we constructed the presentation and the Israeli requirements:

1. The agreement will be in effect in 2019-2028, and therefore cannot be assessed from a perspective of the current situation and threat or only according to the forecast for the next few years. It cannot be a type of work plan. The point in time selected as a reference was 2023, the middle of the period. When an analysis of this reference point is agreed, no scenario can be removed from the agenda, including a conventional war scenario. The force-building process must therefore include readiness for a broad range of scenarios.
2. Israel's revised defense needs (in dollars and shekels) far exceed what the United States is capable of providing in the aid agreement and what Israel is capable of allocating to the defense budget in its government budget. The main conclusion from this principle was that the discussion could not center on the precise scope of needs, which systems the United States would transfer to Israel, and in what quantity, since it is clearly impossible to meet all of the needs, on the one hand, and on the other, it is impossible to predict in advance what needs will require the highest priority. The question, then, is not what and how much is needed, but how much the United States is able and willing to give to Israel.
3. The presentation of these principles, which were gathered from a detailed and reliable database, was a great success, and convinced the Americans that it was impossible to pre-determine in the aid package

which systems would be procured. Similarly, it is impossible to dictate to Israel in advance which systems it must procure with the aid budget. Following our detailed presentation, the Americans abandoned their own outline, which included their position on the scope of Israel's needs and a proposal for the systems that the agreement would include. They decided to work with our data, and to focus the discussion on the framework of the agreement and its indirect terms. It is my professional opinion that the comprehensive preparations we made in Israel and the high-quality meetings we held with the American team paved the way to the new agreement.

In mid-2016, we concluded the discussions and reached understandings that Israel would receive \$3.3 billion a year in American FMF. Two issues were still in dispute: purchase of fuel and conversion of aid to shekels for OSP. Regarding the fuel, at the time, the inclination was to attach a document side letter to the agreement stating that we would not purchase fuel with FMF without the other side's agreement. In the final stages of the negotiations, the Americans (including the president) insisted that this commitment be part of the agreement. After further deliberations, a clause was inserted into the agreement (similar to the general legal principles governing the use of FMF) stating that the United States and Israel had agreed that "FMF is not intended for fuels and consumables."

The thorniest issue concerned the agreement to convert part of the aid to shekels for use in Israel as support for the systems purchased with dollars in the United States. In the previous agreements, Israel received permission to convert 26.4 percent of the dollar aid into shekels for procurement in Israel. One of the arguments made by the Americans in their demand for ending this conversion option from the first day of the new agreement was that this option originally stemmed from the desire to help Israel establish a defense industry and put it on its feet. Today, the Israeli defense industry is thriving, and it is unacceptable for Israel to convert American dollar aid into shekels, invest it in the development of state-of-the-art products, and eventually compete with American companies over these products throughout the world. These inaccurate contentions, according to which Israel is using the shekel conversion budget for research and development, are of course incorrect. Unfortunately, however, they were disseminated and

reinforced by various parties, including Israelis, who were unfamiliar with the data – a fact that hindered us in the negotiations. According to the aid agreements with the United States, Israel is not allowed to use the shekels converted from dollar aid for R&D. Each year, Israel details to the American administration where the converted money is invested in order to prove that it is being invested solely in compliance with the rules. The claims by some industries and irresponsible senior administration officials that halting the aid conversion arrangement would harm Israeli R&D greatly hampered us during the negotiations, and we worked hard to rectify the situation. During the discussions on this issue, Susan Rice reiterated several times that if we did not accept the American position, no agreement would be reached, and if this is what we wanted, we could wait for the next administration.

Following the long and exhausting negotiations, in which then-IDF Planning Directorate head Major General Amikam Norkin and then-IDF Budget Division head Brigadier General Sasson Hadad took part and innumerable compromise formulas were proposed, we reached an agreement that did eliminate conversion of aid dollars into shekels, as Rice had demanded, not at the outset of the agreement, in 2019, but only in 2028, the last year. We were also in accord that the new agreement would include approximately 70 percent of the conversion amount approved in the old agreement, and that the reductions in conversion in the first five years would be purely symbolic. According to this compromise, the conversions were to be reduced gradually, not a dagger thrust starting in 2019, as the Americans initially wanted.

The compromises that we reached on this topic were very important, and will provide the defense industries in Israel, with an emphasis on the small companies, with an extended period to prepare for the change, with the help of government ministries and the large industries. It is important to keep in mind that the agreement was signed two years before the expiration of the preceding agreement, so that a total of seven to nine years was given to prepare for the change (unfortunately, not all of the parties have taken advantage of this time to prepare thus far, but it is not too late to start).

As part of the agreement, the Americans also sought to reach 10-year understandings about the amount of aid for joint BMD projects in order to avoid repeating these discussions every year (and probably also in order to present a bigger hike in aid to Israel by the Obama administration). The White House did not like the annual Congressional debates at which various

parties tried to obtain more support for the joint projects. A majority on the Israeli side also supported reaching decade-long understandings, which would enable better planning of joint projects and avoid the annual effort involved in submitting aid requests to Congress. We ultimately agreed on \$500 million a year for 10 years – a total of \$5 billion for joint projects. The language of the new agreement was copied exactly from the previous agreements in order to preserve all of the existing understandings.

In September 2016, we reached a final draft of the MOU for a sum of \$38 billion over a decade: \$33 billion in FMF and \$5 billion for BMD. Just before the time came to sign it, a last obstacle arose from the direction of US Senate Finance Committee Chairman Lindsey Graham, which itself was caused by the ongoing tension between the White House and Congress concerning responsibility for defense aid. Following a number of exchanges, including letters at the highest levels, this problem was also solved. After over three years of discussions, the MOU for defense aid to Israel in 2019-2028 was signed in November 2016.

It should be stressed that contrary to the rumors and leaks on the matter, at no stage in the negotiations between the teams was a better agreement offered to Israel in exchange for ceasing its opposition to the nuclear agreement. This matter was never raised. Furthermore, because of legal and fiscal constraints, the US administration had no practical way of offering substantially higher sums than those eventually agreed. All of the statements on the subject, mainly in Israel, by parties not directly involved in the negotiations were in my opinion due either to incorrect analysis of the data or unrelated motives. I believe that the agreement reached was very good for Israel, and was signed at the right time, for the following reasons:

1. The amount on which we agreed was higher than any amount that we received in the past.
2. Early on, many argued that we would be unable to obtain anything near what we received in the preceding agreement from President Obama and the United States, in the wake of the financial crisis. Furthermore, the US' total foreign aid budget is predetermined; any increase in aid to Israel would necessarily reduce the amount available for other countries.
3. Could we have obtained a better agreement with a new administration? I am one of those who believe that we did well to sign the agreement with

the Obama administration, despite the tensions and disagreements with it. Moreover, the signed MOU underscores the bipartisan support for Israel.

4. While the new agreement cuts the amount of aid that can be converted into shekels, the cut is gradual and very small in the early stages of the period covered therein. It allows for lengthy preparation (seven-nine years) for the new situation.
5. The new agreement increases total FMF for Israel by \$3 billion in comparison with the current situation. Offset (reciprocal) procurement alone will increase investment in the Israeli defense industry by approximately \$1 billion, which amounts to a large chunk of the reduction in aid conversion. Offset procurement is not binding on the US under the formal terms of the aid agreement, so it will go mainly to the large industries, but history proves that the Americans are committed to making their best effort in this matter, and more.

The signing of the agreement was a superb achievement that enabled Israel to preserve its strategic alliance and cooperation with the United States. It highlighted the overall long-term commitment of the United States to Israel. And it enabled the defense establishment to plan its budget and procure essential platforms for the very long term.

A Review of the Negotiations on the 2016 US-Israel MOU on Military Assistance

Daniel B. Shapiro

The opening of US Fiscal Year 2019 on October 1, 2018 marked the beginning of the implementation of the US-Israel Memorandum of Understanding (MOU) on military assistance. Signed in September 2016 in the final months of the Obama Administration, and building on the previous 10-year MOU, it marked a major milestone in the US-Israel defense partnership.

Over 10 years, the MOU will provide Israel with a guaranteed \$38 billion in military assistance, the largest package ever provided by the United States to any country. It represents a fulfillment of the commitment to Israel's qualitative military edge (QME), reaffirmed by presidents of both parties, which ensures Israel's ability to acquire the most sophisticated US defense technology.

At the time the MOU was signed, some critics in both countries argued that its \$38 billion total, which included both Foreign Military Financing (FMF) and Ballistic Missile Defense (BMD) accounts, was smaller than Israel's needs required. Some accused the Obama Administration of shortchanging Israel's defense needs. Others argued that Prime Minister Benjamin Netanyahu had squandered the opportunity to obtain a significantly higher sum by stoking tensions with the Obama Administration during the disagreement over the Iran nuclear deal, including with his speech in Congress in March 2015.

But those criticisms are based on a misunderstanding of the process that led to the MOU, and the considerations that went into its various elements.

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It is worth recounting that history and the MOU's key provisions, while underscoring that at no time, even at the height of US-Israel tensions, was there any interruption or diminution of the broad defense and intelligence cooperation shared by the two countries.

The MOU Negotiations

The decision by President Barack Obama and Prime Minister Netanyahu to open negotiations toward a new, multi-year MOU was originally announced by the two leaders during Obama's visit to Israel in March 2013 – some five years before the expiration of the previous MOU. Later that year, the two sides assembled teams that met on several occasions. The US side was led by White House Middle East Coordinator Phil Gordon and the Israeli side by Deputy National Security Adviser Jacob Nagel. The Israeli side provided briefings at an unprecedented level of detail about the IDF's force structure, order of battle, budgeting, manpower, threat analysis, and planning. These formed the basis of the discussion of weapons systems that Israel sought to acquire to meet its defense needs. The American side provided detailed explanations of its budget process and competing considerations in Foreign Military Financing and Ballistic Missile Defense.

These talks continued well into 2014, but were put on hold as attention turned to the Iran nuclear deal. Tensions between the two governments over the Iran negotiations were only part of the reason for putting the MOU talks to the side. It also became clear at a certain stage that both sides would need to take into account the impact of an Iran nuclear deal, or the collapse of those negotiations, on the regional strategic picture and Israel's defense requirements in order to develop an up-to-date MOU. Finally, following the announcement of the Lausanne Understandings in April 2015 that formed the outline of the final nuclear deal (the Joint Comprehensive Plan of Action or JCPOA), in a phone call President Obama told Prime Minister Netanyahu that the United States was prepared either to accelerate the MOU talks during the final stage of the JCPOA talks or to wait until after the deal was completed and had passed its Congressional review. He left the choice to Netanyahu, who chose the latter option.

When the two leaders met at the White House in November 2015, following completion of the JCPOA's Congressional review and as the deal was beginning to be implemented, they agreed to relaunch talks to try to complete

the MOU during Obama's final year in office. Yael Lempert, Senior Director for the Middle East at the National Security Council, was appointed to lead the American side, with the deep involvement of US Ambassador to Israel Daniel Shapiro, while Nagel, by this time Israel's National Security Adviser, led the Israeli side with the support of Israeli Ambassador to the US Ron Dermer and the head of the IDF's Planning Division, Gen. Amikam Norkin. These talks opened in December 2015, and continued intensively until the signing of the MOU in September 2016.

There were four primary issues that dominated the negotiations during those months: the top line of the MOU; whether it should include Ballistic Missile Defense funding; the use of FMF to purchase fuel; and Off-Shore Procurement, the provision that permitted Israel to use a portion of its FMF to purchase equipment from Israeli rather than American firms. Each issue warrants its own discussion.

The Top Line

Without revealing details of the negotiations, it is widely known that Israel sought a higher total for the MOU than the \$38 billion that was eventually agreed. Its envoys laid out Israel's defense needs and documented their analysis of the funding levels required to fill them in detailed presentations. They argued that a significant increase in FMF was required to keep up with inflation and make up for the declining purchasing power of FMF dollars.

The US position was that the United States was fully committed to meeting Israel's defense needs, including via an increase in funding from the previous \$30 billion MOU. But, the American side explained, it also needed to take into account certain budget realities. These included the overall pressure on the US budget which resulted each year in large deficits, the declining level of funding for FMF provided by Congress each year, and the increasing Israeli share of the FMF budget. At \$3.1 billion (the closing level of FMF in the previous MOU), the Israeli share of the global FMF budget stood at roughly 40 percent. Two of the three next largest recipients of FMF were Egypt and Jordan, Israel's two Arab peace partners. The American side explained that there would be no way to increase FMF to Israel to certain levels without cutting deeply into the Egyptian and Jordanian programs, and likely eliminating altogether a number of smaller programs in other countries.

The Israeli side faced a dilemma about whether to proceed toward completion of the MOU in 2016 at lower levels than it preferred, or to put the negotiations on hold in 2016 and take them up with the new US administration in 2017. Some advised Israel that it might be able to expect a marginally higher top line in negotiations with a Hillary Clinton Administration, although many of the same budget pressures would be relevant, and some of the same US officials might be involved. As it became clear that Donald Trump would be the Republican nominee, the prospect of negotiating with a Trump Administration was difficult to predict. While he projected a friendly attitude toward Israel, he was disparaging of foreign aid in general and US expenditures in the Middle East in particular, and it was difficult to forecast who would serve on his national security team.

One thing was clear: by not completing the MOU in 2016, the delay would be at least a year, while a new administration appointed its senior officials and negotiations were relaunched from the beginning. That time pressure became an important factor in the Israeli decision. The IDF leadership was eager to complete the MOU in 2016, even at lower levels than Israel sought, to facilitate moving forward with their long-range planning and key acquisitions. In particular, the IDF felt it needed the certainty of a signed MOU to implement its five-year Gideon Plan for the defense budget, and to proceed with the purchase of 31 additional F-35s, beyond the original purchase of 19, allowing the Israeli Air Force to field two complete squadrons of 25 aircraft. While it was possible that, in certain scenarios, the next US administration would agree to a higher top line, the likelihood was that the increase would not be dramatic, and would not make up for the lost time in allowing the IDF to advance on these key steps.

With all of these considerations in play, the two sides struggled over both the top line and whether it should be provided at a flat rate of funding or in a phased increase, as the previous MOU had done. The agreement that was reached provided for a flat rate of \$3.3 billion in FMF funding a year for 10 years, an increase of \$200 million a year over the closing rate of the previous MOU.

Ballistic Missile Defense

The previous MOU had covered only FMF, an account controlled by the State Department. In parallel, Israel requested and received funds each year

from a separate account controlled by the Defense Department to fund its Ballistic Missile Defense (BMD) programs (Iron Dome, David's Sling, and Arrow 3). The typical pattern was that the Administration would call for a certain BMD funding level from Congress that was less than the Israeli request, knowing that Congress would respond by increasing the number, sometimes by a factor of two or three. Israeli planners had gotten used to this "plus-up" process, as well as additional opportunities for funding in supplemental appropriations bills, which resulted in annual funding levels anywhere from \$350 million to over \$700 million.

This pattern created a degree of uncertainty on both sides. For Israeli planners, it meant difficulty in predicting any given year's funding level. For Pentagon planners, it meant concern for the funding stability of US BMD programs, from which the funds for Israel were drawn and which were struggling to make progress in addressing North Korean ballistic missile threats. They also raised questions about the absorptive capacity of the Israeli programs.

The final MOU included a flat rate of \$500 million per year for Israeli BMD programs for 10 years. While that figure was lower than Israel had received via Congressional plus-ups in some previous years, for the first time it provided a stable, predictable level of funding that both sides could plan for, and represented the first long-term commitment, not subject to the ups and downs of annual negotiations with the administration and Congress, to Israeli BMD programs. The Israeli side explained that these funds would permit the buildup of the inventory of interceptor missiles for all three systems, as well as the development of new batteries for Arrow 3 and David's Sling to confront the most pressing threat of missiles from Lebanese Hezbollah, Syria, and Iran.

Fuel

In previous years, Israel had spent in the range of \$300-400 million of its FMF grant on fuel, primarily for aircraft. The American position in the negotiations was that spending FMF dollars on fuel was an inefficiency that should be corrected. They argued that FMF should be used for those systems that the United States has the unique ability to provide, while Israel should budget its own national funds to purchase fuel. They pointed out that the amount spent on fuel each year was equivalent to the cost of two

to three F-35s, meaning those were dollars not spent on unique American defense capabilities and job-creating orders from US defense contractors.

The Israeli side countered that its budgeting had long assumed flexibility to purchase fuel with FMF dollars, and making the adjustment to purchase fuel exclusively with Israeli national funds would require painful cuts elsewhere. But the US position was firm, and its negotiators further argued that Israel would have two years from the signing of the MOU until the beginning of its implementation to make the necessary budget adjustments. The final MOU says that “both sides understand that FMF is not intended for the purchase fuel or other consumables.”

Off-Shore Procurement

Off-Shore Procurement (OSP) was one of the most contentious issues in the negotiations, and the last one to be resolved. Israel was unique among countries receiving FMF in that it was permitted to spend a portion of those funds in shekels to buy from Israeli defense firms. The figure had been set for many years at 26.3 percent of the total US package.

When OSP was launched in the 1980s, its intent was to help build up and sustain Israel’s young defense industry which was considered a critical part of Israel’s national security. Some three decades later, the United States’ view was that the Israeli defense industry was now mature, competitive, and had customers around the world — in some markets even competing with US companies — and therefore OSP had outlived its original purpose. Therefore, the US position was that Israel’s FMF program could now return to normal, to be run as FMF was in all other countries.

The Israeli position was that eliminating OSP could have a negative impact on its defense industry. Israel argued that it would cause budgetary chaos, as it had already made commitments to some companies, and would certainly lead to a loss of jobs, weakening the industry. The US side was sympathetic to these concerns, but did not feel that the United States had an obligation to maintain OSP as a permanent Israeli jobs program, especially in light of the maturity of the Israeli economy. The Israeli side then proposed a reduction, rather than full elimination of OSP, but the US position was firm — OSP needed to end by the final year of the MOU.

The US side did show flexibility on the terms for the phase-out. The two sides developed a creative phase-out formula that reached the US goal of

zero OSP, but softened the impact in the first five years with a very gradual decline from \$815.3 million to \$775.3 million. It was understood that those years would give the Israeli government and industry time to plan, prepare, and adjust for the more significant changes that occurred in the much steeper slide from \$725.3 million to zero in the second five years.

Final Issues

The MOU also contains an agreement that both sides would respect the terms of the MOU, that is, they would not seek to change the terms without the consent of the other side. Specifically, that means that Administration budget requests to Congress should reflect the levels in the MOU, and Israel will not go to Congress on its own to request increases above the MOU levels – particularly on BMD funding, which had been the practice in the past. These provisions provide a significant degree of certainty and predictability to both sides, and strengthen the agreement. Of course, the MOU can always be revisited by the mutual consent of both sides. With respect to BMD funding, the MOU explicitly states that if the two governments jointly agree on the need for a change in light of “exceptional circumstances” – “such as in the event of a major armed conflict involving Israel” – they could jointly approach Congress to advocate for such funds.

Since President Trump took office, there have been rumors that Israel will try to renegotiate various provisions of the MOU – the top line, the decision not to allow the use of FMF for fuel, and most of all, the phase-out of OSP. Israel is clearly within its rights to request such a renegotiation, and anything that they can agree on with the Trump Administration is fair game. But so far, such efforts have not advanced, at least not with any public notice.

Given Trump’s commitment to US jobs, there are serious questions about whether he would support depriving the US defense industry of over \$2.5 billion over the next decade – which would be the effect of canceling the phase-out of OSP. If such a proposal were raised, US defense contractors would certainly make their views known to Members of Congress, citing the jobs that could be at stake in their districts. Some media reports have cited Members of Knesset raising concerns about the Israeli jobs that will be lost if OSP is phased out, which again raises the question about whether US taxpayers, who have been very generous to Israel for many years and continue to support its foreign aid program, should be obligated to fund a

permanent Israeli jobs-support program. If Israel were to advocate for such a change, it would have to weigh whether restoring OSP and the Israeli jobs it supports would be worth the potential decrease in support for Israel's foreign aid from parts of the American public, particularly in key areas of the US where many defense contractors are located.

Part 3

**The Impact of the MOU
on the Security Industries in Israel**

Possible Effects of the Change in Foreign Currency Aid on the Structure of the Israeli Defense Companies

Guy Elfassy, Ronny Manos, and Asher Tishler

Introduction

In September 2016, the Memorandum of Understanding (MOU) was signed between the governments of Israel and the United States for a \$38 billion American defense aid package under the Foreign Military Funding (FMF) Program for the period 2019-28 (hereafter “the new aid agreement”).¹

Ostensibly, the new aid agreement is the largest ever granted to Israel by the United States. Yet, compared with previous FMF agreements, it introduces a number of changes that are likely to have harsh consequences for the local defense industry, Israel’s preservation of armament knowhow, and for the Israeli economy as a whole. In particular, the new aid agreement reduces substantially the amount of aid money which Israel’s Ministry of Defense can convert into Israeli shekels (NIS) under the FMF and use for defense-related procurement from local defense companies.

In this article we estimate and assess the resilience of Israeli defense companies to the worsening conditions implied by the changes in the new aid agreement. Based on an exclusive and comprehensive database containing 603 Israeli defense companies, we analyze the structure of the industry and

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suggest a model of resilience.² Moreover, the validity of the resilience model is assessed by comparing its predictions to the results from interviews and questionnaires filled by 50 senior executives in Israel's defense industry.

Our findings point to key factors that can help predict the resilience of a defense company to the expected decline in local procurement by the Ministry of Defense. These factors include a company's size, sector, technological level, physical location, and extent of cooperation with American businesses. For example, the study projects a drop in revenues and profits among small defense companies with fewer than 250 employees, especially in the metal, electronics, and rubber sectors. The study concludes that the likely long-term consequences of the changes introduced in the new aid agreement include a decrease in the competitiveness and technological knowhow of Israeli defense companies, a change in the structure of the defense industry, and acceleration of the processes of consolidation within the industry.

The article is structured as follows: a brief review of the new aid agreement is presented in part A, followed by an analysis of Israel defense industry in part B. Part C introduces the resilience model, while part D applies the model to defense companies and evaluates its validity by comparison with assessments made by senior executives in the industry. Part E summarizes and concludes our findings.

Part A – The MOU for American Defense Aid to Israel: 2019-2028

In September 2016, the US administration led by President Barack Obama signed a new multi-year FMF aid agreement with the Israeli government. The agreement, which applies to the 2019-2028 period, is the third in a series of 10-year aid agreements between the two countries and reflects the continued commitment of the US to maintaining Israel's military standing. Table 1 provides key differences between the new aid agreement and its predecessor.

The most immediate economic effect of the restrictions introduced in the new agreement relates to the gradual reduction in the ability of Israel's Ministry of Defense to convert dollar aid into shekels. As illustrated in Figure 1, the amount of aid dollars that can be converted into shekels – and thus be used for local defense procurement – will decrease gradually until it is totally eliminated by the end of the period (2028). Compared with 2018,

this is a loss of \$1.2 billion a year of aid money that the Ministry of Defense would not be able to use for local defense procurement.

Table 1: Comparison of the 2019-2028 aid agreement with the 2009-2018 aid agreement

	The 2009-2018 aid agreement	The 2019-2028 aid agreement	Additions in the 2019-2028 aid agreement
Total financing	\$31 billion	\$33 billion	Over the coming decade, the two sides will endeavor to prevent changes or additions to the American aid in foreign currency to Israel.
Financing the joint anti-missile defense program	\$1.49 billion (an additional \$4.513 billion was approved)	\$5 billion	Under certain conditions, additional aid can be requested.
Total permitted to be converted into NIS	\$7.846 billion	\$5.65	Israel is obligated to report in detail the NIS usage of the converted money. The conversion percentage becomes zero in 2028.
Fuel procurement in the US in foreign currency aid	\$4 billion	Cannot be purchased	Continued purchase of fuel in foreign currency aid was allowed only during the first year of the new agreement (2019).
VAT spending ³	\$3.934 billion (equivalent value in NIS)	\$5.61 billion (equivalent value in NIS)	

Sources: Sharp (2018); Zanotti (2018)

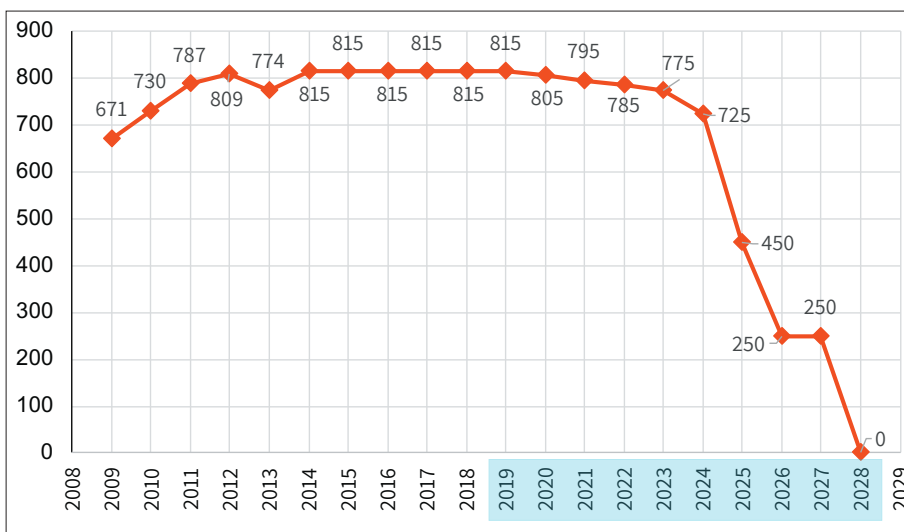


Figure 1: The gradual reduction in conversion of aid in foreign currency to NIS, as determined in the 2019-2028 aid agreement (US\$ millions)

Source: Sharp (2018)

Thus, under the new aid agreement it is more difficult to spend aid money locally, and more defense procurement is likely to be made from foreign suppliers, primarily from the US. Consequently, the cost of defense procurement is also expected to rise because local prices are generally lower and there are additional payments relating to increased purchases from the US. Further, under the new aid agreement, the Israeli Ministry of Defense can no longer use aid money to purchase fuel. It must therefore raise an additional NIS 1-1.15 billion a year from other sources to enable air force planes and other platforms to continue their regular activity.

To understand the specific implications of the changes in the new aid agreement to the local defense industry, we start by analyzing the structure of the industry.

Part B – Analysis of the Defense Industry in Israel

There is no formal definition for a defense company. A popular definition is that a defense company is a company that manufactures products for exclusive defense use (Flamm, 2000). This definition, however, is problematic for several reasons. First, some firms describe themselves as defense companies

although the proportion of revenue they generate from selling defense products is often minor. For example, in 2016, 43 of the 100 largest defense companies worldwide, in terms of revenues, derived less than 50 percent of their total annual revenues from selling arms.⁴ Second, there are private companies that serve defense customers, for which no public information is available (e.g., the percentage of revenue they derive from the sales of goods for defense/military use). Third, there are many companies that serve defense customers, but the products they supply cannot be described as classic defense (such as weapons or ammunition).

Another popular definition for a defense company is one that makes combat platforms or end products for defense use (Dvir and Tishler, 2000). But this definition excludes firms that participate in the manufacturing value chain as subcontractors for arms manufacturers. This exclusion is problematic. Take Rotem Industries, for example. The firm, located near the Negev town of Dimona, is one of the few companies in Israel that specialize in the polishing of sapphire mineral. Sapphire has various uses in the electro-optics industry but is also useful in the manufacturing of certain missiles due to its resistance to pressure and to extreme temperatures. Indeed, in a 2014 interview, Yoram Sadan, the CEO of Rotem Industries, explained that: “A palm-sized dome which is installed in the head of an Israeli-made Python air-to-air missile is sold by Rotem for \$10,000. Similar glass, incidentally, is used to manufacture highly pressure-resistant luxury watches, but Rotem focuses exclusively on the defense market.”⁵ Yet, according to the definition proposed by Dvir and Tishler (2000), Rotem Industries is not a defense company but a subcontractor to other arms manufacturers, such as the large Israeli defense company, Rafael Advanced Defense Systems. However, Rotem is likely to be severely affected by the amendments introduced in the new aid agreement, and in particular the gradual elimination of the ability to convert dollar aid to shekels for local use. For example, if Rafael decides to divert orders for the production and polishing of sapphire from Rotem to the US in order to utilize aid in a foreign currency, this would have severe consequences for Rotem. It would also reduce Israel’s ability to preserve precious manufacturing knowhow.

Alternatively, Dvir and Tishler (2000) propose another definition for a defense company, namely, a company that is directly involved in development and/or manufacturing relating to armaments by government defense agencies.

Thus, a defense company is one that is actively involved, at some level, in the value chain of the local defense industry, regardless of the proportion of total revenue it derives from this activity. This definition distinguishes between companies that are directly involved in development and the production of arms – classified as defense companies – and others that provide goods and services with indirect defense uses. The latter may be supplying fuel, food, energy, catering, medical, and other services to the defense industry but are not classified as defense companies.

This study adopts Dvir and Tishler's (2000) definition of a defense company, as one that is directly involved in the development and production of armaments *for military use*. This allows us to identify and collect data on the companies that make up the local defense industry, and to analyze the structure of the industry and its vulnerability to the changes in the new aid agreement.

Shefi and Tishler (2005) conduct a similar analysis, using company size as their base. They suggest a hierarchical structure including four large companies and approximately 150 small firms. Dvir and Tishler (2000) offer an alternative method which is based on the defense company's technological development and experience in the defense market.

As an extension of both these studies, we analyze the defense sector in Israel based on the hierarchy of companies, their technological development, and the definition of a defense company as one engaging directly in the development and production of weapons.

Accordingly, our analysis is as follows: In the first stage, every defense company is assigned to one of four technology levels. Technology level 1 comprises companies developing and manufacturing a complete weaponry platform requiring access to a range of engineering technologies and capabilities. Companies at technology level 2 are those developing or manufacturing systems designed for integration into weaponry platforms. Companies at technology level 3 are developing or manufacturing sub-systems or services designed for companies at technology level 1 or 2. Technology level 3 supplements the value chain suggested by Dvir and Tishler (2000) and allows for a layer of firms that are employed as subcontractors by companies at higher technology levels.

Parallel to the three technology levels, an additional level is defined (designated with the number 16⁶), consisting of companies that provide

specific defense-related services to defense companies at all technology levels. Specifically, companies in technology level 16 provide defense firms with testing services and assistance with importing raw materials needed for defense production. We refer to companies in technology levels 1-3 as developers and manufacturers of defense products, and to companies in technology level 16 as providers of defense-related services. Table 2 outlines and defines our method for analyzing Israel defense industry based on our four technology levels.

In the second stage of analyzing and mapping the Israeli defense industry, various data were collected about the Israeli defense companies. In particular, information was collected on four elements identified as important in determining the resilience of a defense company to the changes introduced by the new aid agreement. The first element is diversification of sales, including whether the products of the company have dual use (military as well as civilian), diversity in customers, and diversity in products. The second element is the industrial sector in which the company operates, including the uniqueness of the products produced. The third element relates to whether the company has developed business cooperation with companies in the US. Such cooperation makes it easier for the Israeli company to utilize payments it received in US dollars under the new aid agreement. The fourth and last element is the geographic location of the company in Israel.

Additional data were gathered about the defense companies, including company size in terms of number of employees and the year in which it was founded. Altogether, 603 companies were identified as meeting the definition of a defense company and these were classified based on their technology level and other characteristics.⁷ The following are several insights about the Israeli defense industry, gained from our analysis of the database.

Table 2: Mapping Israeli defense companies based on technology levels

Technology level	Characteristics	Types of products developed and produced by companies at this level	Utilization of payments received directly or indirectly from the Ministry of Defense in foreign currency under FMF
Developers and manufacturers of defense products			
1	Companies with the technological capability to develop and manufacture a complete weaponry platform from a broad range of disciplines and engineering technologies. Employ over 500 employees, mostly engineers, with a high ratio of revenue per employee, and advanced research and development capabilities.	Battleships; battle tanks; armored fighting vehicles; airplanes; missiles systems; etc.	These companies find it relatively easy to utilize foreign currency payments received from the Ministry of Defense.
2	Companies with the ability to develop or produce systems/services designed for integration into weaponry platforms or as part of other weaponry. Develop systems or products that integrate a limited number of engineering disciplines and have fewer than 500 employees.	Cannons and mortars; munitions; weapons and electronic systems that are installed on platforms including ships, airplanes, and tanks; electro-optic systems; hydraulic and electrical systems; etc.	These companies are limited in their ability to utilize foreign currency payments received from the Ministry of Defense.
3	Companies capable of developing or manufacturing sub-systems and services designed for companies at technology levels 1 and 2. The manufacturing processes involve a limited number of engineering disciplines.	Textile products; card assemblies; electrical cabling; metal casting; processing of metal and rubber products; software services; etc.	These companies find it relatively difficult or impossible to utilize foreign currency payments received from the Ministry of Defense (either directly or from other defense companies, when they act as subcontractors).
Providers of defense-related services			
16	Companies with no manufacturing or development facilities located in Israel. Provide services to defense companies at all other levels and do not employ many engineers.	Import services for raw materials; maintain local offices of overseas companies; testing services.	

B.1. Analysis of the defense industry – Technology level

Figure 2 displays the distribution of defense manufacturers in Israel according to their technology level. Seven of those companies fit the definition of a company at technology level 1, including: (1) Israel Aerospace Industries (I.I), (2) Elbit Systems, (3) Rafael Advanced Defense Systems, (4) Tomer Systems,⁸ (5) Aeronautics, (6) Merkava Tank and APC Administration,⁹ and (7) Israel Shipyards. Those are the largest defense companies in Israel in terms of revenues and number of employees, together operating 32 development and manufacturing sites (and/or subsidiaries) in Israel. There are 97 additional defense manufacturers at technology level 2, and the rest are at technology level 3.

As shown in Figure 2, level 16 companies, which provide defense-related services such as testing and importing to defense manufacturers at all technology levels, account for 14 percent of the Israeli defense industry. These companies are not directly involved in weapons systems development and production value chain and are therefore not included in the resilience model we developed.

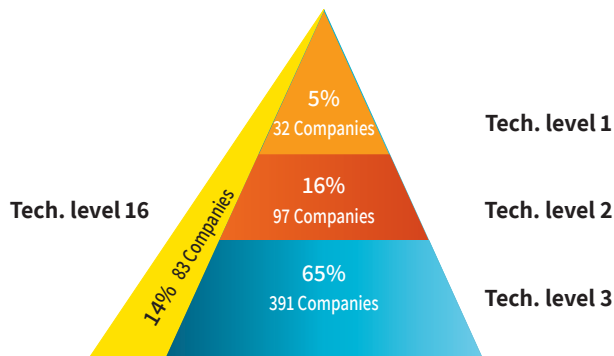


Figure 2: Division of the defense companies in Israel into four technology levels (2018)

B.2. Analysis of the defense industry – Company size (number of employees)

As of 2018, the Israeli defense industry directly employs 72,000 people. Most of this workforce (69,800 or 97 percent) is employed by developers and manufacturers of defense products (technology levels 1-3) and the

remaining (2,500) by providers of defense-related services (technology level 16). Figure 3 presents the number employed by developers and manufacturers of defense products, split into the three technology levels. Looking at Figure 3, it is immediately obvious that most of the workers are employed by the seven companies at technology level 1 (33,200 or 46 percent of the total).

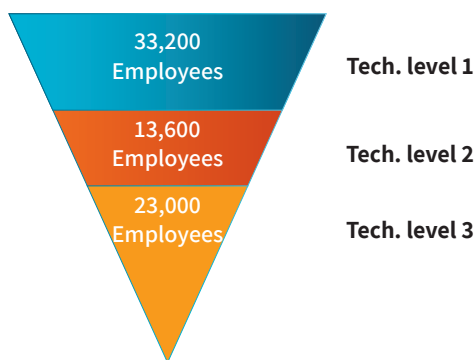


Figure 3: Number of employees in Israel's defense industry by technology level (2018)

Notes to Figure 3: Technology levels 1-3 encompass companies that develop or manufacture defense products. Together these companies directly employ 69,800 workers. In addition, companies in technology level 16, which provide defense-related services, employ 2,200 workers. Thus, a workforce of 72,000 is directly employed by the Israel defense industry.

Data for 2018 also reveal that the number of employees in defense companies located in peripheral Israel (mainly in the country's north) is 15,500 (about 22 percent of the total employed by the defense industry). Moreover, approximately 60 percent of peripheral defense companies are in the metal and electronics sectors, employing, on average, 100 workers each. Indeed, about half of all those working in the industry are employed by defense companies that are located in peripheral areas.¹⁰ As discussed later, defense companies in peripheral areas, especially those at technology level 3 (such as the metal and electronics sectors), are particularly vulnerable to the tightening of the terms in the new aid agreement for converting foreign currency to local currency.

B.3. Analysis of the defense industry – Industrial sectors

Figure 4 displays the distribution of defense companies across industrial sectors. Some sectors, namely electro-optics, IT communication and software, and systems integration, are engineer-intensive.¹¹ These sectors are usually highly innovative, which improves their ability to adapt to dynamic environments. Indeed, Amit and Zott (2010) argue that technological innovation can explain a firm's ability to cope with economic and other changes. Wessner (2005) asserts that key to the survival and growth of innovative firms is their ability to constantly react to changes in the market and in customer requirements. An OECD report from 2016 finds that a highly educated workforce and extensive expenditure on research and development explain Israel's impressive growth in entrepreneurship (OECD, 2016).

At the other extreme are more traditional sectors that are not engineer-intensive, such as metal, rubber, textiles, and materials, electronics, machinery, and general services.¹² Companies in those sectors find it more challenging to compete in the manufacturing of defense products against competitors in countries characterized by low personnel costs.

Figure 4 shows that the bulk of the defense companies in Israel operate in the traditional, low-tech and non-engineer-intensive manufacturing sectors (e.g., metal), which means that they find it more difficult to innovate and adapt in order to cope with dynamic environments.

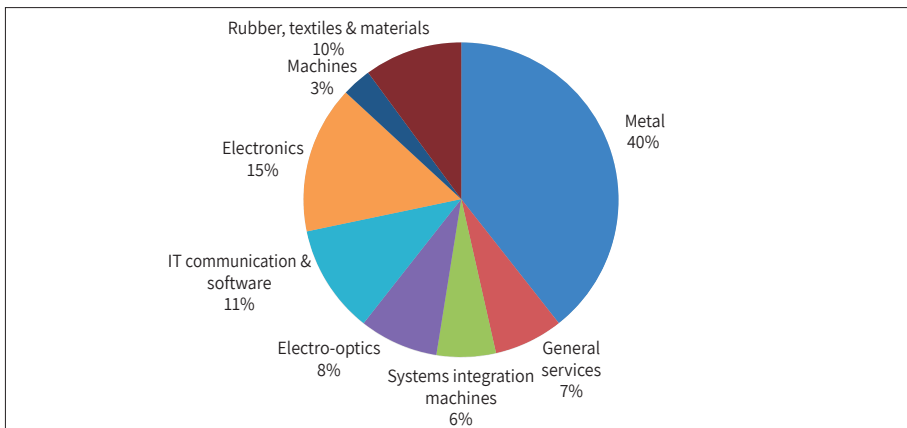


Figure 4: Distribution of Israeli defense companies across industrial sectors (2018)

B.4. Analysis of the defense industry – Geographic location

Soon after Israel gained independence in 1948, defense companies popped up across the country, mostly near the densely populated cities of Tel Aviv and Haifa. Figure 5 displays the geographic distribution of defense companies as of 1960.

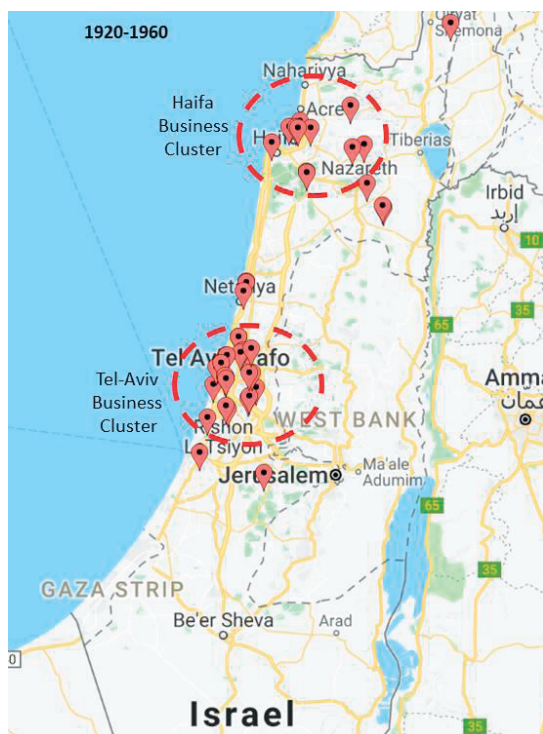


Figure 5: Geographic distribution of defense companies across Israel, as of 1960

Note: The map indicates a 40-kilometer radius around the cities of Tel Aviv and Haifa.

Having clusters of defense companies has clear advantages, for the exchange of knowledge, reduction in transportation costs, and other reasons. However, during the 1980s and 1990s, defense companies started to spread to the periphery, driven by improved infrastructure and the dispersal of the population. Moreover, the government encouraged companies to move to the periphery by providing benefits for those located in national priority areas.¹³ Figure 6 presents the proportion that each sector within the defense industry represents, as of 2019, in national priority areas.

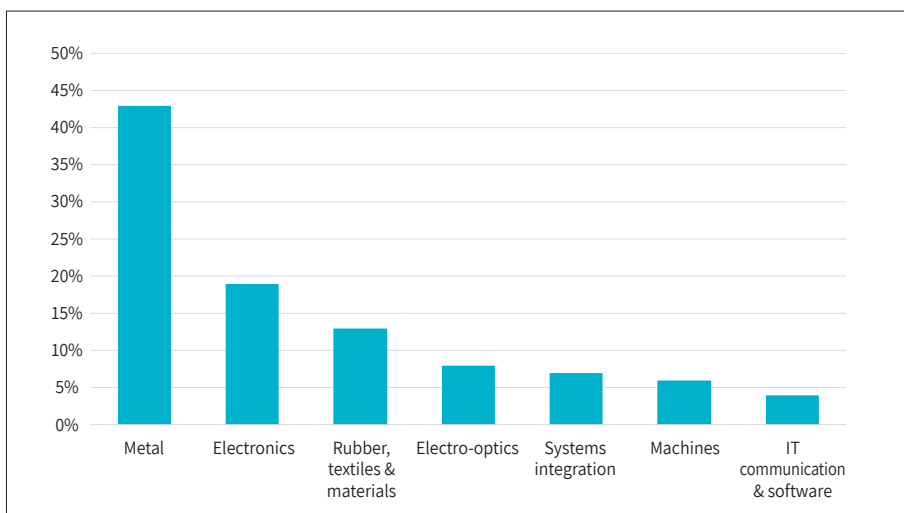


Figure 6: The relative share of each industrial sector within the defense industry in national priority areas (2019)

As can be seen from Figure 6, engineering-oriented companies are conspicuously absent from the periphery. Most of the engineers in the defense industries work in companies at technology level 1, located in the vicinity of Tel Aviv and Haifa. Metal and electronics companies, on the other hand, have a prominent presence in national priority areas of low socioeconomic ranking.¹⁴ This pattern can be explained by the characteristics of the labor force required by companies at different technology levels. In particular, manpower in the periphery is characterized by low levels of expertise and education, enabling low-technology companies that are located in those areas to pay relatively low wages and maintain reasonable profit margins. Indeed, access to workers with a level of education suitable for low-tech production is positively correlated with the socioeconomic conditions in the location where the company is located.¹⁵

Another factor that can explain the high proportion of low-tech enterprises in national priority areas is government subsidies to encourage such patterns. These incentives include land subsidies and deductions on municipal taxes for enterprises distant from central Israel. Moreover, low-tech production-oriented companies, such as in the metal and materials sectors, require large areas to install machinery and store raw materials. In national priority areas, located away from central Israel, the cost of land is relatively low, which

supplements government subsidies and incentives in reducing the cost of operations and attracting low-tech defense companies to the periphery of Israel.

Interestingly, despite the benefits granted to companies located in a peripheral area, our resilience model predicts that companies located in national priority areas are particularly vulnerable to the unfavorable changes introduced in the new aid agreement. Specifically, according to our model, these companies are particularly sensitive to the gradual reduction in the amount of dollar aid money which can be converted into the local currency to be used for defense procurement. In the next section we introduce our model.

Part C – The Resilience Model for Predicting the Probability of the Survival of Defense Companies under the New Aid Agreement

The resilience model aims to predict the ability of a defense company to survive over the coming decade, given the changes in the new aid agreement. The model is based on four key factors that CEOs of defense companies identified as crucial, assuming gradual reduction in shekel-based orders by the Ministry of Defense. The first factor is varied sales (VS), included to measure diversity in revenue sources. The second factor is the industrial sector (IS), included to measure the complexity of the operation, technology level, and competition. The third factor is the existence of business cooperation with a US company, for utilizing aid money in dollars (American business cooperation – ABC). The fourth factor is the company location (L), included due to differing cost structures, as discussed in the previous section.

The VS factor measures diversity in sources of revenue and is expected to have a positive effect on resilience. Specifically, a company is expected to be less reliant on orders from Israel's Ministry of Defense if its revenue comes from different customers or products or if it exports a substantial proportion of its output. To measure these aspects, VS is constructed as a weighted index of three coefficients. The first coefficient of the VS index is allocated a weight of 60 percent and measures the dual use of the company's products for both civilian and military purposes (dual use). For example, a missile manufacturer, the products of which are used exclusively for defense, will receive a 0 ranking for dual use of the company's products. In contrast, a manufacturer with products that have defense as well as civilian uses will receive the value of 1 for the component dual use. The second

coefficient of the VS index is allocated a weight 30 percent and measures the diversity in customers in terms of the mix of customers from Israel and from overseas (customer diversification). A company with customers both in Israel and overseas is more resilient to a reduction in orders from the Ministry of Defense compared to a company which sells in Israel only. The third coefficient of the VS index is allocated the remaining weight of the index, 10 percent, and measures the diversity in the products manufactured by the defense company (product diversifications). A company with a broad range of products is versatile and hence is expected to be able to cope relatively well with a reduction in orders from the Ministry of Defense.

The IS factor will also affect a defense company's resilience. Belonging to an industrial sector characterized with a highly qualified labor force implies that it is more difficult to replace the local company with a US firm in order to make payments in dollars. Moreover, having highly qualified labor implies that the company finds it relatively easy to innovate and develop technological responses to occurring challenges. For example, it can develop unique products that will give it a competitive edge. To measure these characteristics, the IS factor is constructed as a weighted index of two coefficients. The first coefficient, allocated 60 percent of the total, is the level of sectoral innovation. We use engineer-intensity as a measure of innovation. Specifically, we analyzed 1,282 job offers published by defense companies on their websites during April-October of 2018. Based on this analysis, an innovation rank was awarded to each industrial sector. The second coefficient, given the remaining 40 percent of the IS index, is the uniqueness of products. A unique product is a product that is difficult to obtain from local or overseas competitors, usually due to relatively complex manufacturing and development processes. Examples include the digital land army command and control system produced by Elbit Systems, the Merkava tank, or the polished sapphire domes for missiles produced by Rotem Industries.

The third factor in the resilience model, American business cooperation (ABC), measures the existence of cooperation with an American firm, because having such cooperation will make it easier for the Israeli company to receive payments in dollar aid money. Such companies are therefore in a good position to cope with the gradual reduction in the amount of aid money which may be converted from dollars to shekels.

Lastly, the fourth factor, location (L), is also expected to influence companies' ability to cope with the changes in the new aid agreement. While locating in the periphery provides benefits relating to government subsidies and lowers operating costs, these advantages are dwarfed compared to the convenience of being in central Israel. Indeed, locating near the big cities of Tel Aviv or Haifa provides good access to high-quality personnel, professional management and proximity to technology level 1 companies.

Together, the four factors (VS, IS, ABC, and L) make up the explanatory variables in the resilience model. The weight of each one was determined based on the company's technology level and its importance, as judged by 50 senior defense industry executives who were interviewed on a one-on-one basis. The following equation presents our resilience model:

$$\text{Resilience factor} = \alpha * \text{VS} + \beta * \text{IS} + \gamma * \text{ABC} + \delta * \text{L}$$

where:

- α is the weight of varied sales (VS), made up of three coefficients (dual use, customer diversification and product diversification),
- β is the weight of the industrial sector (IS), made up of two coefficients (innovation and uniqueness of products),
- γ is the weight of cooperation with a US company (ABC), and
- δ is the weight of the company's geographic location(L).

The value of α , β , γ and δ is given in Elfassy (2019).

In the next section we present the results of the model. We also validate those results by comparing the model's predictions with those made by the industry executives. Specifically, a questionnaire was distributed to 50 executives to record their opinions on the resilience of their own and other defense companies. Moreover, to gain further insights into the implications of the changes in the new aid agreement and about the resilience of defense companies to those changes, the executives were also interviewed on an individual basis.

Part D – Applying and Evaluating the Resilience Model, Validation, and Insights

D.1. Results

Applying the resilience model to 519 defense companies generated a rating for each company ranging from 1 (indicating high resilience) to 0 (low resilience).¹⁶ The average value of the resilience measure for each technology level was calculated and compared to the average value assigned by 50 industry executives.

Using a questionnaire, the executives were given a list of 40 defense companies spanning the three technology levels. They were asked to rate the likelihood of each company continuing to generate profits by 2028, given its sensitivity to the changes introduced in the new aid agreement. The executives were also instructed to rate only companies they are familiar with, and with which they had business connections.¹⁷ A total of 980 ratings were obtained from the 50 participating CEOs.

The resilience averages obtained from the model and from the executive questionnaire were averaged across the three technology levels and are compared in Figure 7.

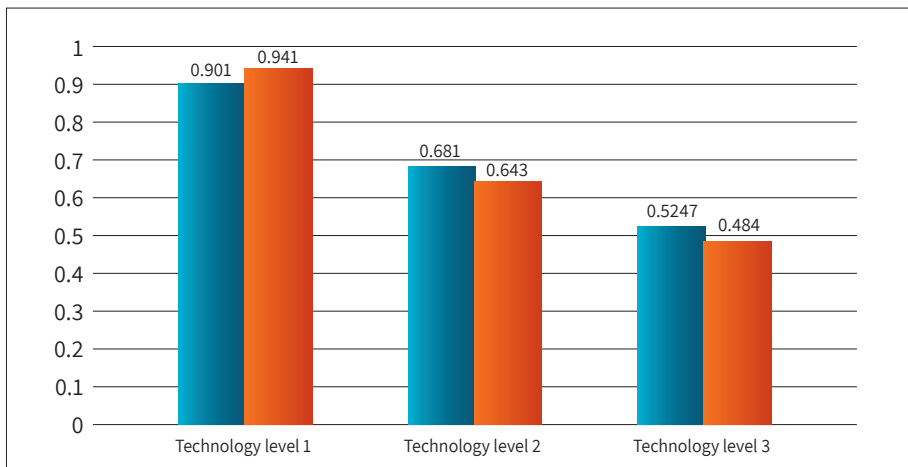


Figure 7: Average value of the resilience measure across the three technology levels – A comparison of results obtained using the resilience model (lighter columns) with results obtained from the questionnaire distributed to industry executives (darker columns)

This figure yields two clear insights: First, there is a high correlation between the ratings produced by the resilience model and those provided by the defense industry executives. This result is reassuring and reinforces the validity of the resilience model. Second, there is a substantial difference in the resilience ratings between the three technology levels. In particular, the values of resilience produced by the model for companies at technology level 1 are substantially higher than those of companies at lower levels of technology.

Figure 8 displays the average resilience rankings for 519 defense companies in Israel, across industrial sectors. The results produced by the model were compared to those obtained from the industry executives. Again, we see a high positive correlation between the model’s results and those from the executives’ questionnaire. Engineer-intensive sectors (systems integration, IT communication and software and electro-optics) have a higher resilience measure compared with production-oriented sectors.

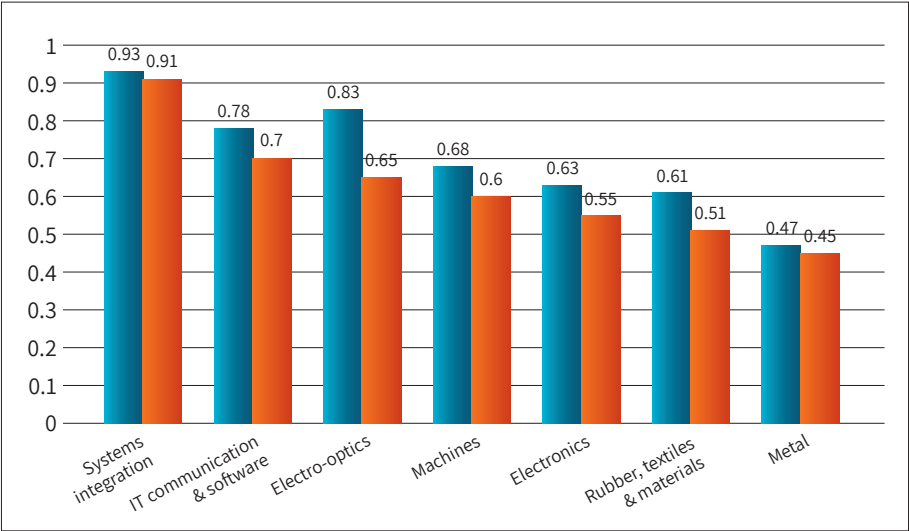


Figure 8: Resilience measures according to industrial sector: Results of the resilience model (lighter columns) and ratings by industry executives (darker columns)

The results support our argument above that a highly qualified labor force is an indication of innovation and contributes to the company’s resilience.

Indeed, we check and find positive correlation between the industrial sector's innovation score and the company's resilience measure ($r=0.8766$, $p<0.01$).¹⁸ Thus, companies in high-technology, engineer-intensive industrial sectors tend to have higher resilience values than firms in low-technology, production-intensive industrial sectors.

D.2. Insights from our interviews with industry executives

Table 3 presents information about the 50 industry executives who filled out the resilience ranking questionnaire and who were also interviewed. The information is averaged across the three levels of technology, giving the average CEO's level of knowledge about the new aid agreement and the average years of management experience.¹⁹ A value of 9 denotes a high level of knowledge, a value of 6 a medium level of knowledge, and a value of 3 a low level of knowledge. A CEO's seniority is based on the number of years served in senior positions in the defense industry.

Table 3: Executives' knowledge of the 2019-2028 aid agreement and seniority according to their company's technology level

Technology level	Average knowledge level of CEOs	Average seniority of CEOs
1	8.45	15 years
2	6.46	14.5 years
3	4.06	17.8 years

As seen in table 3 there is a strong positive correlation between the company's technology level and the executive's knowledge about the new aid agreement ($r=0.71$, $p<0.001$). Most of the executives at technology level 1 said that they were personally involved in preparations to enable their companies to deal with the changes introduced in the new aid agreement. Preparations include improvement to infrastructure facilities of American companies that cooperate with Israeli companies and participation in political and professional committees to discuss the topic and its implications. In contrast, most of the executives from companies at technology level 3 said that they had little or no information about the new aid agreement, and that they were exposed to details about the new aid agreement mainly from the general media. It

is also worth noting that seniority is not a significant factor influencing executives' level of knowledge about the new aid agreement.

Part E – Summary and Conclusions

The new MOU on security between the governments of Israel and the US sets the framework for American defense aid to Israel in 2019-2028. The changes therein, compared to previous agreements, reflect the Obama administration's policy. It also aligns with the attitude of the Trump administration, which endeavors to halt the decline in American production capacity caused by globalization and the opening of markets over the past two decades. The main implication of the new aid agreement for Israel's defense industry is that emerging from the decision to reduce the amount of foreign aid that can be converted into local currency for defense procurement from local producers.

This study analyzes 603 defense companies based on objective data as well as subjective information, which was collected using questionnaires distributed to industry executives. The information was used to develop, apply and validate a model for predicting the resilience of defense companies over the next decade, given the worsening conditions that emerge from the new aid agreement. In-depth interviews with the CEOs who filled out the questionnaire were also conducted to yield further insights on the implications of the new aid agreement to Israel defense industry.

The findings indicate that the local defense industry is likely to face declining profitability and increasing risk of failure in the coming years, as results of the changes in the new aid agreement. Given those changes, the Israeli Ministry of Defense is expected to substantially cut back its procurement in shekels, threatening the survival of particularly small defense companies at technology levels 2 and 3 in the metal, rubber and materials, machinery, and electronics sectors. The risk is exceptionally high for companies in the electronics and metal sectors in the periphery, which may be forced to cease operations due to substantial drop in orders. It is also likely that some of the companies will change their target market from defense to civilian. Furthermore, gaps were identified in the level of knowledge amongst executives in companies at low technology levels regarding the 2019-2028 aid agreement, as well as in their perception of the risk posed by this agreement.

To conclude, an active and productive defense industry contributes directly to Israel's national security. The terms of the new MOU on security between Israel and the US expose the defense industry to a challenging situation in which the industry could lose its edge over its competitors around the world in technology and innovation. In the long term, the loss of Israel's leading position in technology may negatively impact the standing and performance of its defense force. In particular, it may lead to a loss of its technological advantage in weaponry, erode Israel's national security, and reduce the revenues and profits of local defense companies. This situation is also likely to harm the technological advantages and future technological development of the Israeli economy.

Moreover, barring a change in government policy, the new aid agreement is likely to increase the dependence of the Israeli defense establishment on American arms. The local defense industry will experience a gradual decline, coupled with growing reliance on the US for preserving Israel's technological and operational edge. The Israeli government must, therefore, address the fundamental question of whether its defense industry should be exposed to free-market forces like those experienced by the local textile industry in the 1970s and 1980s. Alternatively, the government could classify the defense industry as a national resource that is essential for Israel's national security, similar to resources such as energy and water. It appears that the answer to this question is clear; thus, effective action should be taken to preserve the defense industry.

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Notes

- 1 The first 10-year MOU on Security was signed in 1998. It is often referred to as Foreign Military Funding (FMF) or American Aid in Foreign Money.
- 2 The dataset on the Israeli defense industry is from Elfassy (2019).
- 3 The calculation is for the annual amount of the grant, excluding the proportion converted to shekels, multiplied by the annual percentage of VAT. For 2019-2028, a VAT rate of 17 percent was calculated. The Value Added Tax Law–1975 requires payment of tax on goods imported to Israel, https://www.btl.gov.il/Laws1/00_0022_000000.pdf. To the authors' best knowledge, there is no exemption from VAT for procurement under the FMF Program.
- 4 SIPRI Arms Industry Database 2002-2016.
- 5 "Rafael and Rotem Industries negotiating cooperation over Rotem's Crystals Division," <https://tinyurl.com/syv7bgg>, July 3, 2014.
- 6 The number 16 was selected randomly in order to distinguish this level from manufacturing levels 1, 2, and 3.
- 7 The companies' data were gathered from unclassified sources, such as the companies' websites.
- 8 Tomer Systems was founded as a government company in 2018, after the sale by the government of parts of the business of Israel Military Industries (IMI) to Elbit Systems.
- 9 The Merkava Tank and APC Administration is an agency of Israel's Ministry of Defense, which is responsible for the development and production of the Merkava tank and several armored fighting vehicles for the IDF.
- 10 The peripheral areas, particularly in the south and north of Israel, are considered to be national priority areas.
- 11 Two points to note: First, the "systems integration" sector includes companies at technology level 1 with high engineering integration capabilities. Second, to assess

the engineer-intensity of the various sectors, we analyzed 1,282 job offers published by defense companies in 2018, checking their specifications regarding the education level required. The demand for employees with higher education, particularly in the engineering professions, is dominant in sectors including systems integration, electro-optics, and IT communication and software.

- 12 Two remarks: First, the sector “general services” includes companies at technology level 16 that do not have development or production facilities in Israel but provide defense-related services such as testing and importing. Second, our analysis of job offers revealed that demand for academic education as a threshold condition was not common in sectors including the metal, rubber, textiles and materials; electronics, and general services.
- 13 A national priority area is an area declared by the Israeli government as a preferential area to be granted a set of economic incentives. A national priority area is based on a number of criteria including the level of security threat, geographic location, age of the settlement, and the socioeconomic status of the community. National priority areas are classified as areas A1, A2 and B.
- 14 Israel’s Central Bureau of Statistics divides the localities among Israel into 10 socioeconomic clusters, ranked according to the average level of income and the average level of education of the residents of the same locality. Localities in cluster 1 have the lowest socioeconomic ranking and localities in cluster 10 have the highest socioeconomic ranking.
- 15 See Central Bureau of Statistics 2016 report no. 67 (<https://tinyurl.com/ycut3tca>). The report finds that in 47 communities with a majority population from socioeconomic clusters 3-6, men’s average gross monthly wage was NIS 8,737 (2013 values) and the proportion of high school graduates holding matriculation certificates was 48 percent. In communities from socioeconomic clusters 7-10, men’s average gross monthly wage was NIS 14,725, and the proportion of high school graduates holding matriculation certificates was 82 percent.
- 16 Israel’s defense industry includes 519 developers and manufacturers of defense products. The 84 companies at technology level 16 were not included in the analysis.
- 17 It is important to note that the executives filling the questionnaire received no information about our categorization of the defense industry along technology levels.
- 18 As previously noted, the sectoral innovation score was obtained by analyzing 1,282 job offers published by defense companies in 2018, checking their specifications regarding the level of education required.
- 19 To gauge the level of knowledge of CEOs about the new aid agreement, they were asked the following question: “Could you tell me what you know about the Israel-US 2019-2018 agreement?” Based on the answer, CEOs were assigned a knowledge score. Poor level of knowledge regarding the new aid agreement was given a score of 3. A basic level of knowledge regarding the new aid agreement (e.g., regarding

future reduction in the amount of aid money permitted to be converted into shekels or about the increase in the annual financing budget) was given a score of 6. A high level of knowledge about the new aid agreement (e.g., familiarity with the changes in currency conversion; the increase in the annual budget; and cancelation of the option to purchase fuel in the US) as well as taking active steps to prepare the company for dealing with those aspects of the agreement, were assigned a score of 9.

Tightening the Belt and Introspection – Preparing for the Cut in Shekel Aid

Saul Bronfeld

“The Israeli Navy was always hampered by limited budgets, but achieved smart solutions... It resembles a painter, a poet – [who] creates his greatest art only on an empty stomach.”

Brigadier General (ret.) Shabtai Levy¹

Introduction

The conference at the Institute for National Security Studies in Tel Aviv on the subject of the defense industries² can be summarized in two sentences: first, the defense industries are very important to the IDF, the economy, and the country's outlying areas; and second, a reduction of the shekel component in US aid will have a severe negative impact on Israel's security, the economy, and the local defense industries.

Echoing these statements, most of the speakers at the conference concurred that the reduction in shekel aid was another reason to increase the defense budget for local procurement, and the sooner the better. Brigadier General (res.) Prof. Jacob Nagel, who led the drawn-out negotiations with the American authorities, was the only speaker who argued that the reduction in the shekel aid budget should also prompt some self-reflection on the part of the defense establishment. To illustrate his remarks, he recalled the collapse of Kodak, which failed to identify in advance the changing environment in which it operated.

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This article follows Nagel's argument, and points to a matter that was not raised, but that should be before the budget is reshuffled to deal with an emerging defense-economic problem. In other words, before various actors pounce on the budget, there is a need to reassess the three-way relationship between the IDF, the Administration for the Development of Weapons and Technological Infrastructure (MAFAT), and the defense industries so as to enhance the effectiveness of the budget for force build-up, "to get more bang for the buck." This article will attempt to shed light on this complex issue from an IDF perspective, as reflected in unclassified articles that appeared in the *Journal on Operational Art*, published (mainly in Hebrew) by the IDF's Dado Center for Interdisciplinary Military Studies.

Issue #1: The Need to Increase Compatibility between the Order of Battle and the Doctrine for the Next War

It is difficult to exaggerate the importance of this issue. History is replete with examples of armies that entered a war with an unsuitable order of battle. The British fleet was not prepared before WWII for dealing with the German submarines. The United States Air Force entered the Vietnam War without an attack aircraft capable of operating deep in the North Vietnamese rear. In this vein, the IDF has its own examples of procurement decisions and large-scale investment that were incompatible with the operational doctrine.

- In the early 1960s, air force commander Ezer Weizman undertook to fund the French aircraft manufacturer Dassault Aviation for the development and production of a new supersonic high altitude attack aircraft, Mirage 3F2, a project amounting to hundreds of millions of dollars. Fortunately for Israel, the agreement was canceled due to the intervention of Deputy Prime Minister Yigal Allon.
- After the Six Day War, the Armored Corps asked for and received authorization to procure British Chieftain heavy tanks that had serious and persistent engine defects. This project amounted to hundreds of millions of dollars. Fortunately for Israel, it was canceled because of the British arms embargo.
- Following the Yom Kippur War, the Israeli navy hastily and haphazardly procured Zivani hydrofoil missile boats, a \$100 million project financed with American aid, which went down the drain.

- After the peace treaty with Egypt was signed, Minister of Defense Ariel Sharon and IDF Chief of Staff Rafael Eitan pressed for the construction of a military port off the Gaza Strip coast – another \$100 million project. Opposition by Navy commander Zeev Almog overcame the pressure (the First Lebanon War later erupted, and Sharon and Eitan found other matters with which to occupy themselves).³
- To these can be added the mishaps of the Lavi aircraft and other projects that were completed, but whose operational utility is disputed.

Another type of error made was not purchasing and developing weapons that might have made a critical difference. A glaring example is the shortage of antipersonnel weapons in tanks in the Yom Kippur War. To this sad list can be added the procurement or development of important weapons systems that were authorized only very belatedly, because of opposition by generations of air force commanders: Hawk surface-to-air missiles, unmanned aerial vehicles (UAVs), helicopters for naval warfare, and, in the last generation, Iron Dome and ground-to-ground missiles.

Today, the need to increase compatibility is the focus of military discourse, and is being addressed by many excellent people. We will present here an important aspect of the current debate – the concepts of the land forces referred to as “Land on the Horizon” and “Hupat Atar,” as discussed in articles in the *Journal on Operational Art* – without attempting to take a position on such a complex matter.⁴

In the last generation, Hezbollah and Hamas have succeeded in establishing a balance of terror that the IDF has not yet managed to quash. The difficulties in conducting land-based operations against rocket launchers in Lebanon and the Gaza Strip are hampering Israel’s freedom of action. Despite the importance of the long-standing threat from high-trajectory weapons, no land-based response has been yet devised, though experience has shown that an aerial response – both offensive and defensive – also has many constraints.

One of the main efforts at dealing with the dilemma is the Land on the Horizon concept, prepared by the ground forces in 2012-2015. This is an innovative operational concept, requiring many technological developments, that will make it possible to deal with the rockets themselves, and also those that operate and protect them. At the heart of this plan is what is known as the “system of systems,” Hupat Atar, which integrates surveillance and

strike systems with intelligence, ground, and air units. According to Major General (res.) Yoav Har-Even:

The integrability will make it possible to improve the effectiveness of an attack and provide close support to a variety of forces in all kinds of terrain. Note that the emphasis on integrability naturally centers on an extremely difficult challenge – complete integration of all capabilities from the air, sea, and cyberspace with the ground forces. The main requirements can therefore be described as follows: an ability to gather and process intelligence for the purpose of attacking a range of targets (direct attack and counter-attack) at rapid firing rates in difficult terrain, and close support for a range of forces, while optimizing all of the intelligence gathering and attack units in all areas (air, land, sea, and cyber).⁵

In other words, Hupat Atar is composed of advanced target acquisition systems and long-range high-speed communication systems connecting all participating combat forces and the advance and rear headquarters. The concept also includes digital command posts enabling the ground commander to select the optimal means of fire. The revolutionary quality of Hupat Atar is actually the ability to complete the spot and strike cycle in less than a minute, which is enough time to destroy an anti-tank squad before it can escape and to avoid injuries to uninvolved parties.⁶ Simultaneously with Hupat Atar, there is a need to continue developing weapons and doctrine for combating high-trajectory fire – it is desirable to intercept high-trajectory fire in enemy airspace. This task also requires the use of advanced technologies beyond those of Iron Dome. It should be noted that the new concepts require not only innovative weaponry and infrastructure, but also organizational changes for redistributing the missions between the ground forces, the intelligence corps, and the air force.

Such developments mark another recent chapter in the close dependence between technology and industry and the operational concepts. In its first decades, the IDF made do with imported platforms. These were initially upgraded old platforms, and later also new ones: Sherman, Centurion, and Patton tanks; British, French, and then American warplanes and electronic systems. Later, the IDF and the industries were forced to develop innovative

technologies, because it was impossible to procure weapons that would meet the IDF's operational needs. This is what happened in the early 1960s, when the navy developed missile boats in response to the Komar and Osa boats that the Soviet Union supplied to Egypt. The same thing happened in the 1970s, when the air force developed the weapons used in Operation Mole Cricket 19 to destroy the Syrian-Soviet air defenses, and in the 1990s, when IDF air and land services developed a system code, called Asufa, as a response to a mass land attack by Syria (the naval and air responses proved to be very effective, while Asufa, developed at great cost, was fortunately never used).

Land on the Horizon requires the development of a new battle doctrine based on very expensive innovative technologies, together with a reassessment of the institutional system. The expected cut in shekel aid, however, limits room to move within the budget, while the force build-up required against “third circle” enemies and various defensive improvements further reduce the budget for land operations. IDF Operations Directorate head General Aharon Haliva described the result: “We continue to strengthen our ‘healthy leg’ – intelligence gathering and counter-attack capabilities, and are surprised that we still walk with a limp caused by the land operation.”⁷ He was referring to the budgetary priorities in recent years: intelligence and air attack capabilities come first, while land operations are in second place. Land on the Horizon plays a key role in the IDF strategy presented by the last chief of staff, Lieutenant General Gad Eisenkot, but it was not decided who would lead it, and the necessary resources were not earmarked.⁸ There are many reasons for prolonging the discussions. Here we will mention only the difficulties of the IDF and the defense establishment in coping with an innovative operational concept requiring technological breakthrough, large-scale investments in R&D, and organizational changes in the IDF's branches and directorates. The difficulties stem from a number of causes: “fear” of new technologies by commanders, the weaknesses of the General Staff vis-à-vis MAFAT, conflicting interests of the defense industries, and others.⁹ In addition to all these, there is no consensus in the General Staff and the defense establishment agencies regarding the practicality of Hupat Atar and its expected contribution towards resolving the ground maneuver difficulties (see note 5 above).

It should be added that the coming multi-year plan, “2030 Defense Doctrine,” presented by Prime Minister Benjamin Netanyahu, will contain

heavy demands from the defense budget and human and technological infrastructure, and thus it is extremely important that there is coordinated action by the three partners in this plan – the IDF, the Ministry of Defense, and the defense industries. It should be stated unequivocally: the difficulties are not just budgetary. There is also competition for the supreme command's attention, the defense industry's development infrastructure, and the best officers.

In sum, we argue that the hesitation over Land on the Horizon is only one example, albeit an important one, of the need to make R&D and force build-up correspond to the operational concepts. This need is exacerbated by the anticipated budget cutting. Introspection is therefore imperative in order to examine ways of more quickly applying the efforts of the defense establishment and the defense industries to today's strategic and economic realities.

Issue #2: A Digital IDF?

Since the 1960s, the IDF and the defense industries have successfully climbed the ladder to the forefront of military technology. At the same time, many of the people working in technology claim that alongside its excellent digital achievements, the IDF also suffers from mediocrity, if not worse. The requisite self-reflection should address this question – is Israel's vast technological potential being fully realized? The following remarks by technology experts, both in and out of uniform, appeared in the *Journal on Operational Art*. They highlight mainly the “half-empty glass,” because the “half-full glass” aspects of defense innovation are so well known.

Yotam Hacohen and Yoel Yaffe argue that in the 21st century, the emphasis on innovation is shifting from the development of combat platforms to software development. They add that the defense establishment has not yet adopted the Agile development concept; it still adheres to the old-fashioned Waterfall methods of project management. “The IDF's concept for developing weapons,” they say, is based on “separation between [1] the operational party making the request (‘the customer’), [2] the party writing the specification documents and [3] the party developing and producing the weapons (an industry or IDF technological unit). This concept has advantages for platforms, but it fails in the development of a core software system.”¹⁰

Carmel Or studied the extent of use of open code in the IDF and the defense industries, under the assumption that this is a good indicator of innovation. Her findings are not encouraging: “Israeli defense firms are adopting open source code for their work in a very slow and awkward fashion, due to their organizational cultures... while MAFAT contributes to the adoption of open source code in the defense establishment, it does so passively.” In Or’s opinion, the United States defense establishment and the business sector in general are far ahead of the Israeli defense establishment on this matter.¹¹

Other barriers to digitalization in the IDF include a reluctance to use off-the-shelf products, unsuitable procurement procedures, handling of copyright issues, and other aspects that hamper agreements with development entities. Volume 17 of the *Journal on Operational Art*, in December 2018, was devoted to the army and technology in the information era, with several articles outlining these and other barriers. The articles were written by a long “chain of command” from Major General Lior Carmeli to Brigadier General Guy Paglin to Captain Or Glick and reserve officers involved in defense duties.¹²

A discourse between two groups is taking place within the pages of the *Journal on Operational Art*. One group consists of young technology professionals wanting to lead a culture of development in the IDF similar to that in the business sector; the above statements are a sample of their opinions. The second, older, group demonstrates why the IDF will never operate as a “startup.” Major (res.) Erez Ne’eman, who previously worked on technology in the air force, is a prominent representative of the second group. He described a wonderful “Agile” event that is no longer possible. He recalled that in 1969, three air force engineers replaced the unreliable engine of a French Super Mystère warplane with a high-quality American Skyhawk engine within seven months (the airmen called the upgraded airplane “Blaiberg,” after the first recipient of a heart transplant). Getting back to the present time, Ne’eman said that “Today, rewriting the manual for changing tires periodically will require more time and approval processes than the project of replacing an engine in the 60s.”¹³ Ne’eman also explained why the R&D processes for aerial weapons became longer: the introduction of rigorous procurement rules, following the Rami Dotan affair (in which a former air force procurement chief was convicted of embezzlement); separation between the parties deciding about procurement and those using and maintaining the

equipment; the closing down of the development department in the air force equipment group and transfer of most of the professional engineering know-how to the defense industries; and raising the safety requirements threshold (which significantly reduced accidents). In other words, he demonstrated once again why the modern IDF resembles an aircraft carrier, rather than a surfboard.

Another incredible case is the pace at which the air force, defense industries, and other auxiliary parties developed the revolutionary systems that defeated the Syrian air defenses and air force in the First Lebanon War, in June 1982. Menachem Krauss, who after the Yom Kippur War developed the Periscope command and control system for air warfare, said in an interview, “It was obvious to me that if we work using military methods, meaning forming a team and getting equipment through the IDF bureaucracy, development would take quite a few years... I said that if they would give me a free hand, I could make the system combat-worthy within a year,” and that is what happened. Simultaneous with the Periscope system, all the other elements for destroying the Arab missile batteries were developed: UAVs, guided bombs, electronic warfare systems and decoys, simulators, and so on. All of these functioned perfectly on June 9, 1982. On the first day of the war, the air force destroyed 19 Syrian ground-to-air missile batteries shot down 23 Syrian warplanes, and all of Israel’s attacking planes returned home safely.

The rapid developments and the ensuing operational success were the result of the grave predicament of the air force and the IDF during the Yom Kippur War. An added push was given to the matter by a small number of dedicated people in the air force, assisted by Weizmann Institute scientists, and later by the defense industries. This is another example of penetrating self-criticism that led to an important breakthrough.¹⁴

There is no doubt that young technology professionals are gradually influencing and changing the IDF. Lieutenant Colonel Ori, former chief technology manager at the IDF Military Intelligence Directorate, described a number of business sector methods that were adopted: different types of “hackathons,” “incubators,” use of a minimum viable product (MVP) methodology in the early stages of a project, and forging of a close direct connection between developers and users. All these methods encourage young developers to conduct groundbreaking R&D, on the one hand, and

reinforce their interest in military service, as well as enabling them to resist tempting offers from the business sector, on the other.¹⁵

Finally, let us describe two events that demonstrate failures in development of weapons systems, which highlight the potential for operational improvements while saving on development costs. Erez Ne'eman wrote about a command and control system for air warfare developed in the 1980s. It was created in a relatively short time, and significantly improved the air force's capabilities. At the same time, as often occurs with first-generation systems, it was complicated, hard to use, and required a lengthy training period. Describing the results, Ne'eman wrote, "Most of the system's functions were not used – no user went near them during 20 years of operational use."¹⁶ Nevertheless, the new system which replaced it in the 21st century had the same drawbacks: "Too much time was spent on trying to operate it correctly, and reserve officers usually use only a small number of the system's functions and are incapable of taking creative action or responding rapidly to changes."

Nissim Hania recounted an idea of developing a modular pod to be installed on aircraft that could contain sensory systems in the form of standard cards. This pod is relatively expensive but it would be installed only once on an aircraft. It would facilitate the quick installation of sensors at a later time. This product has two advantages. First, it would only need to be replaced about every 20 years, although sensors must be replaced every two to five years. Second, sensors developed according to the new standard can be inserted into the pod after short tests taking a few months at most, instead of years, as at present.¹⁷ According to Hania, the idea was not implemented because the air force preferred a quick solution that would meet an urgent operation need.

The last two events are not unique to the IDF. The first describes the development of a system made overly complicated by excessive specifications. The second describes a preference for dealing with urgent needs over long-term economizing and effectiveness. At the same time, both of them highlight the potential for operational improvements and streamlining, which could become possible with closer cooperation within the IDF-MAFAT-defense industries triad.

Two Important Issues Must Not Be Forgotten

Introspection on the two issues analyzed above must not make us forget the most important subject – the human factor.¹⁸ Cultivating excellent servicemen and women is the primary imperative of the IDF, and it must not be forgotten in the heat of the technological race. “An open mind is more important than open source code” – the open minds of combat soldiers, headquarters staff, technology specialists, economists, and others are vital. This is a very complex matter that will not be dealt with in this article. The second subject is training, readiness, and more training. As doctrines and weapons become more advanced, more training of all kinds is necessary, including strategic war games, exercises, simulations, and the like. This is also a very complicated matter that is in constant tension with the attention paid to routine security and the “campaigns between wars,” budgetary constraints, problems of the reserve forces, and career paths for officers.

Every one of these matters constitutes an entire universe, and dealing with all of them together requires a comprehensive shakeup of the defense establishment.

Summary

Since the defense establishment is facing painful monetary constraints, it should also engage in introspection. First, there is a need to harmonize the IDF’s strategic concepts and the directions of R&D and force build-up. Second, barriers to realizing technological potential must be removed, so that the IDF and the defense industries can supply effective weapons systems after rapid development cycles and at low cost. Third, the human and leadership factor should not be neglected.

These are three prodigious and weighty tasks that cannot be accomplished with a stroke of the pen, or even in a multi-year plan, and this article does not purport to portray their full complexity. It is enough for us to demand introspection by the defense establishment agencies, and to propose that this take place in the spirit of the words by Brigadier General (ret.) Shabtai Levy quoted at the top of this article.

Notes

- 1 These words were spoken to Dr. Daniela Ran in an interview. Levy commanded a flotilla of missile boats in 1971-1973. See a study describing the beginning of the advanced technology era of the Israeli Navy and the defense industries: Saul Bronfeld, “The Revolution in Naval Affairs – the Missile Boat Flotilla,” *Journal on Operational Art* 14, December 2017 (all articles referenced here from this journal are in Hebrew).
- 2 March 3, 2019.
- 3 Numerous articles, primarily in Hebrew, offer detailed descriptions of these dubious procurement processes. See, for example, on the Mirages – Yoash Tzidon, *By Day, by Night, in the Fog* (Ma’ariv Book Guild, 1996), pp. 335-50. On the tanks – Saul Bronfeld, “The Chieftain Tank Affair: Real Politik, Perfidy, and the Genesis of the Merkava,” *Contemporary British History* 23, no. 3 (September 2015): 314-96. On the Zivanit hydrofoils – Zeev Almog, *The Modern Naval Power of Israel Developed after the Yom Kippur War* (Institute for the Study of Israel’s Wars), 2018, pp. 28-34. The money wasted on the Zivanit was almost enough to procure a squadron of Phantoms. And on the Gaza military port – Zeev Almog, *Voyages of My Life* (Kinneret Zmora-Bitan, 2014), pp. 1,128-134.
- 4 For the complexity of this subject, see the articles (in Hebrew) by Colonel (res.) Yuval Bazak and Colonel (res.) Prof. Gabi Siboni, Lieutenant Colonel (res.) Dr. Ido Hecht, and the late Brigadier General Giora Segal in Maarachot (IDF Publishing House), vols. 482 (January 2019) and 484 (July 2019). See also Dr. Zeev Elron, “The Slowing Pace of Technological Changes,” *Zarkur Histori* (Historical Spotlight) 57, IDF Doctrine and Training Division – History Department (January 2019): 44-74, and Moshe Sharvit, “The Technological Campaign,” *Journal on Operational Art* 20-21 (July 2019).
- 5 Yoav Har-Even, “The Land Battlefield: From Cooperation and Jointness to Fused Capabilities,” *Journal on Operational Art* 16-17 (July 2018): 88. Major General (res.) Har-Even was head of the IDF Operations Directorate, and is currently CEO of Rafael Advanced Weapons Systems. For a more detailed description see articles published by IDF generals in *Journal on Operational Art*, a publication by the Dado Center: Kobi Barak, Tamir Heyman, Yoav Har-Even, Aharon Haliva, Tamir Yadai, Lior Carmeli, and Guy Tzur. See also an article summarizing their views: Saul Bronfeld, “How Did We Get into This Mess, and What Do We Do Now?” *Journal on Operational Art* 2014-2019, 20-21 (July 2019).
- 6 For additional descriptions (in Hebrew) of Land on the Horizon and Hupat Atar, see Amir Rapaport, “Delivering Precision Fire in Real Time Against an Invisible Enemy,” *Israel Defense* (May-June 2016); Ami Rojkes Dombe, “Measurement War Against Terrorism,” *Israel Defense* (Summer 2017); Ami Rojkes Dombe, “IDF 2030: Small, Efficient & Lethal,” *Israel Defense* (Fall 2017). Rafael has developed a smaller operational version of the concept underlying Hupat Atar, called Smart

- Trigger. See Ami Rojkes Dombe, "The Anti-Tank Missiles Market Needs a Longer Range," *Israel Defense* (Winter 2019): 30. In the same issue, see an article describing a system developed by Israel Aerospace Industries called Sky Capture, which applies the concept to air defense systems, Ami Rojkes Dombe, "Air Upgrade," pp. 54-55.
- 7 Aharon Haliva, "More of the Same – On the Need for a Conceptual Leap in Force Build-Up," *Journal on Operational Art* 9 (December 2016): 19. General Haliva currently heads the Operations Directorate.
 - 8 Yuval Bazak and Gabi Siboni, "Do We See Ground Forces on the Horizon?" *Maarachot*, 482 (January 2019): 27-29. Colonel (res.) Bazak and Colonel (res.) Prof. Siboni head the IDF Concepts Laboratory.
 - 9 See Eran Ortal, "Confused? So Are We – A Historical Perspective to the Debate over 'Land on the Horizon,'" *Journal on Operational Art* 16-17 (July 2018): 29-37; Yuval Bazak, "The Drivers of IDF Force Design in the Past, Present and Future," *Journal on Operational Art* 9 (December 2016): 72-74.
 - 10 The Waterfall method, a software development concept – from the specification stage via division into sub-systems, development of a prototype, and practical demonstrations, to the large-scale production stage – is essentially linear. The Agile system is a response to the flaws of the Waterfall method. It cuts the development time and costs by creating a closer connection between users and developers, among other ways. For details, see Yotam Hachohen and Yoel Yaffe, "Land Warfare in the Digital Age: Why Aren't We Succeeding?" *Journal on Operational Art* 16-17 (July 2018): 137. On this subject, see also Daniel Bren, "This is How We've Always Done It: Personal Insights from Transformation and Adaptation Processes," *Journal on Operational Art* 8 (August 2016): 44-45.
 - 11 Carmel Or, "Open Source Code Culture: To What Extent Has the Defense Establishment Adapted to the Software Culture, and What Does It Say About Its Level of Innovation?" *Journal on Operational Art* 7 (April 2016).
 - 12 For other examples and opinions, see Saul Bronfeld, "How Did We Get into this Mess, and What Do We Do Now?"
 - 13 Erez Ne'eman, "Force Design in the Services: R&D in the Air Force," *Journal on Operational Art* 9 (December 2016): 88-89.
 - 14 Meir Finkel, "Force Design for Operation Mole Cricket 19, 1973-1982," *Journal on Operational Art* 20-21 (July 2019). Brigadier General (res.) Dr. Meir Finkel served as commander of the Dado Center.
 - 15 Lieutenant Colonel Ori, "Hewing Water from the Rock – Change and Transformation in the R&D Systems in the IDF," *Journal on Operational Art* 7 (April 2016).
 - 16 Erez Ne'eman, "Force Design in the Services," *Journal on Operational Art* 7 (April 2016) pp. 93-94.
 - 17 Nissim Hania, "Second Order Force Build-Up – Another Viewpoint on Technological Force Build-Up," *Journal on Operational Art* 18 (December 2018): 57-58. Nissim Hania is a technology specialist and Research Fellow at the Dado Center.

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New/Old Trends Affecting the Defense Industries

Guy Paglin

This article analyzes a number of the trends currently affecting the defense innovation system (DIS) in Israel, especially the defense industry. Among these trends are: the change in the character of warfare, the variety of threats and new domains; the modern weapons systems necessary to deal with the change; the digital transformation, information technologies (IT) revolution and emergence of the cyber domain; the transfer of technology (TOT) revolution and the use of commercial off-the-shelf (COTS) products and technologies in weapons systems; the relative decline in defense R&D investments (in comparison with commercial R&D); and the anticipated decline in the volume of orders for local industry, resulting from the most recent changes in the security MOU between Israel and the US.

The Israeli DIS includes the Ministry of Defense and IDF agencies' directorates and technological units, national laboratories and centers, and the defense industries. This group has operated for many years as a balanced system that develops unique and advanced innovative solutions for the evolving IDF needs, relying on short time-to-market cycles and high-frequency operational feedback from users, ultimately becoming a leading innovator with a large ratio¹ of exports relative to domestic orders. Taken as a whole, the trends described in this article point to a significant accumulative change in the current market balance.

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The Change in the Nature of Warfare and the Armaments Needed

First, let's look at the bottom line: what the IDF demands today are new technological, innovative, more lethal and more accurate systematic solutions, far more than "industrial-more-of-the-same" solutions. Over the years, the enemy has responded to the IDF's methods of operation with "disappearing" and hiding techniques, starting in open areas and moving to urban environments and underground, while firing high-trajectory weapons at the Israeli home front. The defense establishment responded by developing unique technological capabilities for defensive purposes: air defense systems against high-trajectory weapons, on one hand, and the Trophy system against the threat of anti-tank missiles and rockets, on the other. While the enemy was operating from within densely populated civilian centers, the IDF and the defense establishment aimed to develop intelligence capabilities extending from cyberspace to outer space. The asymmetry of the conflict is evident in all aspects: the enemy's small NGO terror activities from busy urban centers versus the IDF's spending on all resources needed to detect, isolate (from civilians) and attack specific targets; the enemy's low-cost statistically weak trajectories versus the IDF's endless and costly efforts to defend its citizens; or the enemy's easy-to-achieve "victory image" – by not differentiating between Israeli civilians and IDF soldiers – versus the IDF troops' impossible mission of acting in an urban terrain, risking their lives to achieve precision, while the Israeli public reflects a low tolerance to each casualty in a non-existential conflict. This situation highlights the complex question of what the "right" military achievement is, and how it can be demonstrated.

An example of the IDF's technologically based efforts in this regard is the development of expensive defense systems with expensive interceptors to counter inexpensive threats. The effect of this trend on the Israeli DIS is clear, and is accelerating in several respects: the volume of large-scale "industrial" production of less sophisticated or less accurate weapons for a conflict is declining every year, superseded by new types of weaponry that are more complex, more "intelligence based," and more expensive (computer and software based, automatic/semi-automatic, digital); the nature of the leading industries and professions needed is changing from production based to development based; and the budget for force build-up is being allocated

to the large industries for development of complex solutions rather than to small- and medium-sized ones.

In other words, the weapons needed today are no longer simple arms; they are complex combat systems (and even systems of systems). This is all for the purpose of finding technological solutions against an enemy with supposedly asymmetric inferior self-development capabilities. The other side's ability to accelerate development using commercial technologies as a means of warfare will be described below, and it may well eliminate the asymmetry between the competent high-budgeted Israeli DIS and the supposedly low-budgeted terror organizations. Examples include the use of drones, sensors, and various other COTS elements for the purpose of focused attacks, surveillance, disruption, etc.

The Information Revolution and the Emergence of the Cyber Dimension

The cyber dimension in the realm of warfare grew in recent decades in parallel with the exponential growth of IT such as WAN communication (wide area networks, such as the Internet), computerization (Moore's Law²), cellular communications, and the exponential use of these technologies for people's private use such as their offices, cars, personal telephones, and home (the Internet of Things). With the (terror) enemy blending into the civilian and urban environment, this non-military domain has become of increasing interest to the defense establishments, in Israel as well as elsewhere. The use of COTS technologies (on both sides) has become inevitable, given the huge investments in the global high-tech industry. The innovation created by this industry, which has both military and commercial applications, is developing at a much more rapid pace than purely military innovation, in which the investments are relatively far smaller. Most of the innovation in cyber technologies originates in the civilian world, while the defense industry, which initially was the main developer of all IT for its own use (that were spun-off for civilian and commercial use), are now demanding "spin-on" of COTS technologies that were developed in the global innovation system.

The Technology Transfer Revolution and the Use of COTS Technologies in Weapons Systems

In today's reality, many elements of military weapons systems rely on COTS technologies, such as processing and computers, communications and networks, man-machine interface (MMI) elements and even COTS products as drones. This fact seems trivial, but some of the more elderly system engineers remember that only two decades ago, the situation was completely different. Who would have believed 20 years ago that unmanned aerial vehicles (UAVs) for military use or systems for night vision, encryption, outer space, radar, advanced calculation and MMI (LEDs, joysticks, voice and text processors, etc.) would be developed by commercial industries for private use and entertainment purposes, instead of by industries directed by government (and federal) investment? Most information and cyber technologies are examples of this phenomenon, which encompasses all technological sectors.

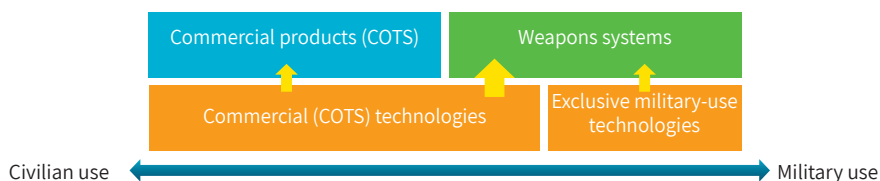


Figure 1: Commercial and civilian arms

A glance at the more distant history of the relations between science and technology and military applications shows that there was once low correlation between these two worlds (see Figure 2), for many different reasons.³ In recent generations, however, they have become closer. This process peaked in World War II (WWII), when the industrial and technological world was recruited to participate in the war. The first congruence between the two main poles – defense needs and commercial needs – emerged immediately after the war. Some 20 years ago, the phenomenon of spin-offs occurred, in which defense technology developed with state funding trickled into the commercial market for civilian uses. In the past decade, by contrast, there have been more and more cases of technology transfer (TOT) in the opposite direction, with civilian commercial technology being used to develop

weapons. From different uncorrelated worlds, the two became close, then co-shared and then became mostly-mutual.

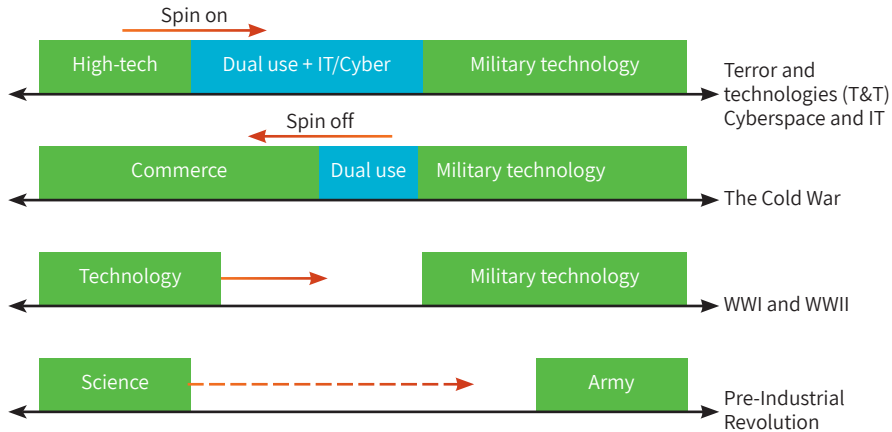


Figure 2: Military and civilian innovative relations and TOT in four generations – from the Industrial Revolution until today

Today, the availability of most of these technologies for private use, whether in a car, mobile telephone, home, or any public service whatsoever, is taken for granted. It should, however, be kept in mind that the vast majority of them were originally developed for military use through the defense establishment and government funding, for example, the Israeli application of an electro-optic tracker for tanks or American technologies such as the first computer, Ethernet, etc. It is interesting to note that in the US, as of now, all of the relevant technologies for operating advanced weaponry – communications, processors and computer miniaturization, computerized photography and MMI, image processing, LCD screens, and even audio signal processing to commands (SIRI) – were developed with US federal funding. Within 20 years, these technologies became the base on which the mobile phones that are privately distributed all over the world were developed, generation by generation.⁴



Figure 3: Typical process in the reversal of the direction and transferral of the technology lead

An in-depth analysis of all the relevant technologies in the past 20-30 years⁵ shows a recurring pattern that took place separately and at a different point in time in each family of technology. It began with spin-offs (civilian commercial use of military technology), continued with the development of an advanced generation for commercial/civil users on a large scale (private car, home, office, leisure, etc.), and ended with the commercial sector taking the technological innovative lead. Another observable phenomenon is that this trend began decades ago at the components level, advanced to the sub-systems level, and today already encompasses the ability to adapt existing products and systems to military use. It can also be seen that the IT sector was the first to undergo this revolution, from computers, processors, communications, and eventually even encryptions. Next was the sensor technology sector: computer vision, night vision, audio and radar. Table 1 maps the technological uses of each family and the shift in the lead from military use only (green) to dual-use (blue). Figure 5 shows the trend towards increased use of COTS as a function of the high level of complexity of the weaponry or system.

Table 1 displays the transition of selected technologies from military use only (green) to dual use of military and commercial (blue), according to technological groups and decades.

Table 1: Mapping of technologies for defense and dual-use purposes over time

Technology Group	Uses in 1980-1990	Uses in 1990-2000	Uses in 2000-2010	Uses up to 2010	Uses up to 2020
High-resolution day cameras	Outer space	Observation and intelligence	HD video broadcasts	Professional cameras	Cellular, car industry
Image processing	Outer space observation, target trackers	Air missiles target trackers	Automation, computer MMI	Facial and vehicle license plate recognition (LPR)	AI
Optical networks	Outer space and aerial communication	Strategic uses	Intercontinental communications infrastructure	Individual infrastructure	Brain-machine communication
Thermal imaging	Outer space and aerial observation	Observation and intelligence	Driving, tactical systems	Civil engineering, aviation, plumbing	Autonomous vehicles
Satellites	Strategic uses	Outer space research and communication	Civilian communication	Civilian navigation	Commercial and government outer space research
Inertial navigation	Outer space and aerial systems and applications	Fire control	Tactical navigation systems	Driving	Cellular, autonomous vehicles and drones control
Robotics	Defense use – combat engineers	Defense use – combat engineers and outer space	Police use (sappers)	Industrial robotics	Home robotics
Marine robotics	NOAA marine research	Marine research – military mapping	Military marine mapping	Robotics for the oil industry	Robotics for the oil industry and research
Air robotics	Observation, marking and designation, intelligence missions	Air force intelligence and the beginning of Cruise missiles	Tactical air force applications	Tactical ground forces applications	Drones for agriculture and entertainment
Radar	Targets search and track applications	Field control and surveillance		Detection of invaders	Driving and autonomous vehicles

The Reasons for the Change in the Direction of TOT and the Acceleration of Civilian Innovation

A number of factors, both global and local, some interdependent and others independent, may explain the 180-degree change in the TOT direction:

- A shift in trend in the volume of technological investments in R&D in the world in general and in Israel in particular, from national or federal investments in defense innovative systems to investments (primarily private) in civilian innovative systems. This change attracted most essential assets needed for innovation, such as technological human resources and capital, and was followed by the acceleration of technological development in the civilian sector. In Israel, for example, investment in military R&D is on a lower scale than private investments (mostly from overseas) in the high-tech innovation industry, from start-ups to large companies.
- The worldwide globalization trend in general and the specific trend towards cooperative technological development processes, such as open code, shared databases, cloud services and cloud resources. Those encourage streamlining and professional specialization, on the one hand, and collaborative ventures, on the other, for the purpose of increasing innovation efficiency, research and even industrial efficiency. This global mega-trend further enhances worldwide accelerated development of the civilian industry over the anti-global conservative defense industry.
- The private consumer creates enormous (scalable) economic potential attributed to the private market, especially in the house, office, and car. Therefore, one of the most important motivating forces for investments in technology is the potential to reach millions of users in the private market.
- A growing defense need for and interest in technologies from the civilian commercial sector.

In Figure 4, the left side shows private vs. government R&D investments and the turnover point in the US; the right side shows exponential growth in the infrared camera business following possible private use penetration in the cellular market.

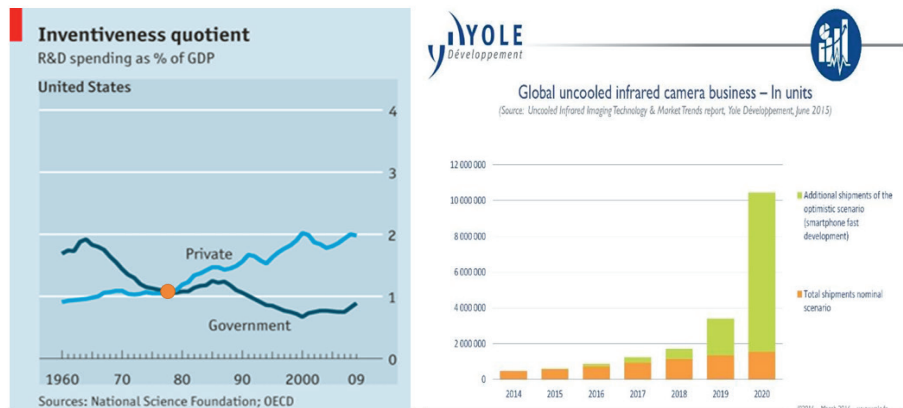


Figure 4: Reasons for acceleration – Private investment and private uses in comparison with government investment

The Dilemma of Using COTS Products and Technologies versus Defense R&D Investment

In some cases, weapons and weapons system development processes begin with an operational demand or gap, while in other cases, a technological opportunity emerges that can be tapped as an out-of-the-ordinary response to an operational gap that is not in the conventional “toolbox.” Responses of this type are usually unique, and to a large extent constitute technological-operational breakthroughs or force multipliers. The way to develop such unique capabilities is through “innovation,” i.e., by encouraging creative thinking.

When a need is based on technology that does not yet exist, or whose viability has not yet been demonstrated, it is necessary to wait for the technology to emerge or reach a suitably mature readiness-level. This means developing the technology and testing its feasibility and relevance through a technological demonstration. At the same time, when the need is based on the integrative use of existing technologies (of the kind likely to be encountered in the military or civilian environment) or a shelf product (from the level of an electronic component to an entire product), a much shorter process can be adapted to achieve the system’s requirements or a more complex system.

Thus arises the procurement dilemma of COTS items or technologies versus self-development. The main considerations are as follows:

- The expected end result from the converted product differs from a product developed specifically for the purpose;
- The economic consequences of adapting a product;
- The time required to get the product to market;
- Technical considerations and standards (environmental, safety, survivability, and durability);
- The required life-cycle cost, including technical and maintenance support;
- The available upgrade ability and dependence;
- The required level of connectivity;
- The security risk in using the shelf product; and
- The ability to confront barriers in the defense establishment in cases in which it is feasible to use a shelf product.

The advantages of using a shelf product or item are clear: the lower cost of a mass-produced item; quality and reliability guaranteed by large-scale or mass use of the product (electronic components and processors, for example) and a high degree of replaceability, resulting from the larger demand of the product; saving the cost of establishing production lines; and saving time and expenses for development and trials. At the level of a single item or system component (e.g., an electronic card, power supply, electric engine for the system, a wheel for a vehicle), the benefit from using a shelf product outweighs the benefit from self-development.

On the other hand, when the item or component involved is controlled (a dual-use item subject to supervision, for example), incurs a sensitive information security risk or requires adaptation for military use, the dilemma between self-development and procurement is heightened. The wish to maintain independent production and flexibility for changes, reduce dependence, and lower the security risks is balanced with the economic benefits.

The impact of this phenomenon on the defense industry in Israel lies in the emerging change in the profile of products developed by it. On the one hand, there is a need to focus on exclusively military technological capabilities (explosives, armor, special weapons, etc.) that have no commercial use (to date) at the expense of products for which there is no longer a need for independent development (computerization, MMI, etc.). On the other hand, there is an accelerated development of capabilities and a need to present

more complex solutions, such as mega-systems and connectivity of existing systems to a “system of systems” architecture, formerly for command and control needs and today for integrated multi-domain warfare, starting as an industry developing and manufacturing weapons based on hardware and technology. The defense industry today consumes more and more commercial hardware and services and even processes in order to adapt them to its needs. The globalization effect on development processes, together with the science of systems engineering and the system of systems idea, led to an increasing level of capability to design complex mega-systems. Of late, much larger budget allocations have been made in these areas, requiring more manpower at a relatively high cost, resulting in an exponential increase in defense investment in weapons systems, in comparison with less complex weapons manufactured in large numbers. This phenomenon has positive aspects, because Israel’s defense exports rely mostly on innovative and unique systems that are usually based on IDF’s operational lessons.

The effect of this has been greater in Israel than in other countries, for the following reasons:

- Israel is, relative to its size, one of the world’s innovative high-tech centers;
- Israel is in constant high-intensity friction with its enemies, which requires the development of unique defense solutions even before the rest of the world requires them;
- The opportunity given by the IDF to try out innovative solutions in action as part of the development process; and
- The uniqueness of the Israeli defense industry’s strong orientation towards exports.

The following diagram illustrates the trend over time towards the general use of commercial components in weaponry. Over the years, the use of available technologies and products, together with the development of systems engineering science, has led to the design of more complex systems increasingly relying on developed modules and elements (software and hardware).

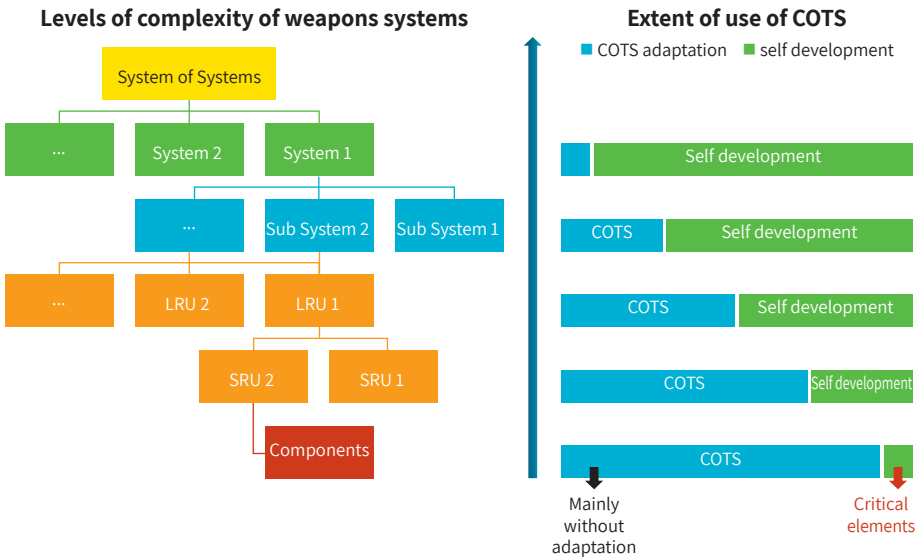


Figure 5: The growing use of existing elements at “higher” system levels

Inherent Barriers in the Defense Innovation System

All of the trends described hitherto are challenging the DIS, including the defense industries, the defense establishment, and the IDF. Until recently, it appeared that the system had reached a productive equilibrium point and was gaining an advantage over both collapsing enemy states and proliferating terror non-government organizations. In practice, the character of the opponent and its behavior has changed, both in operational and innovative aspects. In recent years, the enemy has employed, in parallel, two different innovation systems: first, empowering itself to be used as a proxy for a powerful highly budgeted national weapon industry and, second, the effective use of COTS and the adaptation of them for its needs. These two trends threaten to erode the IDF’s relative edge, in the long run, creating an urgent need for a new National Defense Innovation strategy. While the IDF needs to develop more agile and more complex capabilities in a shorter time, including augmented use of COTS technologies and products and their adaptation, the Ministry of Defense and related industries are still limited in their ability to embrace this change. To do so, the system has to overcome the many inherent obstacles and barriers in its institutional structure and

processes that prevent it from effectively realizing its potential. For example, the lack of defense innovation mechanisms integrated into the civil high-tech industry; the limitations of contractual mechanisms, mainly for the ownership of knowhow and intellectual property; development regulations that are still adapted to lengthy self-development processes, rather than to rapid use and adaptation of commercial technologies; and mechanisms for focusing R&D and dynamic investment on national infrastructure and even the balance between mechanical, electrical, system, and software engineers.

The New MOU

In October 1976, American Deputy Secretary of Defense William Clements visited Israel and met with Israeli Minister of Defense Shimon Peres, senior Ministry of Defense staff, and members of the IDF General Staff. Clements made a very aggressive speech at the time, saying that Israel “would not receive one cent of American aid money for spending or investing in Israel.” He added, “There is a shortage of employment in the United States, 8 percent unemployment, and the United States will not allow money paid by the American taxpayer to fund employment in Israel.”

That same day, Assistant Minister of Defense Gen. (ret.) Israel Tal hosted Clements at a banquet with US Ambassador to Israel Malcolm Toon, who told the deputy secretary, “Our host, General Tal, is anti-American.” Tal immediately explained: “Unfortunately, the United States has applied two aid norms in international relations. One was the Marshall Plan, designed to help countries that underwent suffering and destruction to rebuild themselves after WWII. Using American aid money, they rebuilt their industry and economy. Such countries should be grateful to the United States. But the United States practices a second method in Israel that differs from the Marshall Plan: we receive substantial and generous aid from the United States government, but we cannot use this aid to develop our own industry and rebuild our economy. On the contrary; we order everything from the United States and neglect our industry. In this way, the generous American aid is increasing our dependence in the long term, and reduces the chances of establishing our industry and economy.”

Twenty-four hours later, Clements visited the Merkava production line, and several months later, President Jimmy Carter gave approval for the

conversion of US\$107 million of the American aid to Israeli currency for the manufacturing of the first Merkava tanks in Israel industries.⁶

It appears that a banquet of this type is more necessary today than ever before. Israel has a stable economy and a highly developed defense industry with an impressive and globally unique export coefficient, but its defense budget, especially its force build-up budgets, still rely on American aid to a significant extent. While US policy still encourages local production. President Donald Trump's administration recently endorsed the new aid agreement signed under his predecessor, Barack Obama, which changed the longstanding rules of the game by eliminating the option of converting dollars (to shekels) for local use, while at the same time imposing further restrictions on the use of dollar aid. The Trump administration is putting special emphasis on the traditional industries in the industrialized countries, and is supporting those industries with large-scale orders. Within a short time, the volume of activity has risen steeply, resulting in a price rise that is eroding the purchasing power of the US aid dollar.

In order to analyze the effect of this change on the Israeli defense industry, a number of teams have been formed, and are acting simultaneously, in the Ministry of Defense and the Manufacturers Association of Israel, and there is also an inter-ministerial team from the Ministries of Finance, Economy and Industry, and Defense. These teams all concluded that the change would affect many defense industries, initially the smaller ones, and cause an "export of labor" from Israel to the United States. The disparities in the teams' conclusions refer to the extent of the damage and the macro effect on the economics, if any. What is agreed, is that the damage is expected to be cumulative, occurring first in the small industries that are already affected by all the trends described above, and whose ability to recover is lower than that of the large industries, which in any case have production bases in the US.

The Merkava as a Test Case

The Merkava industry, headed by the Merkava and Armored Vehicles Directorate in the Ministry of Defense (MANTAK),⁷ founded by General Tal in 1970, has also undergone fundamental change in the past two decades with respect to the above-mentioned trends. The initial threat for which these vehicles were designed has changed from massive tank brigades in the 1960s to camouflaged ATGM squads in open territory in the '70s and in

the 2000s to an enemy concealed in an urban environment. The proportion of “smart” systems and the number of computers in a Merkava tank has increased exponentially from Merkava Mk1 to the fifth generation of Merkava Mk4 that is being developed today: the Barak tank. From the steel and metal industry, with no competition at all, the armored vehicles industry has become a “high-tank” industry based more than 50 percent on high-tech solutions and systems and 50 percent on the traditional industries. In parallel, production rates have plummeted to a minimum, but the effectiveness and capabilities of the vehicles have doubled. In the last 20 years, many products based on the Merkava were developed and produced, such as the Namer family of vehicles for infantry, engineering, rescue, command, and special vehicles; active protection systems, such as the Trophy and Iron Fist active protection systems (APS), were developed and integrated into the vehicles; and the Eitan wheeled FV. International interest in the Israeli AFV solutions has grown, and defense exports based on the Merkava products have grown significantly. The gradual introduction of COTS products and technologies has risen rapidly as part of the systems engineering in order to shorten development processes and lower costs, and larger portions of production are being made in the US based on the MOU.

One thing, however, has not changed: the seminal drive by General Tal towards independence and self-reliance in everything pertaining to the capabilities of the manufacturing and development of advanced AFVs in Israel by preserving the Merkava industries in Israel, about half of which are currently located in outlying areas. MANTAK is thankful for the US support that enables the IDF to produce country-unique protected vehicles for its soldiers, and therefore it is using the dollar aid differentially, focusing mainly on items and kits that either have no alternative in Israel or for which the cost-effectiveness of producing in the US is attractive and/or has the potential to be collaborative (Israeli-American).

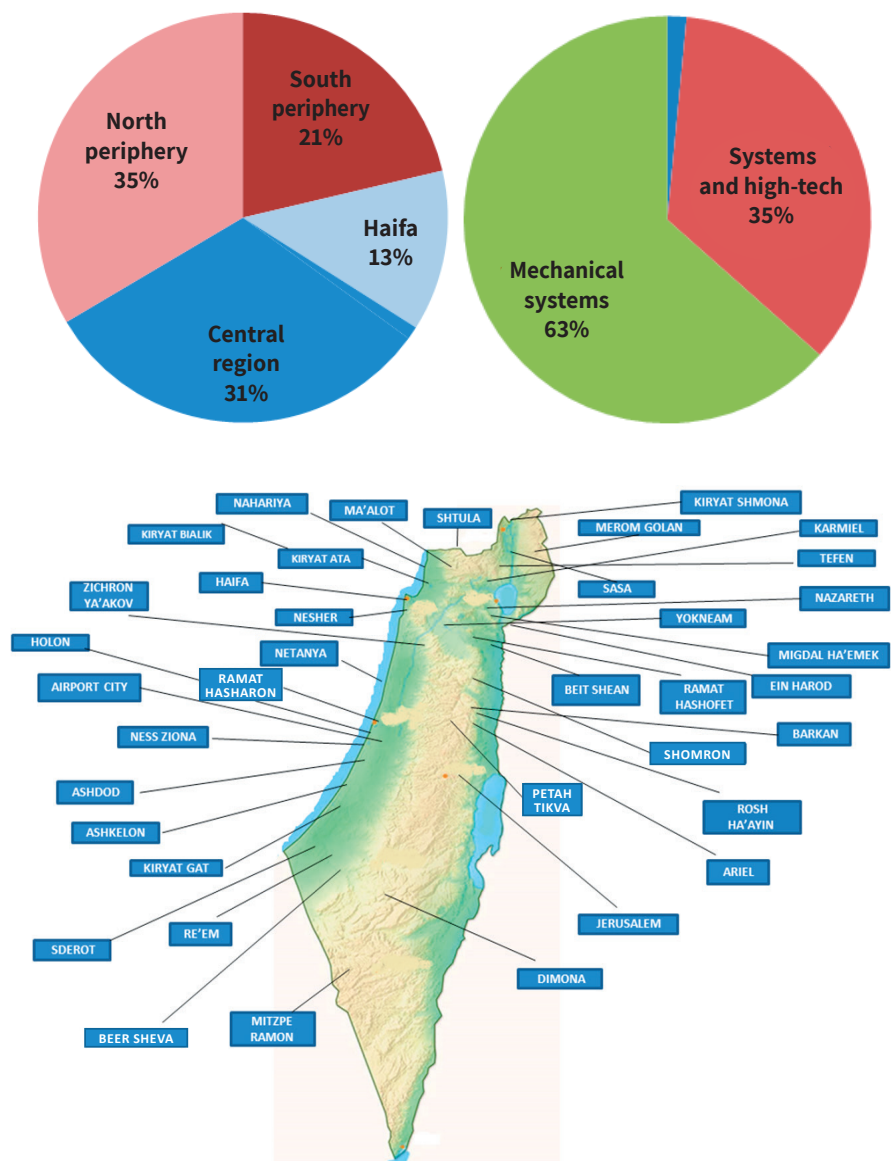


Figure 6: Merkava industries profile: A growing number of high-tech systems, on one hand (35%), and a unique base of more than 100 metal, electrical, and chemical industries manufacturing in the periphery and outlying areas, on the other

Summary

The range of trends described in this article is very challenging to the defense industry in Israel, in that they represent harmonized engines of change, from the required change in weaponry and the need for complex systems with highly developed capabilities to the transition from large-scale industrial production to production of smaller quantities of complex systems and platforms, the change in the occupations needed for development and production, and the need to transfer production work to the US in order to use the aid money.

Israel is unique in comparison with other countries in the following ways:

- Israel rates highly by international standards as a center of high-tech development and investment;
- Israel is in a state of constant high-intensity engagement with enemies of various types having a wide range of technological capabilities, from the use of shelf products to weapons developed by powerful countries;
- Israel has a defense innovation apparatus that operates as one system encompassing the army, the Ministry of Defense, the defense industries, and research and development institutes; and
- Israel faces a significant threat from terrorism and high-trajectory projectiles fired from an urban civil environment replete with commercial equipment.

An analysis of the various defense industry sectors shows a two-pronged challenge. The first is competition for labor and production, involving mainly industries located in outlying areas and small- and medium-sized businesses producing for the large industries and major contractors. These businesses are highly dependent on the defense establishment, and have little independent export capability. Second, the large enterprises, which develop complex systems, face a challenge in recruiting expensive and top-quality personnel in competition with the high-tech market, and in competing with new small players successfully developing capabilities by adopting systems based on shelf products.

Contending with these challenges requires assistance from government ministries, for the following purposes:

- Maintaining the R&D investments, while also preserving the manufacturing element;

- Dealing with the inherent barriers to the usage of COTS technologies – a process that has already begun in the Ministry of Defense; and
- Preserving the small- and medium-sized businesses, with an emphasis on the outlying areas, in order to maintain social, defense, and economic resilience, while preventing the “export of labor.”

All of these measures will make it possible to maintain both the IDF’s advantage through the Israeli defense industry and the attractiveness of exports as part of the equation.

Notes

- 1 The Israeli defense industries’ ratio of production is approximately 1:3 domestic:export.
- 2 Moore’s Law – the observation that the number of transistors in a dense integrated circuit doubles every two years.
- 3 For more on this subject, see Guy Paglin, “The Innovation Race,” Chaikin Chair in Geostrategy, University of Haifa, January 2018.
- 4 Mariana Mazzucato, *The Entrepreneurial State* (London: Anthem Press, 2013).
- 5 Paglin, “The Innovation Race,” Chaikin Chair in Geostrategy, University of Haifa, January 2018.
- 6 Source: An unpublished paper on American aid by Zeev Klein.
- 7 MANTAK is responsible for the design, development, integration, system engineering, manufacturing, and assembly of the Merkava MBT and the armored fighting vehicles (tracked and wheeled).

Part 4

**The Importance of
the MOU to Israel**

US Military Aid – Still a Strategic Asset for Israel

Shmuel Even

US military aid contributes greatly to Israel's security, but also imposes restrictions. Opinions (unofficial ones) are occasionally expressed in Israel arguing that the time may have come for the country to stand on its own two feet and voluntarily forgo this military aid for the sake of its independent image and in order to reduce the possibility of the United States exerting pressure on it. Moreover they argue that the annual US aid accounts for only 1 percent of Israel's GDP and Israel has already relinquished economic aid from the United States in the past. This article examines the pros and cons of US military aid to Israel, and concludes that the advantages of the aid clearly outweigh its disadvantages.

US Military Aid to Israel – Principal Data

Military aid is the main resource for the IDF's force build-up. It is provided in two frameworks: the foreign military financing (FMF) program and the US Department of Defense's share in the financing of joint projects, involving mainly anti-missile defense. Israel also receives special military grants on a need-to basis.¹ In addition, the United States permits Israel to use stocks of American weapons in Israel in wartime. This option expands the inventory available to Israel. Furthermore, the local industries are included in the production of American arms designated for Israel, and American companies carry out reciprocal procurement from Israeli industries (although the aid MOUs do not require this). For example, as part of the procurement

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agreements for Adir (F-35) stealth aircraft, the Americans agreed to procure equipment from Israeli companies participating in production of the aircraft.²

The third 10-year aid program (2019-2028) began in the 2019 American fiscal year. The program includes \$3.8 billion in aid per year: \$3.3 billion in FMF and \$500 million in the Department of Defense's share in joint projects. The various types of military aid allocations in 2009-2018 and the plan in 2019-2028 (as agreed in the 2016 MOU) are outlined in Table 1 below.

According to the MOU figures,³ the 2019-2028 program is distinguishable from its predecessor (2008-2018) mainly in the following ways:

1. FMF increased from \$30 billion in the preceding decade to \$33 billion in the new decade; from \$3.1 billion in 2018 to \$3.3 billion starting in 2019. It can be assumed that the nominal increase is designed to counteract the effect of inflation on the value of the aid, but no more than that.
2. The part of the aid that Israel can convert into shekels for the purpose of procurement from its domestic industries will gradually fall from \$815 million in 2019 to zero in 2028 (a steep decrease is scheduled to begin in 2025). The part of the aid in dollars that Israel can spend in the United States will correspondingly increase.
3. American funding for joint projects of Israel and the US Department of Defense was set at \$500 million a year, and made part of the 10-year aid package for the first time. The US now regards this financing as part of the aid package, not merely a partnership in funding development and production of weapons. Table 2 lists this American aid according to joint projects in 2009-2018.
4. There is an understanding that the American aid is not meant for the purchase of refined oil products from the United States. This clause also increases the financial constraint in shekels on the defense budget in Israel.

Table 1: US military aid allocations to Israel in 2009-2028 (US\$ millions)

US fiscal year	Aid for procurement in the United States	Aid converted into shekels	Total FMF	American share of funding for joint missile interception projects	Total
2009	1,879	671	2,550	177	2,727
2010	2,045	730	2,775	202	2,977
2011	2,211	789	3,000	415	3,415
2012	2,266	809	3,075	306	3,381
2013 ⁴	2,169	774	2,943	447	3,390
2014	2,285	815	3,100	729	3,829
2015	2,285	815	3,100	620	3,720
2016	2,285	815	3,100	488	3,588
2017	2,285	815	3,100	601	3,701
2018	2,285	815	3,100	706	3,806
Total for the decade	21,995	7,848	29,843	4,691	34,534
2019	2,485	815	3,300	500	3,800
2020	2,495	805	3,300	500	3,800
2021	2,505	795	3,300	500	3,800
2022	2,515	785	3,300	500	3,800
2023	2,525	775	3,300	500	3,800
2024	2,575	725	3,300	500	3,800
2025	2,850	450	3,300	500	3,800
2026	3,050	250	3,300	500	3,800
2027	3,050	250	3,300	500	3,800
2028	3,300	0	3,300	500	3,800
Total for the decade	27,350	5,650	33,000	5,000	38,000

Source: Congressional Research Service⁵ and the Israel defense budget⁶

Table 2: US funding for joint missile interception projects (US\$ millions)

US fiscal year	Arrow 1,2,3	David's Sling	Iron Dome	Total
2009	104.3	72.9		177.2
2010	122.3	80.1		202.4
2011	125.4	84.7	205.0	415.1
2012	125.2	110.5	70.0	305.7
2013	115.5	137.5	194.0	447.0
2014	119.1	149.7	460.3	729.1
2015	130.9	137.9	351.0	619.8
2016	146.1	286.5	55.0	487.6
2017	272.2	266.5	62.0	600.7
2018	392.3	221.5	92.0	705.8
2019	243	187	70	500

Source: Congressional Research Service⁷

The US Rationale for Military Aid to Israel

Since the Yom Kippur War, American defense aid to Israel has been given in large amounts as an integral part of the relationship between the two countries, which has become stronger. American aid is not given as an act of kindness or because of short-term give-and-take considerations. It is part of a common long-term strategy, based on the need for the superpower to enhance its power as an ally; the identification of American citizens and leaders with Israel and its values, as reflected in the support for Israel in Congress; and the common threats facing the two countries: terrorism, cybersecurity threats, Iran and the regime of Saddam Hussein in Iraq, and past intervention in the Middle East by the Soviet Union.

For many years, the United States has viewed Israel as a major non-NATO ally (MNNA). Aid to Israel can be considered something of an alternative to US support for its NATO allies – an alternative preferable for both countries. In contrast to other allies, the US does not station military forces in Israel, and Israel's defense is not dependent on American forces.

The American concern about Israel's security as an important ally is also reflected in one of the guiding principles of US policy on this question:

maintaining Israel's qualitative military edge (QME) over its possible enemies in the Middle East. In 2008, the US Congress defined QME in the context of Israel as "[Israel's] ability to counter and defeat any credible conventional military threat from any individual state or possible coalition of states or from non-state actors, while sustaining minimal damage and casualties, through the use of superior military means, possessed in sufficient quantity, including weapons, command, control, communication, intelligence surveillance, and reconnaissance capabilities that in their technical characteristics are superior in capability to those of such other individual or possible coalition of states or non-state actors."⁸ Application of this principle is reflected in the volume and quality of the arms supplied to Israel and the aid terms, including 10-year agreements, and in monitoring of American arms exports to partners of the United States in the Arab world in coordination with Israel. Congress also resolved that every sale of American arms liable to detract from Israel's QME must be reported to Congress.

Israel heads the list of countries receiving FMF. It should be kept in mind, however, that the countries benefiting directly from American defense are not on this list (such as members of NATO, whose defense is guaranteed by the United States, including the stationing of military forces on their territory). As of 2018, defense spending by the US totaled \$649 billion, 3.2 percent of its GDP.⁹ Through this spending the US in effect subsidizes the defense of its allies in Europe, some of whom do not meet the defense spending target of 2 percent of GDP to which NATO countries are committed. American aid to Israel can therefore be seen as a way for the US to help defend an ally in a way that differs from how it supports NATO countries. It should be noted in this context that spending on defense consumption in Israel amounted to 5.1 percent of GDP in 2018, or 4.1 percent of economic resources, excluding all types of American aid.

The relationship between Israel and the United States also promotes other American interests. For example, Israel is a strategic partner that gives the US a foothold in the region, and gives it a key role in promoting diplomatic processes in the Israeli-Arab conflict, even though Israel does not subordinate its policy to US' wishes, as can be seen by the dispute with the Obama administration on construction in the territories and on the nuclear agreement with Iran. Furthermore, the two countries cooperate in a range of areas. In defense, this extends to cooperation on intelligence,

technology, lessons from the use of American arms, and training. In addition, the American arms industries benefit from regular demand for their output from the IDF, which is a consumer with a considerable reputation in the global arms market.

Advantages of the Aid to Israel

American aid constitutes a strategic defense asset for Israel. Its advantages are as follows:

1. It makes an enormous quantitative and qualitative contribution to the IDF's force build-up. In the test of time, the American arms that Israel has received have been superior to the Soviet arms possessed by Israel's enemies.
2. Since 1999, aid has been provided through multi-year programs at 10-year intervals. This provides the IDF with regular access to high-quality American arms, the ability to conduct long-term planning in force build-up, and improved procurement terms. For American arms industries, the 10-year framework provides financial security for long-term orders. Had it not been for the aid, it is very doubtful whether Israel would have been able to commit itself to such long-term procurement programs with the American industries from the Israeli state budget.
3. The aid is a concrete expression of the strong and continuous commitment to Israel's security by the United States. This is also known to have a deterrent effect on Israeli's enemies. The aid is derived from the QME principle, and without the aid, the US would find it difficult to put into effect this principle, which also includes consideration for Israel's views concerning exports of American arms to the Middle East.
4. Backing in emergencies – the aid is increased during defense crises, as was the case during the second intifada. At the same time, an increase in aid requires a special approval process.
5. The American contribution to Israel's heavy defense spending, which is unequalled in the Western world in terms of the ratio of defense spending to GDP and government spending. According to estimates for 2019, military aid accounts for 20 percent of spending on defense consumption in Israel.¹⁰ In comparison with GDP, the aid is only about 1 percent per annum but this is a significant amount in comparison with GDP growth, given that GDP growth net of population growth in Israel is less than 1.5

percent. Without the aid, Israel would have to devote additional resources to defense at the expense of civilian needs, and/or accept a higher level of defense risk. Israel's current economic situation is better than it was in previous decades, but should not be overestimated (per capita GDP in Israel is lower than the OECD average). Israel still needs aid in order to bear the economic burden of defense at the current level of risk.

6. The great contribution to Israel's defense industries, including:
 - a. Revenue for industries from IDF procurement, some of which is funded through conversion to shekels from the FMF program (this conversion will end in 2027);
 - b. Inclusion of output from Israeli industries in American weapons systems produced for the IDF (for example, the installing of auxiliary systems made by Israeli firms in arms manufactured in the US); and
 - c. Inclusion of components from the US purchased with aid money in arms produced for the IDF by Israeli industry.

In addition, the US Department of Defense helps fund joint projects, the most important of which are the production of anti-missile systems by Israeli enterprises. Notice should also be taken of reciprocal procurement by the US, even though American industry has no obligation to conduct any reciprocal procurement under the aid agreement. Industrial cooperation with companies in the US contributes to the adoption of advanced weapons production standards, and is likely to contribute to development of new technologies and products by the Israeli defense industry.

7. Military aid is an integral part of American assistance to Israel, which includes strong United States diplomatic support for Israel.

Limitations and Disadvantages of the Aid

1. Aid increases Israel's strategic dependence on the United States, and potential misuse of this dependence by the US. Views are occasionally expressed in the US calling for utilization of the aid to exert political pressure on Israel with respect to Israeli policy in the West Bank, or demanding that Israel behave according to the aid that it receives. Such views, which run contrary to the spirit of the aid, were expressed in late 2019 by two of the candidates for the Democratic nomination for president.¹¹ These views appear to be part of the internal political strife in the US, given President Donald Trump's close relations with Israel's Prime

Minister Benjamin Netanyahu. Another example was an expectation by the US of a change of Israel's attitude towards Chinese activity in Israel, after which Israel decided in late 2019 to set up an advisory committee to consider the national security aspect in the process of approving foreign investments.¹² At the same time, the US is in no hurry to use aid as a means of exerting pressure. Even in the past, when it cut its economic guarantees to Israel because of construction in Jewish settlements in the West Bank and Gaza Strip, the cutback was limited and ineffective. President Barack Obama also refrained from touching the new military aid MOU (2019-2028) formulated in 2016, despite sharp disagreements with the Israeli leadership on the issue of the Iranian nuclear program and Israel's policy in the West Bank. No evidence has been found to support claims made in Israel and the United States that Israel could have obtained much more aid had it not been for the tension prevailing at the time between the leaders of the two countries.¹³

2. Aid has a restrictive effect on the Israeli defense industries, because most of Israel's defense needs are supplied by American industries according to the aid terms, and also because Israel has to take into account the wishes of the United States when exporting arms from Israel, which restricts the export markets for Israel's defense industries. This effect, which originates with the IDF being forced to procure weapons in the US, is expected to be augmented with the gradual reduction of the option to convert aid dollars to shekels from \$815 million in 2019 to zero in 2028.
3. The aid gives the American administration justification for selling advanced weapons to Arab armies, which affects the potential balance of power in the region. At the same time, it appears that these arms sales motivated the administration to supply the most advanced weapons to Israel in order to comply with the QME principle, which alleviates this disadvantage.

Summary and Recommendations for Israel

The sum of the advantages of American military foreign aid outweighs the total disadvantages. The main reasons for maintaining the aid framework are as follows:

1. Assuming that Israel will find it hard to allocate rigid and long-term procurement frameworks from its budget on a scale similar to that

provided by the military aid, the volume, regularity, and availability of American weapons systems for the IDF could be negatively affected in the long term.

2. The aid applies the QME principle, without which the US will have difficulty preserving Israel's qualitative military edge, an edge based on both military aid to Israel and control of American arms exports to other countries in the Middle East. For example, in the absence of aid guaranteeing American long-term production lines, the American industries may increase their pressure on the government to supply advanced arms to other countries in the region.
3. Expectations that termination of the aid will substantially reduce Israel's strategic dependence on the US are likely to be proved wrong. Even without the aid, Israel's political and security dependence on the US will remain great. For example, Israel will need both protection from the United States in decisions taken by international institutions and its willingness to sell the most advanced weapons to Israel. The United States has other means of exerting pressure on Israel. For example, on December 23, 2016, three months after the current aid MOU program was signed, towards the end of his term, President Obama decided to refrain from vetoing an anti-Israeli resolution by the UN Security Council against the Jewish settlements in the West Bank, reversing US policy up until then. It is hard to envision strategic scenarios in which waiving aid will increase Israel's freedom of action vis-à-vis the United States.
4. Rejecting the aid (about NIS 140 billion over a decade) will have a major impact on Israel's defense budgets, which will be cut, together with civilian budgets. The security risks that Israel bears will increase. Tension between the Ministry of Finance and the Ministry of Defense in Israel will rise, because the procurement budget will come exclusively from state resources. The likelihood of government approval for a multi-year plan for the IDF backed by an agreed-upon budget outline will be reduced.
5. The current aid program (2019-2028) already represents a decline in the economic aspect of military aid, reflected in the more stringent economic terms for the aid, especially the gradual reduction in conversion of aid from dollars into shekels, until it is completely eliminated in 2028 and the understandings that the aid is not designated for the purchase of refined oil products in the United States. From a strictly economic perspective,

these steps, which were taken with Israel's consent, can be seen as a continuation of the terminated economic grants from 2008 (at that time, Israel read the map correctly and forwent them at its own initiative). Although, to date, the reduced scope of American economic aid is justified in light of Israel's improved economic situation from the 2000s, the per capita GDP in Israel is still below the average in developed countries, though Israel alone faces more serious threats. Therefore, Israel would be better off avoiding initiatives with long-term security implications that are largely based on optimistic economic assumptions, such as the issue of aid waivers.

6. US aid to Israel is part of the pattern of strategic relations between the two countries that serve their mutual interests. The United States also derives considerable benefit from these ties.

In the 2019-2028 aid program, preparations for the drastic change in aid conversion to shekels starting in 2025 should begin now, with efforts made on several fronts simultaneously:

- Local financing for the survival and development of unique defense industries in order to preserve strategically important research and development and key industry personnel;
- Assistance for local companies in expanding exports;
- Consideration of mergers in the industry in order to attain economies of scale;
- Including Israeli companies in procurement orders from American companies;
- Closer cooperation with American companies and moving production units and subsidiaries of Israeli companies to the United States;
- Encouraging reciprocal procurement by American companies, even though the American companies are under no obligation in this matter;
- Aid in converting production lines and personnel from defense to civilian production; and
- Assistance in public relations and aid for small companies.¹⁴

Israel's strategic partnership with the United States has a price that is not due exclusively to defense aid, but to the very fact that Israel is a strategic partner of the US. In that role, it must continue showing sensitivity for American

defense and political interests. Israel's contribution as an ally to the security of the US in foreign affairs and defense can be mentioned occasionally (a strategic foothold, leading diplomatic processes, intelligence and military lessons, defense cooperation in counter-terrorism and Iran). Israel should continue to shape the relationship between the two countries in line with long-term considerations.

As for those in the US who advocate making military aid to Israel contingent on its policy towards the Palestinians, Israel should make it clear that the strategic relationship is deeply rooted, multi-faceted, and long-term (the 10-year MOU shows this), while these advocates are trying to portray the relationship as being merely give-and-take, i.e., shallow and one-dimensional. These views clash with Israel's independence and democratic character; conditioning the aid constitutes interference in Israel's relations with the Palestinians, which comprise a fundamental national security – and politically controversial – issue in Israel. At the same time, it is impossible to ignore the fact that these views were pronounced by leading figures in the Democratic Party, who in the future are likely to affect the amount of aid granted to Israel or the terms for receiving it – especially if one of them is selected as the candidate for the presidency. Nor can the integrity of the aid and its future terms be taken for granted from the Republican Party, given the view espoused by President Trump that the US should reduce the amount of resources it spends on defending other countries.

Israel should not retreat from conflicts with the United States on matters of importance to its national security, but it should examine each case individually, while keeping the interests of the US and long-term considerations in mind. In any case, it is best for Israel to maintain a balanced attitude in its relations with both American political parties, as befits the deeply rooted ties between the two countries, and not only with respect to foreign aid.

Notes

- 1 For example, at the height of the second intifada in 2003, Israel was allocated an additional \$1 billion grant.
- 2 Jim Zanotti, "Israel: Background and U.S. Relations," Congressional Research Service, October 28, 2016, p. 25, <https://www.hsdl.org/?view&did=796700>.
- 3 Zanotti, p. 24.

- 4 The figures are after a cut of \$157 million (out of a \$3.1 billion total), due to an across-the-board cut in the American budget in March 2013.
- 5 Jeremy M. Sharp, "U.S. Foreign Aid to Israel," Congressional Research Service: December 22, 2016 edition; April 10, 2018 edition; August 7, 2019 edition.
- 6 Proposed Defense Budget for 2017-2018, Non-Classified Items, October 2016, p. 33.
- 7 Jeremy M. Sharp, "U.S. Foreign Aid to Israel," Congressional Research Service, August 7, 2019, <https://fas.org/sgp/crs/mideast/RL33222.pdf>.
- 8 Jeremy M. Sharp, "U.S. Foreign Aid to Israel," Congressional Research Service: December 22, 2016, p. 2, <https://emetnews.org/documents/us-foreign-aid-to-israel-2016.pdf>.
- 9 US Office of Management and Budget, Historical Tables, Table 5.1, <https://www.whitehouse.gov/omb/historical-tables>.
- 10 The concept of defense consumption includes spending on the Mossad and the General Security Service, but does not include spending by the Ministry of Defense on pensions for retirees and family rehabilitation departments.
- 11 Amir Tibon, "Military Aid to Israel Becomes New Battleground in Democratic Party," *Haaretz*, October 30, 2019, <https://www.haaretz.com/us-news/.premium-military-aid-to-israel-becomes-new-battleground-for-2020-democratic-candidates-1.8058113>.
- 12 Doron Ella, "A Regulatory Mechanism to Oversee Foreign Investment in Israel: Security Ramifications," *INSS Insight*, No. 1229, November 19, 2019.
- 13 See the article in this Memorandum by Daniel Shapiro, who was Ambassador to Israel at the time.
- 14 These solutions were raised in discussions by the defense industries research team at INSS.

Is the Aid Agreement Essential for Israel? A Cost-Benefit Analysis

Sasson Hadad

On September 15, 2016, the United States and Israel signed the third defense aid MOU for 2019-2028, amounting to \$38 billion – \$3.8 billion a year. By 2019, Israel had received over \$100 billion in defense aid since its founding. This is a substantial sum that eased the defense burden on Israel, and constituted the main source of funding for the IDF's build-up in American technology and primary weapons systems. The aid in 2019, constitutes approximately 1 percent of Israel's GDP, 2.5 percent of the state budget, and 20 percent of the defense budget. This sizable amount has considerable advantages beyond the money, in the form of an uncompromising American commitment to Israel's security and direct access to American technology and the American defense establishment. Furthermore, American aid benefits the American defense industry, which receives additional contracts and is able to sell to other countries that regard the IDF as a sophisticated user whose choice constitutes important sales promotion. It also benefits the American defense establishment, which gains invaluable intelligence and operational knowledge from the Israeli defense establishment.

The agreement, however, also has a number of drawbacks involving Israel's dependence on the United States. This was highlighted by American pressure in economic relations between Israel and China; plans to exert political pressure in exchange for the aid, as recently stated by some leaders of the Democratic Party in the Palestinian context; the legitimacy given to

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military aid to Arab countries and the sale of advanced weapons to them; the IDF's absolute dependence on American technology and weaponry, and the negative effect on procurement from the local industries.

In the overall cost-benefit balance, it appears that most of the benefit in relations between Israel and the US is independent of the amount or existence of aid, while the aid has drawbacks that will be eliminated if the agreement is canceled. It should also be emphasized that the US benefits from the agreement no less than Israel. In the end, as long as the US does not use the aid to Israel's detriment, there is no reason not to continue it. At the same time, if the agreement is misused, there should be no hesitation in canceling or changing it in order to prevent this misuse.

A Historical Review

The United States and Israel have a strong relationship based on a number of factors, including solid US support for Israel and its security, common strategic goals in the Middle East, a mutual commitment to democratic values, and strong historic connections beginning with the US vote in favor of the UN partition plan in 1947.

American foreign aid was a key element in securing and strengthening these ties. Official sources and many lawmakers in the US have dealt with the need and importance for Israel to be an essential partner in the region, and the American aid package for Israel reflects this stance. While there have been people in the US who have fostered American support for Israel since its founding in 1948, a large and well-established internal American lobby emerged following the Yom Kippur War in 1973 for the purpose of nurturing bipartisan support in Congress for the relationship with Israel, including for US aid to Israel – the American-Israel Public Affairs Committee (AIPAC).¹

Israel has received the most cumulative foreign aid from the United States of any country since WWII. The total amount of US aid granted to Israel between its founding and 2019 is approximately \$135 billion, as outlined in Table 1 (excluding the anti-missile defense program) and in a report of the Congressional Research Service.² Over \$100 billion of this amount consisted of defense aid, of which \$11 billion was given in the form of loans.

All of the aid given before 1973 consisted of loans. Aid in 1973-1984 contained both loans and grants, while all the aid received by Israel since 1984 has been grants.³ Since 1999, the aid has been anchored in inter-

governmental 10-year MOUs. Unlike treaties, these MOUs are not legally binding agreements, and therefore do not require Senate approval. Congress is entitled to accept or change the annual amount of aid for Israel, and to grant additional aid. In any case, these documents have previously had a significant effect on the terms of American aid to Israel. Congress allocated foreign aid to Israel mainly according to the terms of the MOU in effect at the time.

The first 10-year MOU (1999-2008) was signed by the Clinton administration and the first Netanyahu government. It represented a commitment of at least \$26.7 billion in economic and military aid (\$21.3 billion was earmarked as military aid). This MOU included the gradual termination of all economic aid to Israel.⁴ Benjamin Netanyahu took this decision in 1996 for the purpose of reducing Israel's dependence on American aid by 20 percent by eliminating economic aid for which there was no longer any justification.⁵ The agreement signed in 1998 provided for a gradual reduction in economic aid by \$120 million a year, half of which was turned into military aid. This process was completed in 2007, and from 2008 Israel received only military aid.⁶

In 2007, the Bush administration and the Olmert government signed the second MOU providing for \$30 billion in military aid over a 10-year period (2009-2018). For the first time, the agreement included an explicit option⁷ to convert up to 26.3 percent of the aid into shekels for procurement of equipment produced by Israel (off-shore platforms procurement – OSP).⁸

On September 15, 2016, a third MOU was signed by the Obama administration and the Netanyahu government. Covering the next decade (2019-2028), this agreement totaled \$38 billion and included an Israeli commitment (which did not previously exist) to refrain from asking for additional aid during the period, unless a security event made this necessary.

Under this agreement, foreign defense aid from the budget of the US State Department rose from \$30 billion in 2009-2018 to \$33 billion. Furthermore, the MOU included for the first time a \$5 billion 10-year framework from the American defense budget for American funding for American-Israeli anti-missile defense programs (Israel undertook to invest a corresponding amount in the projects).

Another important change concerned the part of the aid that Israel will be able to convert into shekels for procurement from the local defense industries. Under the agreement, this amount will gradually decrease over the years

from \$815 million in 2019 to zero in 2028. Israel also signed a statement that it understood that the aid money will not be used for the purchase of fuel and fuel products from the United States.⁹

The actual amount of aid before 2019 was over \$100 billion, a considerable sum that eased the defense burden on Israel and constituted the main source of funding for the IDF's build-up in American technology and primary weapons systems.

Annual defense aid, as it appears in the agreement, and subject to annual approval by Congress, currently amounts to \$3.3 billion, 0.85 percent of Israel's GDP and 2.1 percent of the state budget. This is a substantial sum that eases the defense burden on Israel, and constitutes 16.67 percent of Israel's defense spending.¹⁰

This amount appears significant, but for the sake of comparison, defense and economic aid was similar in 1995 (\$3 billion: \$1.2 billion in economic aid and \$1.8 billion in defense aid). Aid at that time amounted to approximately 3 percent of GDP¹¹ and 5.2 percent of Israel's state budget,¹² and defense aid accounted for 37.5 percent of defense spending.¹³ A comparison between the two years shows clearly that the economic weight of aid in the current year is less than half of what it was in 1995, when, on the basis of the figures for the time, Prime Minister Netanyahu decided to forgo the economic aid and convert half of it to defense aid, as stated above.

Many people in Israel¹⁴ have recently called for reconsideration of whether defense aid is necessary, because of the dependence that it creates on the United States and the damage it does to the special relationship between the two countries. These views were supported by statements made by candidates for the Democratic Party nomination for president in the US¹⁵ linking aid to relations between Israel and the Palestinians and demanding political concessions by Israel in the matter. Israel's current obvious economic strength, with higher growth than in the Western world and per capita GDP nearing \$40,000, on the one hand, and the declining importance of aid to the Israeli economy, on the other, raises questions about the amount of aid and whether any aid is necessary, given the price that may be paid for it. I will try to answer these questions by reviewing the advantages and disadvantages of aid and assessing whether canceling or reducing it will alter the situation.

Advantages of the Aid to Israel

Defense aid to Israel expresses the uncompromising American commitment to Israel, which began with the US vote in favor of the UN partition plan and recognition of the State of Israel and continued with the vast amounts of economic and defense aid given to Israel (over \$142 billion to date), and its pledge to keeping Israel in the forefront of technology in comparison with its neighbors (quantitative military edge – QME), as reflected in the American law stating that arms sales by the United States must not detract from Israel's QME over other countries in its region. US support for Israel in UN votes has been almost unqualified. “Put your money where your mouth is” is a popular American saying. If both Israel and the US want to ensure that that support is properly understood in the Middle East, the best proof is the money that the United States grants to Israel.¹⁶ This strong connection was also reflected in the free trade agreement signed by the two countries in 1985, and the status of the US as Israel's biggest trade partner.¹⁷ The two countries' ties are further anchored in shared strategic goals in the Middle East and a mutual commitment to democratic values.¹⁸

This commitment is also demonstrated in emergencies. The American administration has always given Israel support and backing in a crisis. For example, during the Yom Kippur War in 1973, it flew large quantities of weapons, munitions, and spare parts to Israel for immediate use from American army warehouses (the “airlift”). This aid given to Israel in an emergency, and the potential for such aid in a future war, has an enormous effect in deterrence and inventory management.¹⁹ In the 1991 Gulf War, the US stationed Patriot missile batteries in Israel, manned by American soldiers, to protect Israel against missiles fired from Iraq. Today, also, beyond the various US support and assistance programs, ready-for-action munitions designated for future American use are stationed in Israel, but can be used by Israel for its needs in a crisis on little or no notice. Nothing comparable to this aid is given to other countries; it stems from the above-mentioned profound commitment.

There are a number of other advantages in addition to this deep connection:

- The economic advantage, which as noted above is declining.
- The technological advantage – the MOU facilitates procurement of advanced arms and technology on a large scale, on the one hand, and increases Israel's access to technology through direct working channels

to the US Department of Defense and its units responsible for military aid, on the other.

- Another advantage is direct access to the American defense establishment, from the US National Security Council to the Department of Defense and its units and the various branches of the American armed forces. This advantage generates direct connections and growing collaborative efforts. The cooperation extends to the Israeli defense industry, which benefits from these advantages; the development of anti-missile defense systems (such as Iron Dome and Arrow) is the result of such cooperation.

Procurement in the United States under the defense aid MOU also has major advantages for the Israeli defense industry in the form of reciprocal (offset) procurement²⁰ agreed in transactions, and in quite a few cases from the inclusion in the production of sub-systems for the rest of the world and various adaptations to Israel's needs. This brings technology and knowledge to the local defense industry, and contributes to its development, thereby enabling it to provide independent maintenance capabilities for systems used by the IDF.

Another advantage resulting from the recent MOU, which is due to expire during the period of the current MOU, is the option of converting approximately one quarter of the aid into shekels for use in procuring Israeli-developed technology. The most prominent examples here are armored fighting vehicles (AFVs), the Merkava and the Namer, procurement of which is based on such conversion. These amounts provided a major stimulus for the Israeli defense industry, and were used to generate large-scale domestic demand for the industry. Towards the expiration of the conversion option in 2028, as agreed with the American administration, difficulties are expected to arise, which pose a great challenge to the local defense industry.

Still another advantage of the aid is that it is earmarked solely for force build-up and defense procurement. It is therefore protected against being diverted to other uses, and is not subject to cuts and various and sundry legal restrictions (such as transfer between years and financing restrictions based on temporary and other constraints).²¹

The Americans also see major advantages in the agreement, which appear to benefit them no less than Israel. First of all, it furthers US interests in

the Middle East by enabling its closest regional ally to deter enemies and defend itself against a broad range of threats. Israel faces threats from Iran, Hezbollah, Syria, ISIS, and other regional enemies, as well as Hamas and other terrorist organizations in the Gaza Strip. Almost all of the aid offered by the US is used against these threats. All of these players also threaten American soldiers, American interests, and other American allies, so that Israel's capabilities well serve the interests of the United States, as well as those of Israel.²² This strategic advantage is very powerful at this time, when the US wants to scale back its presence in the region.²³

Furthermore, the relationship resulting from this aid is part of a broader defense partnership between the United States and Israel, in which the former enjoys access to the latter's intelligence service, one of the best in the world; joint maneuvers with the IDF; access to groundbreaking technologies, such as Trophy and Iron Dome; direct learning by the Americans from Israel's operational experience in operating American weapon systems; and the lessons learned by Israel from those systems and the improvements that it makes in them, which create invaluable knowhow.²⁴

Moreover, the lion's share of the aid in dollars returns to the United States economy and supports thousands of jobs in United States defense industries.²⁵ Beyond their direct value, the sale of advanced systems to Israel also enables the American defense industry to close huge deals with other countries, in accordance with American policy towards Israel, in which it is committed to preserving the QME of the systems sold to Israel in comparison with the rest of the region. In other words, when advanced systems are sold to Israel, it becomes possible to sell other advanced systems, one level below them, to countries in the region at market prices.²⁶ These and other countries regard the IDF as a sophisticated user whose choice constitutes important sales promotion for American defense companies. The volume of military transactions expected as a result of the aid agreement contributes directly to the American defense industry. It definitely supports President Trump's America First policy, and is welcomed and supported by the lobby for the relevant American industries.

Disadvantages of the Aid to Israel

In addition to the many advantages, over the entire aid period there are a number of conspicuous disadvantages that warrant addressing, and which occasionally cast a shadow over the relations between the two countries.

The most prominent disadvantage is the dependence on the United States that Israel has developed. This dependence runs deep through a very broad range of issues, from economic dependence, which was very strong in the 1980s and 1990s, then later receded with the termination of economic aid and the fading economic significance of aid, as highlighted at the beginning of this article. Note that when aid through loans was discontinued and replaced exclusively by grants in 1985, the aid amounted to over 10 percent of Israel's GDP. The dependence on aid was expressed in the characteristics of Israel's military capability, with an absolute preference for American technology and weaponry in the IDF's force build-up, and in the ability of the Israeli defense industry to export arms. Israel is the world's eighth largest arms exporter, but its sales are conducted under the watchful eye of the Americans. A crisis occurred between the two countries when Israel sold its Phalcon aircraft to China in 2000. The deal was called off following American pressure and demands for the removal of then-Ministry of Defense director general Major General (res.) Amos Yaron and the creation of an oversight mechanism for defense exports. These demands resulted in the founding of the Israeli Defense Export Controls Agency (DECA).²⁷

This dependence is discernible now too in the Israeli attitude towards American concern about ties between Israel and China and Chinese investments in Israel (mainly in infrastructure), and in the founding of a mechanism for dealing with foreign investments, which was approved by the cabinet in late October 2019.²⁸

Concern about use of aid as a political bargaining chip is another disadvantage. The demand by some of the current candidates running for the Democratic nomination for president that this lever be used in the diplomatic negotiations between Israel and the Palestinians to induce Israel to accept views against its will in this matter created a stir, despite the tradition in both parties against using aid as a bargaining chip.²⁹ Great efforts were made in both parties to recruit support for Israel. An internal American movement emerged following the Yom Kippur War (1973) for the purpose of fostering bipartisan support in Congress for the relationship with Israel,

including for United States aid to Israel. In recent years, however, strong support for Israel has become a more divisive issue. Demographic trends in the US (young people, people with no religious affiliation, American Muslims, Hispanics) were among the factors contributing to a change in the perception of US-Israel relations. It appears that liberal voters in the US have more critical views of Israel; certainly, American opinions about the Israeli government are becoming more polarized. In April 2019, the Pew Research Center published survey results showing that “by nearly two-to-one (61 percent to 32 percent), Republicans have a favorable view of Israel’s government. By contrast, two-thirds of Democrats view Israel’s government unfavorably, while just 26 percent have a favorable opinion.”³⁰ The call in both countries for leaving the issue of aid outside the political argument between the Democratic and Republican parties is evidence of the concern about the matter.”³¹

In May 2019, former acting National Security advisor Major General (res.) Prof. Jacob Nagel published strategic defense principles of Prime Minister Netanyahu. In his document, Nagel states, “Netanyahu argues that Israel’s security rests on four main pillars. The first pillar is military power, deterrence, early warning, defense, and attack. The second pillar is economic power, which results from strengthening the private sector, removing trade and commercial barriers, and the strengthening of global economic ties. The third pillar is political power, which comes from strong alliances and deterrence, in order to ensure a free hand for our army to act, and to undermine the reflexive anti-Israeli majority in international organizations. Netanyahu describes the final pillar as social and spiritual power, which is likely to prove a better characteristic than human capital, while taking note of the flexibility of the Israeli people.”³² It can be seen that economic power and the strengthening of global economic ties play a considerable role in strategy; indeed, the improvement in the Israeli economy in recent years is evidence of the importance assigned to this. In view of these goals, the large-scale aid that Israel receives from the US each year contradicts the wish to demonstrate Israel’s economic independence. Furthermore, from a moral standpoint, Israel’s status as the leading recipient of aid, far ahead of all the poor Third World countries, with their sick and hungry people, is problematic, to say the least. Even if there is no assurance that US aid not

granted to Israel will be diverted to other countries, this decision should be left to taxpayers in the United States.³³

Despite the contribution of American aid, it is now no longer essential for Israel's survival. If the United States decides to cancel it for some reason, Israel will be able to live without it. Covering the entire defense budget with local resources is economically possible, but will obviously cause cutbacks in other areas.³⁴

Another disadvantage of American aid concerns Israel's defense industry. No one disputes the strategic importance to Israel of the defense industry, which guarantees the ability to provide a technological response to its own defense needs when an embargo is imposed on it, as occurred following the Six Day War, or to develop weapons systems such as the Merkava tank and Iron Dome. These weapons function as a force multiplier for Israel's military capability and provide an advantage over the enemy. The defense industry requires large long-term investments in order to maintain its technological edge; this is one of the foundations of the defense budget in Israel. Israel and the United States reached the most acute point in their defense relations with the cancelation of the Lavi project in 1987, which led to the breakthrough in their agreement that made it possible to devote a substantial proportion of the American defense aid budget to procurement in Israel.³⁵ In the current aid program, the dollar conversion option, which gave a major boost to demand for the local industry (\$815 million a year in recent years), will be gradually eliminated by 2028, a step that will deal a blow to the Israeli defense industry. The aid itself grew in nominal terms, but all of it will be channeled to the American defense industry. This will lower the domestic demand in Israel and increase its dependence on American technology, make independent development less worthwhile (because the procurement budgets will be in the US), and reduce the ability to adopt the procured arms to IDF needs and adjustments, including radar and electronic warfare systems critical for the quality of use of weapons systems. The result will be a decline in the IDF's independent maintenance capability.³⁶ A side effect of the transfer of procurement and the diminished viability of independent development concerns various categories of employees with specialized knowledge, engineers, and highly skilled technology personnel; there is concern that the drop in demand may induce them to emigrate. In addition, the above-mentioned question of the volume of sales of advanced

arms to countries in the region, which is liable to cause a palpable change in the regional balance of power, should be taken into account.

Another disadvantage of the aid is the economic problems that it causes. The aid is designated exclusively for defense procurement in the United States, and is protected against changes in the Israeli budget. The degree of uncertainty in it is therefore far less than in the shekel budget. The result is that the defense establishment assigns a lower internal value to the aid budget, which encourages its use even when this is not worthwhile. The consequence of non-optimal use is procurement of goods and services that gives rise to questions among those in the Ministry of Defense responsible for managing the aid budget. As a result, we often see various restrictions in American policy on the use of the aid budget (such as a ban on purchasing food with this budget, restrictions of its use in construction, and recent restrictions on the purchase of fuel).

In conclusion, if we look at the advantages, we see that most, if not all, of them result from the special relationship with the US, not from the aid and its size (except for the economic advantage, which has already greatly diminished in recent years).³⁷ A number of the above-mentioned disadvantages of the aid, on the other hand, will be avoided or substantially alleviated if military aid is canceled or reduced. These include the great dependence generated by the aid and the threat of its use as a political bargaining chip. As noted, Israel's economic situation in recent years has been very good, and even if the United States decides to terminate its aid, Israel is likely to survive without it. Israel should keep this insight in mind if such a situation materializes, and it should be reiterated that the US benefits from the aid no less than Israel.

In the overall cost-benefit balance, it appears that most of the benefit in Israel-United States relations can be obtained without dependence on the amount or existence of the aid MOU. The disadvantages of the MOU, on the other hand, will mostly fade away if the agreement is canceled.

The US benefits from the agreement no less than Israel. As long as the administration does not misuse the aid, there is no reason not to continue it. At the same time, if the aid is misused, Israel should not hesitate forgo it, or at least to request less of it, in order to prevent it from being misused.

Notes

- 1 Jeremy M. Sharp, CRS Report RL33222, U.S. Foreign Aid to Israel, August 7, 2019, p. 1.
- 2 U.S. Overseas Loans and Grants (Greenbook), U.S. State Department (Obligations and Loan Authorizations July 1, 1945 – September 30, 2017), p. 19.
- 3 Ibid, from the attached Excel table.
- 4 Jeremy M. Sharp, CRS Report RL33222, U.S. Foreign Aid to Israel, August 7, 2019, p. 5.
- 5 This change also resulted from the completion of debt repayment to the Americans in 1998, and from concern about an American initiative to terminate the economic grants. This termination was greatly appreciated by the US Congress.
- 6 Roni Bart, “Israel and American Aid: Continue Forward or Reverse Course,” *Strategic Assessment* 10, no. 1 (June 2007).
- 7 The first conversion of \$107 million was approved in 1977 as a special case for development of the Merkava tank. Starting in 1983, conversion of approximately \$250 million was approved each year for development of the Lavi fighter aircraft. In order to ameliorate the costs of canceling the Lavi program, the US agreed to increase conversion for procurement in Israel to approximately \$400 million. See Jeremy M. Sharp, December 22, 2016, p. 5, footnote. For the annual amount of conversion, see Yaacov Lifshitz, “The Economics of Producing Defense: Illustrated by the Israeli Case,” Jerusalem Institute for Policy Research and the Ministry of Defense Publishing House, 2003.
- 8 Jeremy M. Sharp, CRS Report RL33222, U.S. Foreign Aid to Israel, August 7, 2019, p. 5.
- 9 Shmuel Even and Sasson Hadad, “US Aid to Israel: Budgetary and Strategic Significance,” *INSS Insight*, No. 1070, July 2018.
- 10 See “Defense Expenditure in Israel 1950-2017,” Table 4, Central Bureau of Statistics Publications. Defense spending amounted to 5.1 percent of GDP in 2017. This figure was used for calculations under the assumption that the annual changes were minor, and because it was the most recent figure published.
- 11 According to figures from the World Bank, Israel’s GDP totaled \$100.24 billion in 1995 and \$387.72 billion in 2019.
- 12 The state budget in 1995 was about 57.5 percent of GDP. See Dan Ben-David, “State of the Nation Report – Society, Economy and Policy,” 2009.
- 13 Defense spending in 1995 equaled 8 percent of GDP. See “Defense Expenditure in Israel 1950-2012,” Publication No. 1579, Central Bureau of Statistics, October 2014.
- 14 For example, Major General (res.) Gershon Hacoheh, *Globes*, July 26, 2016; Gideon Israel, “Defense Aid Weakens Israel,” September 3, 2019; and Major General (res.) Isaac Ben-Israel on various occasions.

- 15 Jacob Nagel, "The U.S.-Israel Military Partnership Should Remain Outside Presidential Politics," *RealClearDefense*, November 12, 2019.
- 16 Roni Bart, "Israel and American Aid: Continue Forward or Reverse Course," *Strategic Assessment* 10, no. 1, June 2007.
- 17 Jim Zanotti, CRS Report RL33476, "Israel: Background and U.S. Relations," July 7, 2018.
- 18 Jeremy M. Sharp, CRS Report RL33222, U.S. Foreign Aid to Israel, August 7, 2019.
- 19 Aviad Sela, "American Aid to Israel in an Emergency – The Boundaries and Limitations of Friendship," IDF Publishing House, Volume 393, February 2004.
- 20 Procurement under the MOU does not require reciprocal (offset) procurement in Israel by the American defense industry; it takes place in practice separately as part of the understandings and negotiations for each transaction.
- 21 The aid is subject to across-the-board cuts in the American budget. Experience shows that this occurs very seldomly, in comparison with the prevailing practice in Israel.
- 22 Daniel B. Shapiro, "What Democrats Need to Learn from Obama about Aid to Israel," *The Forward*, November 9, 2019, <https://forward.com/opinion/434331/what-democrats-need-to-learn-from-obama-about-aid-to-israel/>.
- 23 JINSA's Gemunder Center for Defense and Strategy, U.S.-Israel Security Policy Project, "Arming Israel to Defeat Iranian Aggression: Frontloading Weapons Delivery," November 2019.
- 24 From a conversation on August 31, 2018 with Lieutenant General (res.) Moshe (Bogie) Ya'alon in the framework of the INSS defense industries research team.
- 25 Daniel B. Shapiro, "What Democrats Need to Learn from Obama about Aid to Israel," *The Forward*, November 9, 2019, <https://forward.com/opinion/434331/what-democrats-need-to-learn-from-obama-about-aid-to-israel/>.
- 26 For example, see comments by Major General (res.) Amir Eshel about the huge volume of American arms sales in the region, mainly to the Persian Gulf countries, "Israel Air Force Chief: Arms Sales to Region Could Erode Israel's Military Edge," *Haaretz*, June 21, 2017.
- 27 Ora Coren, "The Phalcon Affair: The American Pressure Began in 2003," *Haaretz*, January 2, 2008, <https://www.haaretz.co.il/misc/1.1298310> [Hebrew].
- 28 Doron Ella, "A Regulatory Mechanism to Oversee Foreign Investment in Israel: Security Ramifications," *INSS Insight*, No. 9212, November 19, 2019.
- 29 The United States has almost never used this lever since the heavy pressure on Israel to withdraw from the Sinai peninsula in 1956. See Roni Bart, "Israel and American Aid: Continue Forward or Reverse Course," *Strategic Assessment* 10, no. 1, June 2007. The case in which President Bush reduced American loan guarantees by approximately \$290 million in 2003 because of what it termed "illegal" construction in the West Bank was an exception. See Steven R. Weisman, "U.S. Rescinds Part

of Loan Guarantees to Israel,” *The New York Times*, November 26, 2003, <https://www.nytimes.com/2003/11/26/world/us-rescinds-part-of-loan-guarantees-to-israel.html>.

- 30 Jeremy M. Sharp, CRS Report RL33222, U.S. Foreign Aid to Israel, August 7, 2019.
- 31 Jacob Nagel, “The U.S.-Israel Military Partnership Should Remain Outside Presidential Politics,” *RealClearDefense*, November 12, 2019; Daniel B. Shapiro, “What Democrats Need to Learn from Obama about Aid to Israel,” *The Forward*, November 9, 2019.
- 32 Jacob Nagel and Jonathan Schanzer, “From Ben-Gurion to Netanyahu: The Evolution of Israel’s National Security Strategy,” Foundation for Defense of Democracies (FDD), Washington, DC, May 13, 2019, <https://www.fdd.org/analysis/2019/05/13/from-ben-gurion-to-netanyahu-the-evolution-of-israels-national-security-strategy/>.
- 33 Roni Bart, “Israel and American Aid: Continue Forward or Reverse Course,” *Strategic Assessment* 10, no. 1, June 2007.
- 34 Moshe Arens, “Israel Values U.S. Military Aid, But Does Well on Its Own Steam, Too,” *Haaretz*, August 22, 2016, <https://www.haaretz.com/opinion/.premium-israel-values-u-s-military-aid-but-does-well-on-its-own-steam-1.5427267>.
- 35 Moshe Arens, *ibid*.
- 36 This is in addition to the loss of defense industry jobs, the extent of which is disputed by the Ministry of Finance and the Ministry of Defense, with estimates ranging from a few thousand to tens of thousands. In view of the state of full employment in Israel’s economy, however, the significance of this loss is probably not especially great.
- 37 It is possible that canceling the aid will also indicate a decline in the other aspects of the “special relationship, and that aid should therefore be maintained, even if it is reduced. If the aid is maliciously misused, however, it is proposed that it be given up altogether, since this usage in itself shows that the “special relationship” has been greatly diminished.

The defense industries are one of the cornerstones of Israel's security. They were born of an understanding that Israel could not rely on external sources for procurement of needed materials and systems. Local production goes hand in hand with research and development in Israel, enabling the tailoring of unique weapons systems to the IDF's changing needs, giving it advantages on the battlefield.

The IDF is widely seen as the defense industries' central customer, and its use of the industries' products enhances their reputation when exporting their products to countries around the world.

The defense industries rely to a great extent on orders from the Ministry of Defense, which to date have been in large part funded by converting US\$815 million in American aid money into shekels for local development and procurement. According to the latest Memorandum of Understanding outlining the US military aid agreement, which covers 2019-2028, Israel's ability to convert the aid money for use with the local industries will be gradually decreased – especially from 2025, until it ceases entirely in 2028.

As a result, the Institute for National Security Studies set up a research team in the summer of 2018 on the topic of Israel's defense industries, with the participation of researchers from the INSS and guest experts from relevant fields. The team discussed the strategic role of Israel's defense industries today, the US military aid, the possible implications for the Israeli defense industries of ending the conversion to shekels, and ways to cope with this process. This memorandum is the product of the comprehensive work of the research team.