



# Embracing the Organized Mess

## Defense AI in Israel

Inbar Dolinko and Liran Antebi

DAIO Study 23|15

Ein Projekt im Rahmen von

 **dtec.bw**  
Zentrum für Digitalisierungs- und  
Technologieforschung der Bundeswehr



### **About the Defense AI Observatory**

The Defense AI Observatory (DAIO) at the Helmut Schmidt University in Hamburg monitors and analyzes the use of artificial intelligence by armed forces. DAIO comprises three interrelated work streams:

- Culture, concept development, and organizational transformation in the context of military innovation
- Current and future conflict pictures, conflict dynamics, and operational experience, especially related to the use of emerging technologies
- Defense industrial dynamics with a particular focus on the impact of emerging technologies on the nature and character of techno-industrial ecosystems

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## About the Authors

Inbar Dolinko is a researcher and consultant specializing in the intricate intersections of AI with defense, regulation, and ethics. Holding an M.A. in political science from Tel Aviv University, she graduated Cum Laude. Her thesis delved into examining the attitudes of AI practitioners regarding public regulation of AI, demonstrating her dedication to understanding the field's complex dynamics. Over the past six years, Inbar has worked in various capacities, including think tanks, private companies, and the Israeli Ministry of Defense. Her expertise spans multiple technological domains, including AI, cyber, and space technologies. She has contributed to the establishment of new initiatives and provided policy recommendations to decision-makers, led projects, and worked closely with top companies and academic institutions. Additionally, she has served as a teaching assistant at Tel Aviv University. During her time at the Institute for National Security Studies (INSS), Inbar served as the Program Coordinator of the AI and National Security Program. In this role, she effectively oversaw the research steering committee, organized impactful events, and contributed to published research.

Dr. Liran Antebi is the director of the Advanced Technologies and National Security Program at the Institute of National Security Studies (INSS). She is an expert in AI policy and has been leading groundbreaking research on the intersection of AI and policy for over a decade. With extensive experience in advising organizations, including the Israeli Ministry of Defense, Dr. Antebi contributes to the responsible development and implementation of AI. In addition, she has taught at several leading universities in Israel, including Tel-Aviv University and Ben-Gurion University. As a former member of iPRAW, she advocates for global AI regulations balancing innovation and security. Her publications on AI and national security explore topics like AI's impact on current and future battlefield, AI and national security in Israel, and the challenges of deepfakes in national security. Dr. Antebi has a Ph.D. in Political Science. Her practical insights span technical, operational, business, legislative, and international aspects of AI.

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Defense AI Observatory | Chair of Political Theory | Helmut Schmidt University  
Holstenhofweg 85 | 22043 Hamburg | T +49 40 6541 2776  
www.defenseai.eu | contact@defenseai.eu | @Defense\_AIO

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# Content

1 Summary .....	6
2 Thinking About Defense AI .....	8
2.1 Definition of AI .....	9
2.2 The Role of AI in Israel .....	10
2.3 Defense Opportunities and Concerns .....	13
3 Developing Defense AI .....	15
3.1 Ecosystem Cooperation .....	16
3.2 IDF Contribution .....	17
3.3 Industry Contribution .....	18
4 Organizing Defense AI .....	19
5 Funding Defense AI .....	22
6 Fielding and Operating Defense AI .....	25
6.1 Logistics .....	26
6.2 Intelligence .....	26
6.3 Command and Control .....	28
6.4 AI in Fielded Air, Sea, and Land Systems .....	29
6.5 Cyber .....	31
6.6 Conclusion .....	31
7 Training for Defense AI .....	32
7.1 Training Human Capital .....	33
7.2 Training Models .....	34
8 Conclusion .....	36
Literature .....	38

# 1 Summary

Israel has emerged as a prominent player in the field of artificial intelligence (AI), particularly in the realm of defense and security. The role of this technology goes beyond its traditional defensive functions and extends to its impact on the Israeli economy and its reputation on the global stage. To utilize AI's full potential, Israel must face both common and distinct challenges.

Some unaddressed challenges have led to deterioration in Israeli leadership; most notably are the challenge of competing in a fiercely aggressive global race for dominance in the field of AI, without a proper national strategy or budget and central management to support it. In addition, Israel's relative smallness and limited resources available for AI can be considered additional limiting factors. Despite its shortcomings, the country is still among the most advanced in the field of defense AI, relying on the Israeli ecosystem's distinctive advantage, born out of structural and organizational aspects.

Mandatory and reserve services at the Israeli Defense Forces (IDF) nurture and facilitate a unique exchange of personnel and knowledge. Moreover, IDF units, such as Unit 8200 and LOTEM, the unit for Operational Technological Intensification, indirectly support the AI ecosystem by supplying skilled personnel to academia and industry. These processes create a trained and familiar talent pool and enable collaborative AI development in Israel, involving the Israel Ministry of Defense Directorate of Defense Research & Development (IMOD DDR&D), the defense industry, academia, and civil companies.

As of May 2023, there is no single Israeli body responsible for overseeing the field of defense AI. Nonetheless the Ministry of Defense (IMOD) and Israel Innovation Authority are shaping it by launching several key initiatives aimed at improving the necessary infrastructure and enabling further advancement in defense AI. For example, the Israel Innovation Authority, IMOD DDR&D, and the Ministry of Innovation, Science and Technology have together set up the National Natural Language Processing Plan. This initiative specifically focuses on tackling the unique challenges posed by Semitic languages like Hebrew and Arabic in the context of developing Natural Language Processing (NLP) models. In addition, bottom-up initiatives and organizational changes are being made to support defense and security-related AI applications in Israel. For instance, in 2023, a new directorate was established at IMOD DDR&D focusing on innovative technologies, including AI. The IDF is also creating new units and roles that leverage AI's immediate operational value in combat contexts and everyday needs.

Israel's investment in AI for defense and security purposes is challenging to quantify due to the lack of transparency regarding its defense budget. However, the significance of investing in AI has been recognized, resulting in the allocation of NIS550 million (around €140 million) to several critical projects.

Throughout the years Israel's leading position in defense AI has emerged from the ongoing security challenges it faces, requiring the Israeli security and defense establishment, defense industry of Israel, and academia to stay alert and continuously evolve, and as a result contributing to its rapid advancement. Israel's implementation of AI extends beyond its traditional areas of expertise, such as unmanned military systems, air defense, and cyber warfare. Its prowess in AI for intelligence is evident in its diverse range of applications, which have contributed significantly to its military successes in recent operations, for example, against Hamas in Gaza.

Despite notable progress and achievements, Israel's approach to defense AI is the result of an "organized mess," triggered by Israel's informal culture, the country's tendency to let market forces push technology forward, a demanding security environment, and the need to be able to respond to new threats in a quick and flexible manner. This approach has yielded benefits in the past and enabled Israel to become a prominent player in various technology fields. However, as the international competition for defense AI (and AI in general) grows, Israel should adopt a more robust approach to extend its leading role. In so doing, overcoming the "organized mess" with the help of a more institutionalized set up and the definition of a comprehensive national plan, oversight and budget would be important steps into the right direction.

# 2 Thinking About Defense AI



## 2.1 Definition of AI

As in many other countries and organizations around the world, Israel has struggled to formulate one encompassing definition for AI. Furthermore, the country tends to let market forces push technology forward, which means formal definitions sometimes follow practice. Nevertheless, a few definitions have been suggested by Israeli governmental agencies, due to the increasing role of AI in all areas of life and defense specifically.

One definition can be found in the recommendations of the TELEM forum (National Infrastructure for Research and Development) for a national AI strategy:

A machine or system that performs tasks that usually require human thinking, such as understanding natural language, learning behaviors or problem solving. There is a wide range of such behaviors, but most involve computers running algorithms, which are often based on data.<sup>1</sup>

Furthermore, the definition recognizes the acceleration of the field due to “technological, algorithmic and computational advancements, and due to the availability of big data.”<sup>2</sup> Another definition can be found in a recent publication by the Ministry of Innovation, Science and Technology – a draft detailing principles, regulations, and ethics for AI. The writers distinguish between two types of common definitions for AI: technical ones, which focus on AI’s capabilities and the methods to achieve those, and practical ones, which compare AI’s abilities to those of humans. The ministry offers the following definition for the purpose of the publication:

The field of AI is a general name for development in the field of information and communication technologies and data science that enables decision-making, making predictions, or performing actions by a computer at a high level of independence, in a way that simulates or is able to replace human intelligence.<sup>3</sup>

Both definitions are broad, touching briefly on technical aspects and emphasizing AI’s independence. AI is perceived as a versatile tool that can replace humans in a variety of tasks. The underlining approach allows for flexibility and does not require frequent updates depending on technological advancement. This is important due to the nature of AI as a dynamic emerging technology that effects all dimensions of warfare.

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1 Committee for the Advancement of AI and Data Science, p. 16

2 Committee for the Advancement of AI and Data Science.

3 “Principles of policy, regulation and ethics in the field of artificial intelligence – Draft for public reference.”

## 2.2 The Role of AI in Israel

Technology is holding critical importance to Israeli defense and security, ever since the days when Israel's first prime minister, David Ben-Gurion, shaped the foundations of the country's "Security Concept" (National security strategy). As a small state with few natural resources and many defense and security challenges, Israel has always focused on cultivating its technological edge to maintain its economic, international, and security status. With AI being a general-purpose technology that impacts every aspect of life, including defense, as well as enabling many opportunities, it appears to be an essential technology for Israel.<sup>4</sup>

The global "competition for superiority" that has been increasingly shaping all technology areas including AI also influences Israel. This competition impacts the global balance of power, countries' standing, and their ability to operate in the international arena. Israel is affected by this competition both in "hard" military aspects such as military force buildup, battlefield capabilities, and counterterrorism capabilities counterterrorism; As well as in "soft" aspects such as the export of civilian and military technologies that affect the economy, jobs in the economy, and the ability to employ soft power in the international arena.

As part of the "competition for superiority," AI has been recognized as a crucial technology for Israel's economy, not just in defense. Israel was an early leader in this field compared to many other countries, as reflected in its industry, defense, and academia. However, there was no proper national strategy or budgeting to support this, as will be discussed further in chapter 3. Israel's leadership in AI has diminished in the past few years due to various reasons. One reason is the challenge of competing in a fiercely aggressive global race for dominance in the field, without a proper national strategy or budget and central management to support it. In addition, Israel's relative smallness and limited resources available for AI can be considered additional limiting factors.

Nonetheless, Israel is ranked fifth on the 2023 Global AI Index, which is reflected in different benchmarks.<sup>5</sup> The number of start-ups active in the field of AI, for example, has risen in recent years. According to Start-Up Nation Central, as of March 2023, there are 2,039 Israeli companies focusing on AI as a core technology (out of 6,995 active start-ups registered in the database).<sup>6</sup> Additionally, many international companies have established R&D centers in Israel. Furthermore, in academia, the number of academic publications on AI has been on the rise over the last decade, based on OECD data.<sup>7</sup> In 2018, a study identified 273 Israeli researchers

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4 Antebi, Artificial Intelligence and National Security in Israel.

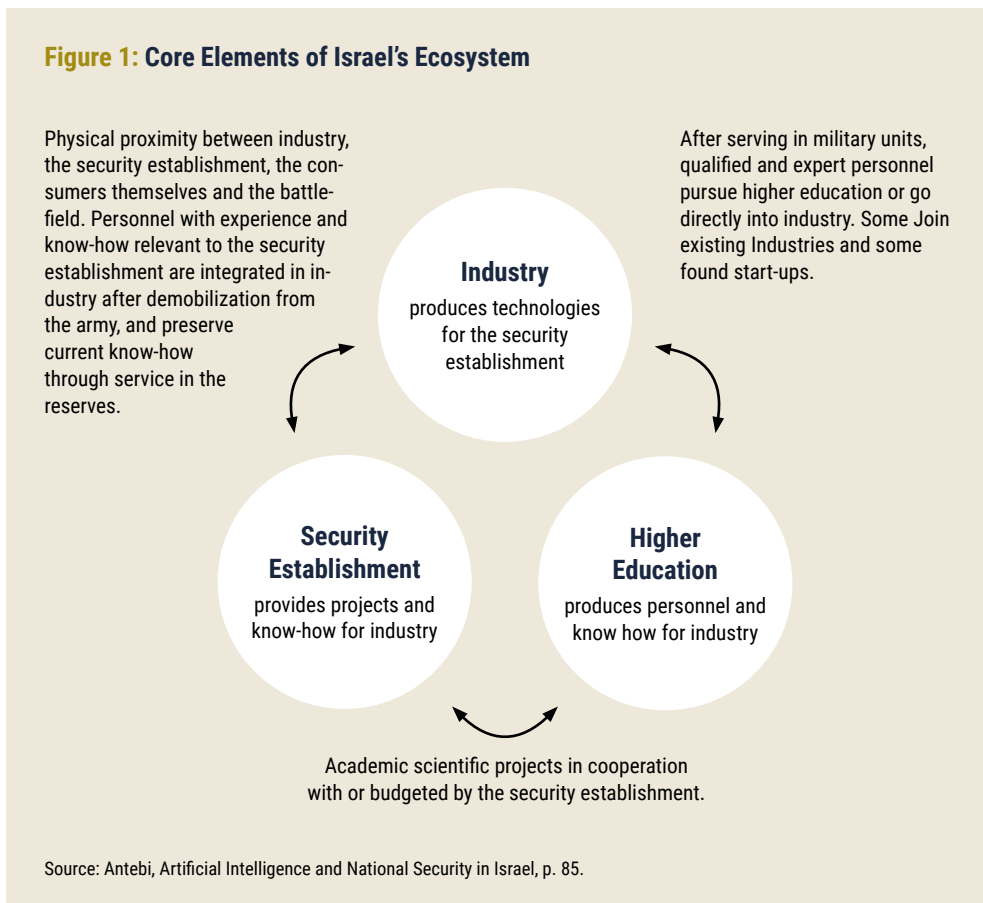
5 "The Global AI Index. 2023."

6 "Startups: AI companies."

7 "AI in Israel."

specializing in AI and its related fields such as natural language processing (NLP), computer vision, and big data, across various academic institutions.<sup>8</sup>

The vibrant business and research environment has helped establish a well-functioning ecosystem, in which the Israeli defense and security establishment works closely with local institutes and companies. The Israeli academia contributes to the development of AI research, while the leading industries and giant technological companies establish research centers and work alongside thousands of innovative startups. Moreover, the Israeli defense and security establishment has undergone impressive development, especially for military intelligence and operational activities. Several factors explain close public-private cooperation in Israeli ecosystems (Figure 1).<sup>9</sup>



<sup>8</sup> Artificial intelligence, data science and intelligent robotics: First report.

<sup>9</sup> Antebi, Artificial Intelligence and National Security in Israel.

- **Familiarity**  
Connections between academia, the civil–commercial industry, and the defense and security establishment emerge quickly at the organizational, social, and professional level. There is a great sense of familiarity, which fosters innovation and creativity.
- **Proximity**  
The short physical distance between a significant number of regional technology clusters and Israel’s government as well as defense and security centers facilitate strong cooperation.
- **Culture**  
As Israel faces many defense and security challenges, many professionals both in academia and industry, have a sense of “partnership of fate”, encouraging their collaboration with defense and security agencies, especially the IMOD and the IDF. Moreover, an open and entrepreneurial character of Israeli culture (in comparison to countries where it is more hierarchical and bureaucratic) help move ideas and gain achievements.
- **IDF Service Model**  
The IDF is composed of mandatory service personnel, professionals from the standing army, and military reserves. As a result of this interaction, knowledge is exchanged from different sources and at different stages of a professional career – in the industry, academia, or defense and security establishment. By working together, the three pillars can remain up to date on the advances in the field and leverage each other’s strengths. Furthermore, military experience of Israeli academics and industry professionals enhances their ability to contribute to civilian roles through familiarity with defense and security needs and system operations.

To sum up, Israel’s unique ecosystem has contributed to its impressive achievements in the field of AI and has helped position the country as one of the global leaders in this rapidly growing field, despite the erosion of its leadership.

## 2.3 Defense Opportunities and Concerns

Israel acknowledges the immense potential of utilizing defense AI, just as it has successfully done with cyber technologies and UAVs in the past. AI is viewed as a versatile and empowering technology that can greatly augment Israel's capabilities. It has the ability to revolutionize various aspects such as logistics and command and control systems, while also enhancing fields in which Israel has already established significant expertise. Leadership in AI has a profound impact on Israel's economy, international standing, and defense capabilities.

Despite the benefits and opportunities, challenges remain. Technological challenges and scarce human capital are two challenges that are of particular relevance for Israel:

- **Technical Challenges**

AI presents numerous technical challenges. Historically, the military has led technological development, and many of these innovations have later been adopted for civilian use. However, nowadays, the private sector has taken the lead in developing new technologies, with the military adapting them for their purposes. Adapting AI algorithms to the military context can be challenging due to differences in training data, environments, and standards. These differences can impact the algorithm's performance and safety and make it difficult to utilize commercially available AI in the defense sector.

One specific technical challenge stems from Semitic language and has direct consequence for using AI techniques like Natural Language Processing (NLP). NLP focuses on enabling computers to comprehend human languages and perform tasks such as speech recognition, natural-language understanding, and natural-language generation. In the past year, NLP has gained significant traction due to advancements like Chat-GPT and demonstrates impressive progress in English and Indo-European languages. However, the progress in Semitic languages, such as Hebrew and Arabic, is much slower. As these are Israel's two national languages and Semitic languages play an important role in its intelligence efforts, there is a need for advancement in this field. Therefore, the Israel Innovation Authority, IMOD DDR&D, and the Ministry of Innovation, Science and Technology have together set up the National NLP Plan.<sup>10</sup> The plan proposes multiple approaches to tackle the challenges in Semitic language NLP. This includes initiatives such as establishing language corpora, facilitating access to Hebrew and Arabic datasets; developing generic NLP

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<sup>10</sup> "The National Program for Natural Language Processing."

algorithms for Semitic languages; training a comprehensive language model rooted in Semitic linguistics. The aim is to enhance accessibility and adaptability of these capabilities using open-source infrastructure when possible, catering to diverse applications.

- **Human Capital**

Due to its small size and limited resources, Israel faces challenges in competing with global AI leaders like the US and China in terms of funding and talent pool. The country's smaller GDP means it cannot allocate the same level of funding to national AI efforts. Recruiting and retaining skilled personnel capable of developing, adapting, and implementing AI systems for military and national security purposes is challenging due to intense competition from the private sector, which provides more favorable employment conditions. While Israel's economy benefits from a flourishing private sector, competition on human capital challenges the ability of the Israel defense and security establishment to retain skilled professionals. Additionally, confidentiality and compartmentalization requirements limit the ability of personnel to move between defense organizations. Therefore, it becomes difficult to establish a career path that will encourage qualified individuals to stay in government service.

Additional concerns complement these two key challenges. These include, among other aspects, the requirement for explainable AI, ethical considerations regarding AI, bias and fake news in the defense environment, and the impact of AI on the pace of war and operations.<sup>11</sup> The IDF and IMOD have not publicly disclosed their position on these matters. The only public document on AI ethics in Israel, published by the Ministry of Innovation, Science, and Technology, suggests that Israel aims to align its ethical standards with those established by other prominent nations, rather than taking a leading role in this domain.

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<sup>11</sup> For more information about these challenges: Antebi, *Artificial Intelligence and National Security in Israel*.

# 3 Developing Defense AI

The research and development of AI in Israel is the result of a collaborative effort among the IMOD DDR&D, the defense industries, and academia as well as startup companies, as elaborated in the preceding chapter. Below we discuss several defense AI R&D projects that exemplify how the relevant stakeholders contribute at different levels of the national ecosystem.

Despite delivering successful defense AI applications, the lack of national funding and appropriate institutional provisions to plan and execute defense AI projects is a serious shortfall (see also Chapter 5). This shortfall constitutes one of the biggest hurdles Israel will need to address in the future.

## 3.1 Ecosystem Cooperation

Two particular examples illustrate how ecosystem partners cooperate to provide and advance defense AI capacities in Israel:

- **MAFAT Challenge**

This challenge<sup>12</sup> organized by DDR&D includes a series of prize competitions in the field of data science that are open to the public, academia, and industry. It aims at exploring “the potential of advanced data science methods to improve and enhance IMOD current data products. The winning method may eventually be applied to real data and the winners may be invited to further collaborate with IMOD on future projects.”<sup>13</sup> As of April 2023, one challenge is ongoing, three challenges were completed, and another three are planned.<sup>14</sup>

- **Projects Stargate and Startrack**

Out of ten planned projects these two focus on developing and using AI tools for intelligence. They include participants from Israeli startups, the Israeli defense industry, and academics. They are joined by soldiers from the Israeli Military Intelligence Directorate, the Israeli Computer and IT Directorate, the Israeli Ground Forces, the Israeli Air Force, and soldiers from Project “See Far,” that enable young people on the autistic spectrum to join the IDF. This collaboration allows the quick development of AI tools tailored specifically to the IDF’s needs.<sup>15</sup>

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12 A challenge is a common high-tech industry practice, allowing companies to quickly find solutions to problems, identify qualified human capital, and sometimes support certain communities and social goals.

13 “MAFAT challenge.”

14 Ibid.

15 Cohen, “No longer satisfied with 8200: this is how the army develops artificial intelligence in cooperation with high-tech companies.”



## 3.2 IDF Contribution

Inside the IDF, specialized units work on defense AI research and development. These include Unit 8200 and Unit 81 in the Israeli Military Intelligence Directorate and LOTEM, the unit for Operational Technological Intensification in the Israeli Computer and IT Directorate. Tools are developed to serve the needs of these units, as well as other users within the IDF. The newly established Information and Artificial Intelligence Division in the Computer and IT Directorate utilizes the large amount of data in the IDF to conduct meaningful operational projects that benefit other departments. One such project is a system that warns soldiers in the Western Negev of threats from anti-tank missiles from the Gaza Strip. Another project uses algorithms that recognize suspicious patterns in the field and prioritize videos for human observers in Division 210 on the Israel-Syria border.<sup>16</sup>

Furthermore, some new units and roles are being established to accommodate needs arising from the use of big data in defense. The Analytics Lab of Shazar Unit – a cooperation between the Computer and IT Directorate and the Personnel Directorate – is a notable example of this process. In the lab, the first of its kind, data analysts and researchers use AI and machine learning models to recognize patterns and predict needs of the IDF's manpower. The analysts and researchers are soldiers with a relevant background who undergo special training. Three notable research projects include predicting the likelihood of soldiers extending their service, identifying potential outstanding commanders early on, and creating personalized training programs for combatants to prevent injuries.<sup>17</sup>

In addition, each year, hundreds of experienced soldiers enter the technological ecosystem at existing companies or as founders of new AI startups. This process reinforces the capabilities and capacities of the Israeli tech industry as a whole.<sup>18</sup> A notable example is Unit 81 as one hundred graduates of this unit have established about fifty companies from between 2003 and 2010. Some of them, such as Innoviz and D-Fend, offer solutions used for defense.<sup>19</sup> The startup Exodigo was also founded by Unit 81 graduates, who won the Israel Security Award during their service. This startup developed a system combining a drone, ground sensors and AI to map in 3D what is happening underground.<sup>20</sup>

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16 Bohbot, "A game-breaking weapon: the technology that will decide the IDF's next campaign."

17 Greenberg-Cohen, "Based on data: the IDF laboratory that determines who is suitable to sign permanently."

18 Lt. Col. G., Major G., and Major L., "On Network Intelligence and Artificial Intelligence: The Artificial Intelligence Transformation of the Information Processing and Analysis Center in 8200."

19 Shulman, "An army of startups."

20 Alxalsi, "A year ago they were released from 81 and now they are exposed with one of the largest Seed Round in Israel."

### 3.3 Industry Contribution

Several prominent projects were developed by the Israeli Defense companies. One example is CARMEL, the future Ground Combat Vehicle (GCV) of the IDF, which is being developed by ELTA systems.<sup>21</sup> The CARMEL program will improve the GCV's AI, autonomous, and automatic capabilities for future combat scenarios, urban maneuvering, and operating with only two soldiers.<sup>22</sup> Another example is SOI ("Standoff In"), a secret project in development by the IAI. This program uses uncrewed air and ground vehicles that are controlled from a safe distance to protect Israeli soldiers during combat. Both of these projects will be further discussed in chapter 6.

Most Israeli defense industry projects cater to Israel's own needs, but occasionally systems emerging from national projects are sold to other countries. For instance, Elbit's Seagull system, an unmanned surface vessel, has been sold to a state in East Asia. It is believed that the system incorporates AI capabilities to facilitate its operation. This suggests that defense industries generate revenue and contribute to AI development through international collaborations. However, information on budgeted collaborations between Israel and the USA in defense AI remains scarce, indicating a high level of secrecy in the field.<sup>23</sup>

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21 A subsidiary of Israel Aerospace Industries (IAI).

22 "Surprise: IAI won the Ministry of Defense tender for the development of the "light tank" technology."

23 Frantzman, "Israel's Elbit sends Seagull USV to Digital Horizon event in Bahrain."

# 4 Organizing Defense AI

Right now, Israel has no single body to guide the development and use of AI in general and for specific defense and military purposes. However, several significant organizations are involved in leading and funding the field, including the IMOD and Israel Innovation Authority, which is affiliated with the Ministry of Innovation, Science and Technology.

Over the past few years, several committees have been established to address the organization of the AI field in Israel. These committees have recognized the importance of AI in defense and security matters. However, due to political instability, the matter has not been fully prioritized or budgeted.

Consequently, a new program has been established which focuses on national infrastructure related to AI. The program operates through the Ministry of Innovation, Science and Technology, though it may encounter difficulties in asserting authority over other government ministries. Despite this, IMOD DDR&D maintains strong relationships with academic institutions and the defense industries in R&D. At the same time diverse AI initiatives led by academia, industry, and the military continue to emerge.

These new AI initiatives are primarily focused on enhancing the country's defense capabilities through the development of advanced technologies, including autonomous systems, cybersecurity, and intelligence gathering and processing. The IDF, in collaboration with IMOD, leads most of these programs, which are designed to serve all branches of the IDF, including the Israeli Ground Forces, Navy, and Air Force. However, some specific projects are developed and managed independently inside the forces themselves.

Over the past several years, the widespread use of AI has led to a growing recognition among high-ranking officials in the IDF and the IMOD that data is a critical asset, much like traditional weapons. This shift in mindset has significant implications for how the military operates in regards to data. Given the abundance of advanced technology available, there are significant opportunities to fully leverage its potential. Therefore, the IDF and IMOD must adopt proactive strategies to harness these opportunities.<sup>24</sup>

Consequently, the IDF is undertaking significant efforts to promote connectivity and knowledge sharing among its various units. These projects are designed to facilitate collaboration, enhance communication, and streamline the exchange of information, ultimately improving the effectiveness and efficiency of the IDF's operations.<sup>25</sup>

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24 "Artificial Intelligence is a Weapon for Everything: The IDF's Plans for the New Battlefield."

25 Tzafarir, "The cloud significantly helps to increase the operational effectiveness of the IDF."

Israel's focus on digital transformation has led to the announcement of Project Nimbus, aimed at establishing national cloud centers. The IDF is a key participant in this project, and Amazon AWS and Google Cloud have won the bid to set up and operate the project. It is a state tender at an investment of roughly NIS4 billion (around €1 billion).<sup>26</sup> This initiative reflects a commitment to enhancing the country's technological capabilities and promoting innovation in the public sector, including within the IDF.<sup>27</sup>

In addition, the IDF's technology units also adopt a civilian tech sector mindset and approach. This involves building a collaborative environment where researchers from diverse backgrounds cooperate towards achieving a common goal. This fosters an environment that functions more like an incubator, putting a premium on continuous improvement and constant development to deliver "products" rather than "projects." This approach propels R&D to a new level needed to successfully compete in the ever-evolving technological landscape.<sup>28</sup>

Furthermore, the IMOD is also implementing significant organizational changes to retain its leadership role on defense AI. In February 2023, MG (ret.) Eyal Zamir, the new director general of the IMOD announced the establishment of a dedicated administration within IMOD DDR&D to focus specifically on the development of future technologies. The aim of this initiative is to position Israel as the "world's leader in futuristic technologies." The new administration will oversee the development of AI technologies in Israel and provide the necessary management to ensure their progress and contribution to the country's advancement.<sup>29</sup>

In line with this effort, MG (ret.) Zamir also recently addressed the 2023 Herzliya Conference to unveil a new multi-year plan, a strategic initiative aimed at enhancing Israel's military capabilities. Highlighting the significance of AI, Zamir emphasized its potential to revolutionize Israel's intelligence and targeting systems. He argued that by harnessing AI technologies, including group and swarm operations and independent combat systems, Israel aims to gain a significant advantage on the battlefield. In conjunction with this plan, the Defense Ministry will establish a dedicated organization focused on AI and robotics, operating under the DDR&D. Zamir also announced a substantial increase in the defense R&D budget, with investments directed towards secure production lines, ensuring independence from potentially hostile powers. Despite his clear statements and broad references to artificial intelligence and his intention to invest funds and administrative resources in it, no specific numbers regarding the investment size were revealed.<sup>30</sup>

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26 Ziv, "Israel Picks Google, Amazon for Massive Official Cloud; "Data Will Remain Here."

27 Berkowitz/Levy-Weinreeve, "Now it's official: the state chose Amazon and Google in the Nimbus cloud tender."

28 Bohbot, "Sneak peek: The IDF's Unit 3060 is leading a revolution in intelligence information."

29 Azoulai, "The Ministry of Defense is planning: the establishment of an administration for the development of future technologies."

30 Berman, "Defense Ministry to invest heavily in AI in bid to improve intel on Iran."

# 5 Funding Defense AI

Neither the amount of funding dedicated to developing and using AI for defense and security purposes in Israel, nor the national budget allocated to defense organizations such as the Mossad and the Shin Bet are made public. The budget articles of the IMOD and the IDF are classified and not available to all members of the Knesset, the Israeli parliament.<sup>31</sup> Therefore, unlike other nations, Israel does not have one comprehensive document that would lay out the country's defense AI investments. However, some information can be gleaned from recent attempts to formulate a national AI strategy. Those point to the fact that while the funding of defense AI is still decentralized and lacks national oversight, its importance is not lost on decision makers and progress is slowly made.

Over the last five years, two national committees have been formed to address the need for a national AI strategy. Each of them identified areas in need of budgets and resources. In 2018, a government committee chaired by Professor Isaac Ben Israel and Professor Eviatar Matania was established. Its goal was to formulate a plan that would position Israel as a leading force in AI worldwide. Over 300 experts and 15 different sub-committees made up the committee, which examined the impact of AI on all aspects of life in Israel. Among its recommendations, the committee called for an annual investment of NIS1-2 billion (around €250-500 million) per year for five years.

Given that Professor Ben Israel is regarded as one of the key figures behind the strategy that transformed Israel into a formidable cyber power, the findings of the committee were awaited with anticipation. But the proposals put forth by the committee were not officially endorsed, primarily due to the political uncertainty that prevailed during its tenure. Israel held a total of five national elections between April 2019 and November 2022.<sup>32</sup> For three years no state budget was approved, and no resources could be allocated to finance the committee's vast recommendations.<sup>33</sup>

The visible deterioration of Israel's leading position in the international AI competition, exemplified by its declining rankings in the global AI index,<sup>34</sup> has been linked to the inadequate allocation of government resources and the lack of a comprehensive national strategy. As a result, it seems imperative to deal with these issues promptly, even outside of direct government involvement.

This understanding has led the TELEM forum to establish an independent committee in December 2019 chaired by Dr. Orna Berry. TELEM included representatives from the Israel Innovation Authority; Council for Higher Education; IMOD DDR&D;

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31 Schwartz/Harosh, "The process of approving the defense budget and its supervision in Israel and other countries."

32 "About the elections for the 25th Knesset."

33 Zarchia, "For the first time after three years: the government approved the state budget; The decision will go to the Knesset."

34 "Global AI Index. 2023."

Ministry of Innovation, Science and Technology; and Ministry of Finance. The committee examined where Israeli industry stands in the field of AI, what barriers can be removed, and how the government can contribute to the field's development. The recommendations were submitted a year later. TELEM's narrow plan requested a budget of a billion NIS for five years.<sup>35</sup> TELEM's recommendation was to start by investing NIS550 million (around €140 million) into urgent projects, which include infrastructure building, personnel training, and prioritizing R&D projects with significant national importance.<sup>36</sup> When eventually a state budget was approved during November 2021, resources were allocated to the program and the rest of the budget should be approved in the current government budget.<sup>37</sup>

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35 Ziv, "Where is the field of artificial intelligence progressing in Israel? A second government committee will review;" Committee for the Advancement of AI and Data Science.

36 Orbach, "There is a national program for artificial intelligence, but there is no budget."

37 Halperin, "Will the national artificial intelligence program be delayed because of the elections?"



# 6 Fielding and Operating Defense AI

Israel is recognized as a leader in the development and implementation of AI in military operations. The country has developed various AI-powered systems that help with early warning of potential attacks, planning and executing military operations, and situational assessment. Israel's expertise in AI also extends to other defense-related areas as we discuss below.

## 6.1 Logistics

At 2021, IDF started to establish three logistics centers in Israel, costing NIS5.5 billion (around €1.4 billion). The centers will be constructed and managed by an external civil contractor over a period of 20 years, as the IDF aims to implement a significant transformation in the logistics field. The primary objectives of this initiative are to achieve substantial personnel savings and enhance equipment and inventory optimization. The project leaders assert that the plan will incorporate cutting-edge technologies, including some specifically designed for this project, which are currently unavailable. The project comprises automated warehouses and robots to carry out picking operations, all of which are powered by AI technologies.<sup>38</sup> In addition, there are several further projects within the IDF that relate to the management of munitions and other operational warehouses, which make use of AI while connecting to systems that assist in the planning and management of operations.<sup>39</sup>

## 6.2 Intelligence

Intelligence is one of the prominent fields in which AI is being used in Israel's defense. In recent years, Israel has been utilizing AI to collect and analyze vast amounts of data, making the intelligence-gathering process more efficient and effective. This has allowed the country to stay ahead of potential threats and protect its citizens.

### General Intelligence

The Israeli defense and security establishment has been utilizing AI to enhance its intelligence-gathering and processing capabilities. One notable example is the facial recognition technology developed by AnyVision, which is being used in two primary applications. The first is for checkpoints where Palestinians pass

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<sup>38</sup> Binstock, "Amazon, behind you: The IDF replaces the Warehouses with artificial intelligence."

<sup>39</sup> Heller, "Changes the rules of the game: A first look at the IDF's artificial intelligence."

on their way to work inside Israel. The system enables quick identification of visa holders and shortens queues, facilitating movement and reducing waiting times. The second application is a more secretive project based on a network of cameras spread throughout the area. The system is used to track and identify potential threats, even outside the checkpoints. The use of AnyVision's technology in the Israeli-Palestinian conflict has been controversial, but it has also been praised for its potential to enhance security.<sup>40</sup>

In addition to facial recognition technology, Israeli defense and security establishments are also utilizing AI capabilities to analyze encrypted content, track suspicious parties, and handle vast amounts of information in the cyber dimension. The IDF, the Shin Bet, and the Mossad have each developed their own set of technologies for gathering, processing, and analyzing different types of data such as voice, image, and text. These advanced technologies allow Israel defense and security establishment to monitor potential threats more effectively and respond quickly to any suspicious activity. With the ongoing development of AI technologies and the increasing use of big data, Israel defense and security establishment is likely to continue expanding its use of AI in intelligence operations:

- The Shin Bet, for example, established in recent years an accelerator for companies that develop technologies for its use, including, among others, a company in the field of Speech Recognition by AI.<sup>41</sup>
- The Mossad has created Libertad, a fund for technological innovation that invests in breakthrough technologies. The fund has expressed a specific interest in AI and NLP technologies.<sup>42</sup> The Mossad has also been reported to use AI for a range of purposes. The agency's use of AI is largely classified, but it is known that they work with Israeli startups and academic institutions to develop and integrate advanced technologies into their operations.<sup>43</sup>

## Intelligence for Operations

AI has improved real-time targeting, reduced collateral damage, and increased efficiency. The IDF uses AI for intelligence analysis and distribution, for example, with a trio of applications. "The Alchemist" provides real-time visual detection of targets, while "The Gospel" generates target recommendations based on AI capabilities. Another albeit classified project is "The Depth of Wisdom."

These programs helped enhance the efficiency and accuracy of intelligence analysis and distribution, thereby contributing to the IDF's overall operational effec-

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40 Solon, "Why did Microsoft fund an Israeli firm that surveils West Bank Palestinians."

41 Pick, "Israel's Shin Bet, Tel Aviv University Announce Third Accelerator Cohort."

42 Orbach, "Mossad's Venture Arm to Diversify Portfolio."

43 Devori, "The Mossad is stepping into a more technological future."

tiveness.<sup>44</sup> During Operation Guardian of the Walls, the Israeli Air Force attacked 50% of the 200 high-quality targets that the IDF produced in twelve days. A huge improvement, because prior to this operation it took the IDF almost one year to produce such number of high-quality targets.

Overall, improved accuracy also reduced the number of enemy multi-barreled rocket launchers and halved the number Kornet launchers, both count as a problematic threat by the IDF.<sup>45</sup> Unit 8200 developed the AI programs, while Unit 9900 used AI technologies for visual intelligence analysis, creating “dual maps” for accurate fire plans and executing the “Lightning Strike” operational program. AI also helped detect “ground violations” for hidden rockets, building tunnels, and bunkers, producing additional targets for attack.

## 6.3 Command and Control

The IDF has developed several AI-powered systems, such as the one created by the Israeli Computer and IT Directorate, which provides early warning of potential attacks and helps plan the IDF’s attacks while coordinating all different military units. Additionally, there are systems that can prioritize hundreds and thousands of targets, examining armaments and officials who can act against them, which would be time-consuming or even impossible for humans to do. These systems combine information from various sources, including tanks, surveillance cameras, airplanes, UAVs, and ships, to provide a comprehensive situational assessment to the Commanders. This allows them to quickly understand the situation and make decisions. The system’s data and insights are also available to attack units and even to the Chief of the General Staff, who is Israel’s Commander-in-Chief, if necessary.<sup>46</sup>

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44 Antebi, “Has Artificial Intelligence Triumphed over Terrorism?”

45 Bohbot, “The destruction of the metro and the thwarting of launches: the technological means that the IDF first operated in Gaza. Kornet is considered one of the most advanced anti-tank missiles in the world.

46 Heller, “Changes the rules of the game”: A first look at the IDF’s artificial intelligence.”

## 6.4 AI in Fielded Air, Sea, and Land Systems

### Unmanned Systems

Israel is a prominent provider of unmanned systems across all domains and plays a leading role in developing, producing, operating, and exporting unmanned systems that utilize AI. These systems are designed to perform with different levels of autonomy. AI allows these systems to operate independently, reducing human intervention. Israel has used the respective expertise in particular to develop unmanned air power with UAVs for intelligence, reconnaissance, and surveillance (ISR) as well as strike missions. Israel also holds the top position in loitering weapons.

In the land domain, project SOI (“Standoff In”) provides a glimpse into the future, although this development project, for which IMOD contracted IAI, is top secret. This program aims to reduce risk to Israeli soldiers in direct combat with enemy forces by using an armed vanguard of uncrewed air and ground vehicles controlled by human soldiers from a safe distance. The SOI program builds on prior Israeli programs, including Rafael’s SmartTrigger system, which automates the process between identifying a target and assigning it to a weapon. The first SOI capabilities are scheduled to become operational within three years, but experts question the ability of unmanned systems to effectively operate in densely populated areas.<sup>47</sup>

At sea, the Seagull USV discussed in chapter 4, highlights the combination of unmanned technology with AI for underwater and surface warfare, including anti-submarine warfare, electronic warfare, and mine detection, and has participated in the Digital Horizon exercise led by the U.S. Navy.<sup>48</sup>

### AI-Enabled Military Manned System

The IDF is utilizing AI technology in its advanced military systems such as the F-35 fighter jet and the future Ground Combat Vehicle (GCV) named CARMEL. ADIR, the Israeli version of the American F-35 fighter jet, incorporates advanced AI systems to enhance its combat capabilities. The IDF’s F-35 aircraft have been operational since December 2017 and have already played a significant role in intercepting two Iranian drones and participating in various operational missions.<sup>49</sup>

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47 “Israel Plans to Field Advanced Autonomous Combat Unit By 2025.”

48 Frantzman, “Israel’s Elbit sends Seagull USV to Digital Horizon event in Bahrain.”

49 “Three new F-35 fighter jets land in Israel;” Tor-Paz, “For the first time in the world: ‘Israeli ‘Adir’ (F-35i) planes intercepted Iranian drones.”

CARMEL is being developed by ELTA. The program aims to improve the AI, autonomous, and automatic capabilities of the GCV to handle present and future combat situations, maneuver in urban environments, and operate with only two soldiers. Right now, similar systems operate with a crew of eleven fighters. Reducing the number to two suggests a significant reduction of human risk on the battlefield while maintaining combat power.<sup>50</sup>

The GCV is equipped with a comprehensive set of situational awareness, force protection sensors, target acquisition, weapon stations, electronic counter measures (ECM), as well as autonomous navigation and maneuvering features. Although the GCV has not yet been deployed for operational use, it is considered a vital element in bolstering the IDF's military capabilities and is being evaluated for its potential use in future conflicts.<sup>51</sup>

## Air Defense Systems

Israel's air defense systems rely on AI features to enhance their capability to advance protection against various air threats. In use since 2011, the Iron Dome systems is a crucial element of Israel's air defense umbrella, designed to intercept short-range rockets, mortar shells, and UAVs.<sup>52</sup> This portable active air defense system has undergone upgrades, making it more effective in addressing multiple rocket barrages in a short period. Additionally, the Drone Dome system disables drones, while the new David's Sling system supplements Iron Dome using an interceptor missile that maneuvers quickly and directs itself using a radar and an electro-optical sensor.<sup>53</sup>

During the 2021 operation "Guardian of the Walls" involving Israel and Hamas, the Iron Dome system intercepted 1,660 rockets with a 90% success rate, despite firing heavy barrages of 100-150 rockets in the same area. This remarkable accomplishment is due to the high level of autonomy combined with AI and full integration into Israel's air defense systems.<sup>54</sup>

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50 "Surprise: IAI won the Ministry of Defense tender for the development of the 'light tank' technology.

51 "'Carmel' Revealed: What Will the IDF's Vehicle of the Future Look Like?"

52 Uzi. "Israel's Air Defense in Test During Operation Guardian of the Walls."

53 Formerly known as 'Magic Wand'.

54 Levin/Bustan, "The stick and the laser: the IDF's impressive technological capabilities will not suffice in the next round."

## 6.5 Cyber

Israel is a global leader in the cybersecurity industry, with over 450 cybersecurity companies (as of September 2021), many of them using AI and machine learning technologies to provide advanced threat detection and response capabilities.<sup>55</sup> Israeli companies such as Cybereason and Cynet use AI to identify and respond to cyber-attacks in real-time.<sup>56</sup> Other leading companies like ActiveFence detects and protects against disinformation, terror, and other malicious content and activities online.<sup>57</sup>

The Israeli government has also recognized the importance of AI in cybersecurity. In 2018 it has launched the National Cybersecurity Agency and has made significant investments in developing the country's capabilities in this area.<sup>58</sup> The IDF is also a leading developer and user of AI for cybersecurity purposes, with several units dedicated to this task, including Unit 8200 and the Israeli Computer and IT Directorate. The IDF has established a dedicated research center, the Artificial Intelligence and Big Data Research Center, to develop cutting-edge AI algorithms for threat detection and response. Israel's commitment to staying at the forefront of technological innovation in defense and security underscores its position as a global leader in the field of AI-powered cybersecurity.<sup>59</sup>

## 6.6 Conclusion

Israel has been integrating AI not only in traditional fields – such as unmanned military systems or cybersecurity – but also in other areas like logistics and intelligence. Although some major AI projects like the SOI and CARMEL are still under development, operational applications of AI in unmanned ground and naval systems are not yet widespread. This is similar to the situation in other leading countries. At the same time, Israel's leadership in the field of intelligence is evident, with a wide range of capabilities and applications. These capabilities have contributed to significant military achievements in recent operations against Hamas in Gaza. It is likely that Israel possesses even more advanced capabilities that it has not yet revealed.

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55 The Israeli Cybersecurity Sector.

56 For further information, see: <https://www.cybereason.com/>; <https://www.cynet.com/> (last accessed 30 May 2023).

57 For further information, see: <https://www.activefence.com/about/> (last accessed 30 May 2023):

58 "About Israel National Cyber Directorate."

59 "Deputy Commander of Elite Intelligence Unit 8200 Reveals Its Secret Weapon."

# 7 Training for Defense AI



## 7.1 Training Human Capital

As part of the mandatory service customary in Israel, high school graduates are recruited for a service that ranges from 24 to 32 months. An appropriate training program is needed to allow the IDF to reap the benefits of their service before their release, especially when it comes to technological roles that require complex and expensive training.

Leading military technology units such as Unit 8200 of the Israeli Military Intelligence Directorate and the LOTEM unit in the Israeli Computer and IT Directorate recruit talented high school graduates in a series of exams prior to their enlistment. Training generally lasts two to six months and is sometimes incorporated into pre-military training programs. The young recruits learn computing and software skills, as well as professional tools used in civilian and defense environments.<sup>60</sup> Their demanding role requires them to constantly improve their skills and to be able to cope with complex issues in a quick and efficient manner.

The IDF school for computer and cyber professions is the main unit to train soldiers for various technological roles: developers, DevOps, data analysts, cybersecurity, and many others. The courses combine theoretical studies with practical exercises, encouraging trainees to study independently and find the method that suits them.<sup>61</sup> The school incorporates concepts from the civilian tech industry and offers personalized learning areas as well as meetups and hackathons in collaboration with academia and civilian industries.<sup>62</sup>

The growing role of AI in all areas of life led to the need for additional training to all military personnel, especially commanding officers. A new program – a collaboration between the Shiloh Brigade (Combat Methods and Innovation) with the Maltak (Tactical Command College) and Microsoft – aims to answer this need. This program has two parts: The first is available to any soldier through their phone or computer and offers soldiers lectures and material on AI, the means to integrate it to governmental organizations and how to create a culture and strategy for AI.<sup>63</sup> The second is under higher classification and is open to Majors and above in the IDF internal system. This part discusses AI in operational contexts, considers its potential and reflects upon use-cases relevant to the IDF.<sup>64</sup>

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60 "Get to know LOTEM unit."

61 "The School of Computer and Cyber Professions."

62 Tal, "The base of the computer science school has moved to the south – get a special look inside."

63 Information about the course along with the syllabus are available in Hebrew on the website: <https://cloudsociety.microsoft.com/he/aiforidf> (last accessed 30 May 2023).

64 Revivo, "Meet the new IDF artificial intelligence course."

## 7.2 Training Models

Another important aspect is the training of AI models. AI is an ever-improving technology, requiring an iterative process of learning and adjusting. In this context data plays an important role, as it enables training the algorithms and preparing them for autonomous action. A lack of data challenges the ability to improve and use AI. This issue is relevant both to civilian companies in the private sector, and even more so to the defense sector where data is scarce and costly. There are several challenges regarding data in the defense sector:

- **Secrecy and Compartmentalization**

As the defense agencies are traditionally not connected to external networks and cloud technology, they are unable to use the data centers of other entities, sometimes even within the same organization. Due to national security and safety concerns the Israel defense and security establishment avoids sharing data, algorithms and even results due to fear of exposing data through reverse engineering. Therefore, these agencies are compelled to operate using only their own hardware capabilities and internal databases, with limited ability to collaborate.

- **Lack of Data**

In the intelligence and operational world insufficient data can impede the training of vital algorithms needed to solve problems. For instance, one image or a few images of strategic importance is not enough to train the algorithm properly to act on a specific subject or phenomenon.

- **Training for the previous War**

Israel's defense and security establishment primarily gather information in routine, but statistical changes in emergencies or combat need to be addressed. However, databases cannot fully represent future operational realities, so training data is based on past routine or emergency scenarios. This poses a challenge as it's like preparing for a war that has already happened, while the operational arena is constantly changing and unpredictable.

- **Technical Challenges**

In addition, there are technical challenges that may not be unique to the defense sector but present a meaningful hurdle for any data-oriented organization. The cost of storage and lack of space sometimes leads to the erasing of data. Moreover, the information collected over the years may not always be suitable for processing within the framework of AI, and it is necessary to "clean it" and rearrange it to accommodate its use with an AI model.

Some work has been aimed at addressing these challenges. Private and local cloud infrastructure has been developed in the IDF as part of Momentum (Tnufa) Multiyear Plan since 2018.<sup>65</sup> In addition, the previously mentioned Project Nimbus aims to provide the Israeli government, the Israeli defense establishment, and others an all-encompassing cloud solution.<sup>66</sup> The move towards a shared operational cloud service could solve technical challenges relating to storage and enable a secured connectivity within the defense apparatus that in turn could facilitate more collaboration and sharing of data and algorithms.

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<sup>65</sup> Htoni, "Everything you wanted to know about the operational IDF cloud and didn't dare to ask."  
<sup>66</sup> Ziv, "Israel Picks Google, Amazon for Massive Official Cloud; 'Data Will Remain Here.'"

# 8 Conclusion

AI has become a cornerstone of Israel's national security strategy, serving as a critical tool for enhancing defense capabilities, driving economic growth, and bolstering the country's international standing. While Israel has reaped numerous benefits from leveraging AI in defense and security applications, it also faces distinctive challenges that set it apart from other leading countries in this field. Nonetheless, these challenges have not prevented Israel from emerging as one of the world's foremost AI innovators and leaders in the defense and security domain, as described above.

Israel successfully uses defense AI in the absence of coherent management and explicit budget allocation. Its relentless defense and security challenges enable its position as a global AI powerhouse, which is further based, among other things, on the uniqueness of the Israeli ecosystem in the field. The defense and security establishment, defense industry, and academic institutions of Israel have contributed significantly to the rapid progress of AI in various domains, including logistics, intelligence gathering, command and control, unmanned and manned systems, air defense, and cyber warfare. Additionally, Israel's remarkable capabilities and applications in the field of intelligence have played a pivotal role in recent military successes, further solidifying its position as a leader in AI.

Due to the significant impact of AI on Israel's defense and security, it becomes evident that Israel is obliged to take proactive measures to uphold its position as a world leader in this field. To accomplish this, the Israeli government must allocate a dedicated budget and management resources at the national level, rather than relying on the advantages of the unique Israeli ecosystem to compensate for any shortcomings in governance. Israel could reap additional benefits from allocating extra resources from relevant organizations like the military and IMOD towards enhancing the "soft aspects" of defense AI. This could involve activities like formulating and advocating suitable doctrines, increasing involvement in international forums, and dedicating more comprehensive consideration and expert attention to legal and ethical concerns that may emerge in relation to the operational use of AI for defense and security objectives.

In a fiercely competitive environment and amidst a global arms race, it is essential to recognize that relying on an organized mess approach may no longer guarantee the same level of success. However, by embracing this challenge as an opportunity for growth and innovation, Israel can adapt its strategies, foster collaboration, and harness its technological prowess to stay competitive and to keep its position as a leader in defense AI.

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## Defense AI Observatory Studies

- 23|15** Inbar Dolinko and Liran Antebi, Embracing the Organized Mess. Defense AI in Israel
- 23|14** Alastair Finlan, A Fertile Soil for AI? Defense AI in Sweden
- 23|13** John Lee, "Overtaking on the Curve?" Defense AI in China
- 23|12** Heiko Borchert, Torben Schütz, and Joseph Verbovsky, Master and Servant. Defense AI in Germany
- 23|11** Katarzyna Zysk, High Hopes Amid Hard Realities. Defense AI in Russia
- 23|10** Yvonne Hofstetter and Joseph Verbovsky, How AI Learns the Bundeswehr's "Innere Führung." Value-Based Engineering with IEEE7000™-2021
- 23|09** Robert C Engen, When the Teeth Eat the Tail: A Review of Canada's Defence Artificial Intelligence
- 23|08** Çağlar Kurç, Enabling Technology of Future Warfare. Defense AI in Turkey
- 23|07** Lauren A. Kahn, Risky Incrementalism. Defense AI in the United States
- 22|06** Yvonne Hofstetter, Wie KI Innere Führung lernt. Wertbasierte Technik mit IEEE7000™-2021
- 22|05** Andrea Gilli, Mauro Gilli, and Ivan Zaccagnini, Exploring the Benefits of a New Force Enabler: Defense AI in Italy
- 22|04** Kenneth Payne, Bright Prospects – Big Challenges. Defense AI in the United Kingdom
- 22|03** Heiko Borchert, Christian Brandlhuber, Armin Brandstetter, and Gary S. Schaal, Free Jazz on the Battlefield. How GhostPlay's AI Approach Enhances Air Defense
- 22|02** Peter Layton, Evolution not Revolution. Australia's Defence AI Pathway
- 21|01** Heiko Borchert, Torben Schütz, Joseph Verbovsky, Beware the Hype. What Military Conflicts in Ukraine, Syria, Libya, and Nagorno-Karabakh (Don't) Tell Us About the Future of War

