

START-UP NATION CENTRAL: FINDER INSIGHTS SERIES

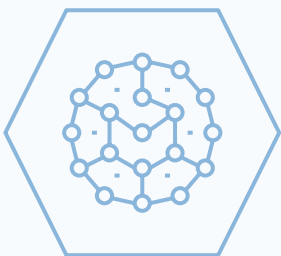
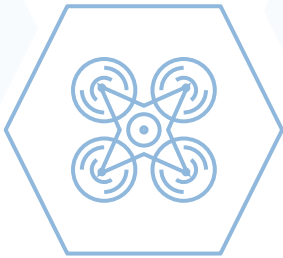
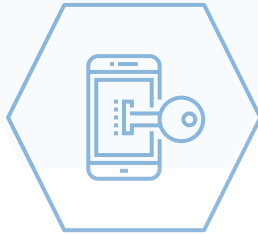
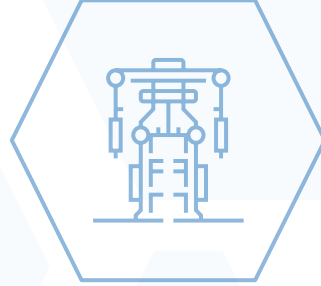
ISRAELI INDUSTRY 4.0 SPECIAL EDITION



START-UP NATION CENTRAL

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INTRODUCTION

Almost a year has passed since Start-Up Nation Central issued its first report on the Israeli Industry 4.0 sector.¹ We now offer a supplementary addition to last year's more extensive offering, which sums up the first half of 2018, and adds a new layer of data and analysis.²

Israel's competitive advantage in the high-tech industry hinges on its excellence in certain core technologies that can be applied to several sectors. In the second part of this update, we focus on Machine Intelligence (MI) - a core technology that plays a significant role in the transition of traditional industry into Industry 4.0. The term MI incorporates the following technologies: Artificial Intelligence (AI), Machine Learning (ML), Computer Vision, Advanced Robotics, Natural Language Processing and Deep Learning. We explore how this technology can contribute to corporations in such functions as Management, Operations, R&D, IT and so on.

HIGHLIGHTS

Industry 4.0 (I4) is a term much used over the last decade, but with varying interpretations. Start-Up Nation Central refers to I4 as set of technologies that digitize the entire production process, by connecting physical industrial assets with digital insights, using digitization, automation and extensive data usage. The primary technology used to execute this change is the Industrial Internet of Things (IIoT), and the ability to rapidly and accurately process the data that IIoT sensors collect.

¹ [Unlocking Industry 4.0 Potential - Israel's Role in Global Trends](#), Start-up Nation Central and Deloitte, January 2018.

² All figures pertaining to Israel are based on Start-Up Nation Finder™

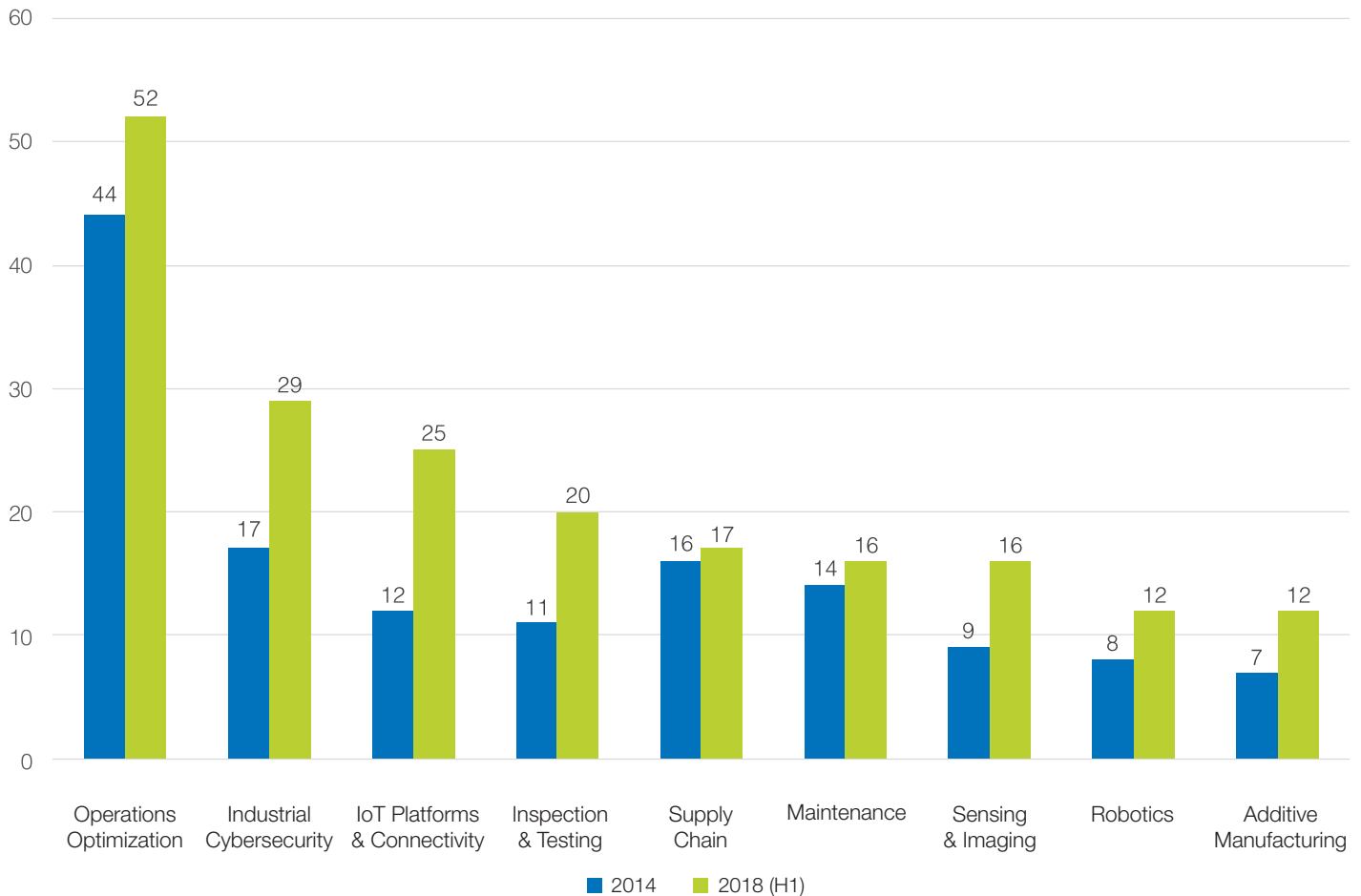
BREAKDOWN OF THE ISRAELI I4 SECTOR

The Israeli I4 sector comprises almost 200 companies (up from 138 in 2014 indicating a growth of 44%) and consists of nine innovative subsectors³ that address the entire manufacturing process:

<p>Operations Optimization</p>	<p>Maintenance</p>	<p>Inspection & Testing</p>
<p></p> <p>Solutions that increase yield, decrease the consumption of raw materials or electricity, and enable a faster time to market</p>	<p></p> <p>Maintenance and predictive maintenance of production machinery to reduce downtime</p>	<p></p> <p>Plant inspection, and testing of materials and products</p>
<p>IoT Platforms & Connectivity</p>	<p>Supply Chain</p>	<p>Sensing & Imaging</p>
<p></p> <p>Communication and integration of data</p>	<p></p> <p>Improvement of supply chain efficiency and visibility</p>	<p></p> <p>Devices involved in data collection</p>
<p>Robotics</p>	<p>Additive Manufacturing (3D Printing)</p>	<p>Industrial Cybersecurity</p>
<p></p> <p>Advanced machinery for complex tasks automation</p>	<p></p> <p>3D printers and the surrounding ecosystem</p>	<p></p> <p>The protection of collected data and connected systems</p>

³ Since our previous Industry 4.0 report, the Safety subsector has been removed from this list.

Figure 1: **Active Israeli I4 Companies (2014 vs H1 2018)**



The largest subsector is Operations Optimization, comprising 52 companies, with 26% of the I4 companies in Israel. The next largest subsectors are Industrial Cybersecurity and IoT Platforms & Connectivity Solutions with 14% and 12% respectively. Industrial Cybersecurity has an inherent advantage in the Israeli ecosystem due to the influx of highly trained talent from IDF technological units, and this advantage is also expressed within I4.⁴ These three subsectors make up just over 100 companies together, comprising about half of the entire Israeli I4 sector.

The impressive growth of the Inspection & Testing subsector (82% from 2014) is an example of the Israeli I4 sector strength in “Phase 1”, as defined in the box on the right. Inspection & Testing is part of quality assurance, mainly comprising solutions that are concerned with end-product quality. It relies on computer vision and image recognition-based technologies to examine products, and is increasingly popular due to rising consumer demands both for improved quality, and a decreased time to market.

The Three Phases of Industry 4.0 – The Journey into Digitization

There are three phases of Industry 4.0, as described in detail in our report “[Unlocking Industry 4.0 Potential - Israel’s Role in Global Trends](#)”.

Phase 0. Initial Connectivity –

Basic levels of data collection, analysis, and communication.
*Essential prior to beginning the process.

Phase 1. Process Optimization –

Increased networking and digitization, improving current processes, and optimizing use of assets.

Phase 2. Process Flow & Quality –

Creating a digital thread throughout the entire process

Phase 3. New Business Models –

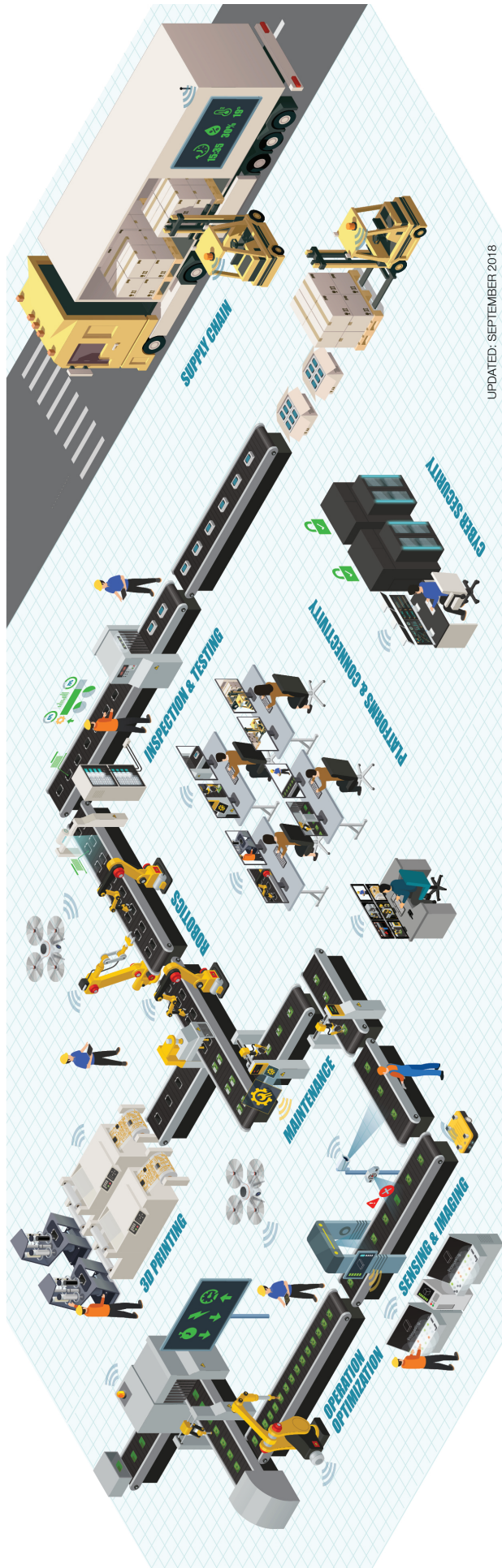
Creating new revenue streams and value for customers, and building new products based on insights digitally gathered from clients.

Note: As we progress towards later phases, the ROI becomes less clear.

⁴ For more details on potential I4 horizons, please read our previous report on the subject, [Unlocking Industry 4.0 Potential - Israel’s Role in Global Trends](#).

ISRAELI INNOVATION: INDUSTRY 4.0

THERE ARE **200** INNOVATIVE INDUSTRY 4.0 START-UP COMPANIES IN ISRAEL



UPDATED: SEPTEMBER 2018

GROVE VENTURES
 Grove Ventures is an early-stage fund, focused on investing in cutting edge deep technology startups. We support Israeli startups throughout their inception and growth by providing our brilliant entrepreneurs with the capital, expertise and network needed to shape and build successful global businesses.

START-UP NATION CENTRAL
 Start-Up Nation Central is an Israel-based non-profit that serves as a gateway to Israeli innovation. The organization leverages its in-depth knowledge of Israel's innovation sector to introduce business leaders, governments, and NGOs from across the globe to the most relevant people and technologies that address their critical needs.

To download the full landscape please visit: [click here](#)

INVESTMENTS IN ISRAELI I4

The amounts raised in H1 2018 by this sector almost equal the annual funding raised in 2017 (\$225M), with 15 deals amounting to \$193M. Figure 3 shows an increase in the median amount of investment rounds, which is consistent with the I4 global trend.⁵ The median round in I4 in H1 2018 is \$8M – double the median round in 2017.⁶

Figure 2: Number of Rounds and Capital Raised

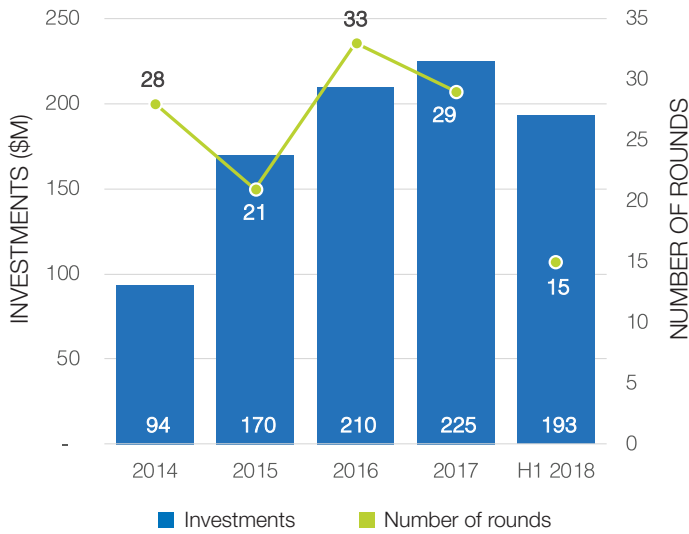
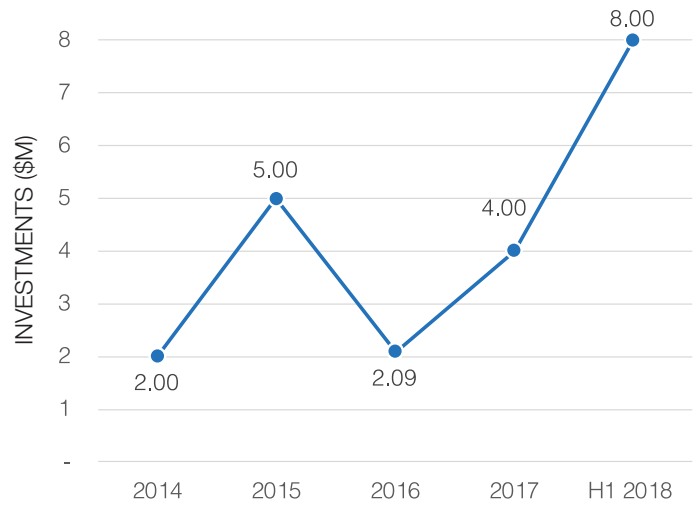


Figure 3: Median Investment per Round (\$M)



Industrial Cybersecurity is the leading I4 subsector in terms of total investments in H1 2018, with \$112.5M raised (58% of total investment in the sector), the highest of which was the Claroty series B round of \$60M. The Supply Chain subsector also saw a high investment, with CommonSense Robotics raising a series A funding round of \$20M from Aleph, Innovation Endeavors and Playground Global.



FUNDING STAGE

40% of the I4 sector in Israel are late stage companies.⁷ While it may seem surprising that such a young sector has such a high percentage of late stage companies, it stems from the progression of established companies into I4 tech. An example of this phenomenon is mPrest, a defense company founded in 2003, which is the brain behind the Iron Dome radar and target acquisition system, which pivoted into I4 by adapting its management platform for industrial uses.

⁵ Sources: [Venture Pulse Q2 2018 – KPMG](#), [MoneyTree Report Q2 2018 - PwC and CB Insights](#), [Preqin](#), [Crunchbase](#), [Startup Fundraising in 2018 - Gil Ben-Artzy \(UpWest Labs\)](#).

⁶ Including only equity-based rounds.

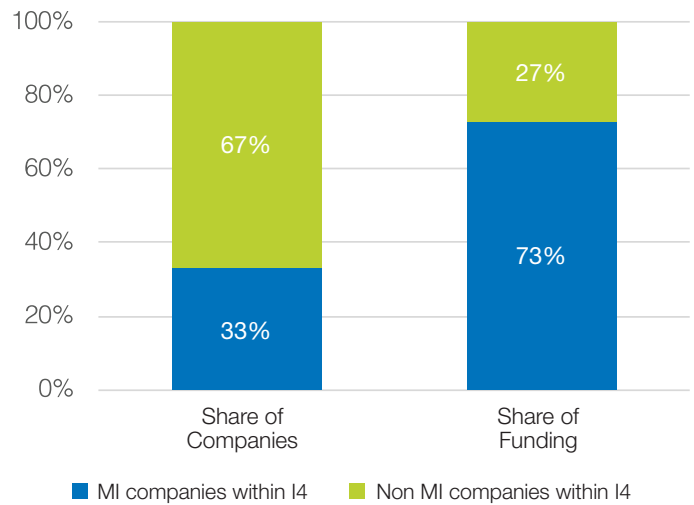
⁷ Early stage defined as: bootstrapped, pre-seed, seed and A. Late stage defined as: B, C, revenue financed, established and public.

MACHINE INTELLIGENCE AND I4 IN ISRAEL

The Israeli ecosystem includes approximately 1,000 companies that utilize various MI technologies. MI plays a crucial role in the IoT domain, and particularly within I4. MI capabilities rely heavily on cross-sectorization, which is where Israel has a significant advantage. In this section we analyze how Israeli I4 start-ups utilizing MI can significantly contribute to a variety of manufacturing firms, OEMs, Tier 1 companies, multinational corporations (MNCs) and so on.

Within Israeli I4 sector, 65 companies (33%) utilize some form of MI, although these companies also attracted a disproportionate amount of funding since 2014 - 73% of all the sector investments (\$650M). This shows the attraction that Israeli MI I4 companies have for investors. In addition to younger VC-funded start-ups, several established companies have adapted their MI-based technologies to I4 applications.

Figure 4: Israeli MI in I4 - Share of Companies and Share of Funding (2014 - H1 2018)



ISRAEL'S MI VALUE PROPOSITION

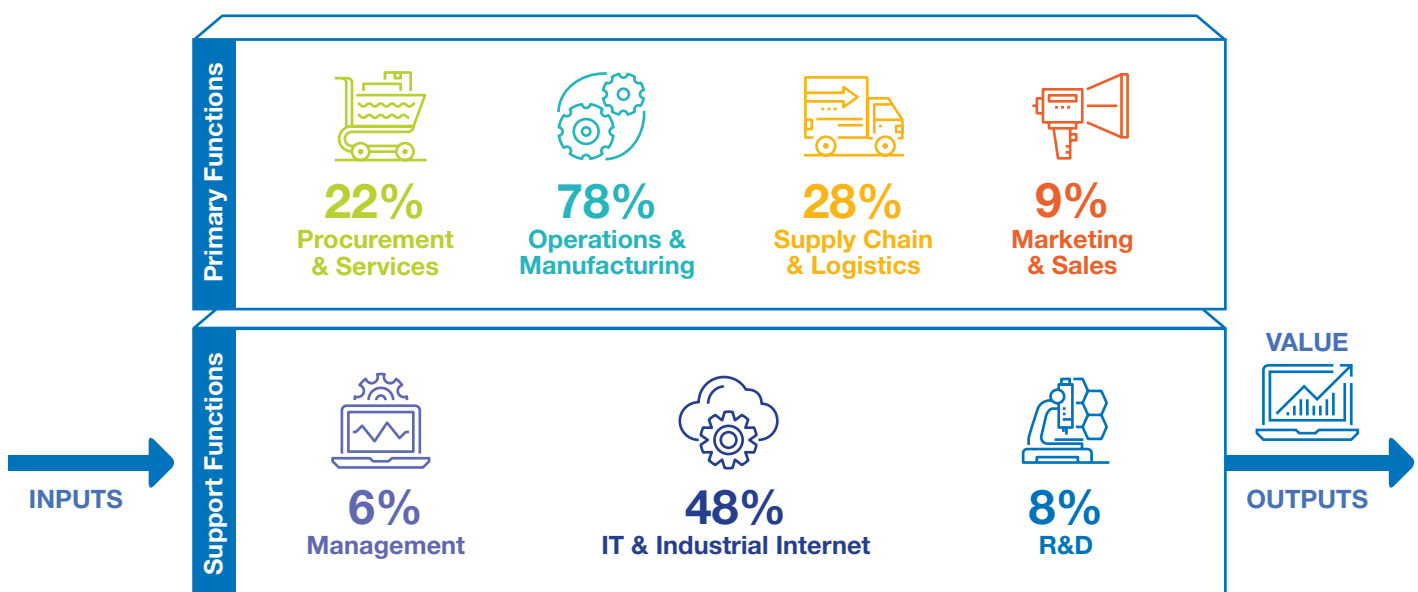
In this section, we examine the I4 applications in which Israeli innovators using MI can provide the most value.

Figure 5 schematically maps Israeli I4 companies developing MI solutions that contribute to all functions found within industrial companies. As these technologies frequently serve more than one component of the value chain, the total is higher than 100%.

Operations leads with 51 companies addressing this issue, followed by IT and Supply Chain & Logistics with 31 and 18 accordingly.

These are functions in which one can more easily quantify the ROI of technology adoption. As indicated in our earlier report, there is a significant global demand in each of these three fields.

Figure 5: Israeli I4 using MI contribution to the value creation within a company



Below we focus on one specific I4 application within the Operations function. Predictive Maintenance is the solution to a major pain point for every industrial firm, regardless of its product vertical. This section describes the advantages of using MI to improve predictive maintenance, and thereby decrease downtime, improve output, and achieve efficiency.

Predictive Maintenance

The market for Predictive Maintenance is steadily increasing, estimated at \$3B in 2018 and expected to reach \$11B by 2022.⁸ A basic principle in maintenance is that the later a fault is detected, the greater the collective damage. This is why early detection, or even better, early accurate prediction is extremely valuable. There are several maintenance methods:



Reactive – fixing a machine when a problem occurs



Scheduled Preventive – scheduled replacement of components, regardless of their condition



Human Based Predictive – check-ups by experts who regularly examine the condition of a machine (vibrations and oil analysis, ultrasound testing, infrared thermography and so on).

Each method has its shortcomings. Reactive maintenance necessarily requires rapid intervention, thus raising costs. Scheduled preventive maintenance that is not data based introduces two types of inefficiencies: when it is too early it causes unnecessary downtime and redundant replacement of components; when it is too late, we are back to the cost of reactive. Human-based predictive maintenance is imprecise, expensive and long.

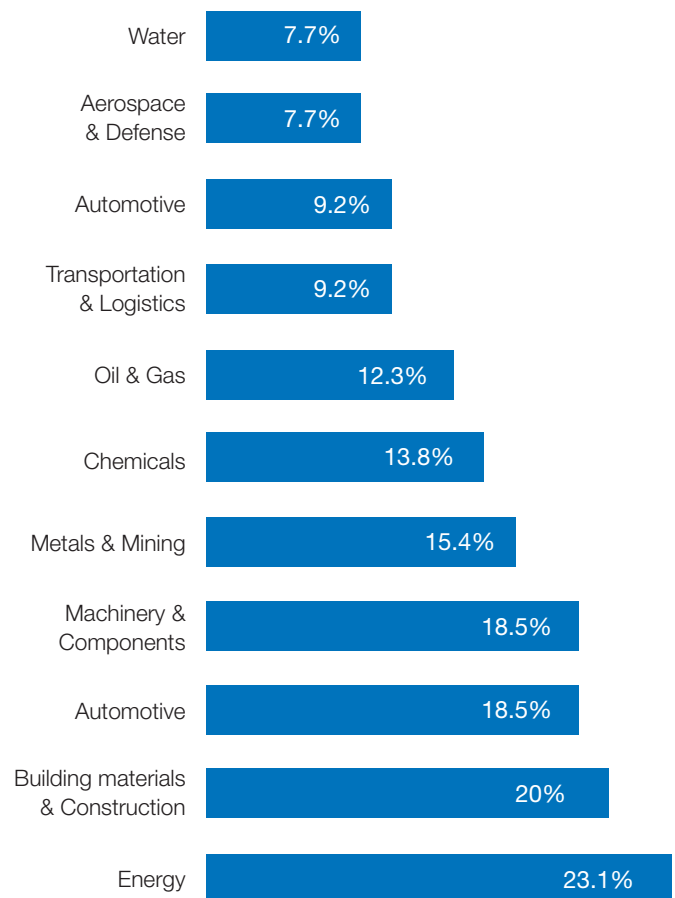
MI, with Sensors and AI, is revolutionizing the maintenance domain. Sensors continuously monitor the equipment, generating enormous amounts of data, which AI technologies analyze to detect anomalies, while at the same time monitoring performance. AI produces real-time predictive alerts and allows for a timely response without the need for long-term maintenance downtime. AI-based predictive maintenance is scalable, since it is size independent. In fact, algorithms work better on larger scale and intensity, since more data improves detection and predictability.

Many companies create AI based predictive maintenance solutions in Israel, including Augury, Presenso, 3D Signals, and Precognize (recently acquired by Samson AG). For the full list of companies please visit - [Predictive Maintenance in Finder](#).

Verticals

While some industries attract more Israeli I4 companies than others, all of them receive significant coverage. Figure 6 indicates that the largest number of companies focus on the Energy industry, mostly concentrating on improving efficiency. Following Energy are the Construction and Automotive industries – the latter rapidly gaining the attention of the global automotive industry. In the Construction space, the focus is on digitizing the construction site and designing autonomous equipment. Automotive I4 uses technologies such as advanced robotics, aggregation platforms and data collected from sensors to create a MI ecosystem which improves production and reduces manufacturing hold-downs. Most clients and collaborators are Tier 1 manufacturers.

Figure 6: Percentage of Companies Operating in each Vertical using MI



8 The Statistical Portal – [Projected size of the global predictive maintenance market from 2018-2022](#).

START-UP NATION CENTRAL AND INDUSTRY 4.0

Start-Up Nation Central is an Israel-based non-profit that serves as a gateway to Israeli innovation. As an organization, we leverage our in-depth knowledge of Israel's innovation sector to draw insights and act on them, working in partnership with individuals and organizations in Israel and around the world, to help this sector expand and flourish.

Start-Up Nation Finder is Israel's definitive innovation discovery platform, provided as a free online resource. Mapping more than 6,500 innovative companies, investors, hubs, technology transfer offices, and multinational R&D centers, Start-Up Nation Finder is a widely utilized source of information and insights. Based on its success, Start-Up Nation Central has also launched a Global Finder network that allows growing innovation hubs across the world to map and connect all the relevant stakeholders.

The success of the Israeli innovation ecosystem is the motivation behind Start-Up Nation Central's activities. We engage corporate, government, and NGO leaders from across the globe with Israeli innovation, creating customized and curated experiences where they connect to the relevant people and technologies that can address their most pressing challenges. We help start-ups build practical tools and expand their skillsets, regardless of their field, while paying special attention to the development of the Agritech, Digital Health and Industry 4.0 sectors. We support tech communities, increasing collaboration and knowledge-sharing within the ecosystem. Start-Up Nation Central's mission is also to help the tech innovation sector remain strongly rooted in Israel, and to this end, we have become an important voice on policies relating to this, together with creating innovative solutions to achieve this aim. We convene diverse thought leaders to help shape long term strategy for the country, as well as directly addressing the issues of human capital shortage and development of regional ecosystems. Utilizing its knowledge and its connectivity within the community, Start-Up Nation Central promotes Israeli innovation at home, and across the globe.

Starting in 2018, Start-Up Nation Central has included Industry 4.0 in its Sector Development Program's initiative, joining existing programs in Agritech and Digital Health. Within these sectors we aspire to identify unique challenges holding back entrepreneurs and young technological companies from presenting unique and novel solutions. Our activities look to expose Israeli innovation globally, deepen the local sector's knowledge and understanding of the market, and develop partnerships between the Israeli ecosystem and leading international players.

Both locally and globally, Industry 4.0 is still considered a young segment, with activity spanning a wide range of verticals. Although promising great returns, companies within the sector are still paving the way, by presenting concrete use cases that match a variety of industries. Together with additional partners on the local landscape, Start-Up Nation Central is looking to deepen the engagement with strategic locations and partners around the world that have a matching value proposition in sharing knowledge and opportunities. Furthermore, Start-Up Nation Central has taken a leadership position in putting Israel and Industry 4.0 on the global map, co-organizing an annual international event in Tel-Aviv, [Israel Industry 4.0: Beyond Man and Machine](#). Industry 4.0 has already established itself as a unique and exciting domain, promising great economic impact.

METHODOLOGY

Data set

Amounts and definitions relating to Israeli innovation and entities accord with those of Start-Up Nation Finder. Companies considered for this report were founded by Israelis and pursue R&D activities in Israel, and are not service providers. This report organizes Israel's Industry 4.0 sector into nine subsectors. This subsector division organizes the relevant companies into an inherently simplistic regimentation. Some companies offer multifaceted technologies and therefore may be assigned to multiple subsectors. However, for the sake of identifying investment and tech trends, we associate each company with only one subsector, which reflects the company's major focus. Figures representing numbers of companies and investments in Israeli Industry 4.0 and its subsectors are likewise exclusive.

Financing

Refers to any equity transaction (e.g. VC, corporate, or angel investments; private equity in growth stage), but excludes full or major liquidity events (these are considered to be Exits). In cases where companies receive investments from incubators conjointly with grants from the Israel Innovation Authority, the latter are included in the funding amounts and are not specified. Funding amounts entail only the value invested in a given time period; even if a deal includes terms for future obligations, we do not include the pending conditions in the amounts listed in this report. Some investment figures may include funding that does not appear to the public on Start-Up Nation Finder. These amounts reflect data that Israeli companies disclosed to Start-Up Nation Central in confidence, which remain undisclosed on an individual level while still factored into aggregates.

For more information on the Israeli Industry 4.0 sector and the companies cited in this report, please visit:

finder.startupnationcentral.org

Questions and comments should be directed to:

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