



Samuel Neaman Institute
for National Policy Research

Science & Technology

Environment
& Energy

Long-term
Planning

Industry
& Innovation

Physical
Infrastructure

Health

Human
Capital

Higher
Education

Society

Education

Economy

Artificial Intelligence, Data Science and Smart Robotics- Companies-Survey summary

Dr. Daphne Getz

Oshrat Katz Shacham, Rinat Klein,

Dr. Roey Tzezana, Shlomo Rosenberg,

Avida Shoham, Sima Tziperfal, Ella Barazani,

Dr. Eran Leck

July
2019

Artificial Intelligence, Data Science and Smart Robotics- Companies-Survey summary

Researchers:

Dr. Daphne Getz

Oshrat Katz Shacham

Rinat Klein

Dr. Roey Tzezana

Shlomo Rosenberg

Avida Shoham

Sima Tzipperfal

Ella Barazani

Dr. Eran Leck

July 2019

« Research Background

The Israeli government acknowledges the potential of the Artificial Intelligence, Data Science and Smart Robotics domains in fostering the Israeli economy, its security and societal welfare. The government is interested in promoting and augmenting the development of these fields, by supporting private and public investments.

The National Council for Research and Development (MOLMOP) at the Ministry of Science and Technology has issued a tender requesting a study on these technological domains in Israel. The Samuel Neaman Institute was commissioned to perform a comprehensive mapping of activities in the Israeli academy, industry and government sectors, and to explore the possibilities for promoting and developing these fields in Israel.

Earlier publications in the framework of this project:

Artificial Intelligence, Data Science, and Smart Robotics, [First Report \(HEB\)](#)

Artificial Intelligence, Data Science, and Smart Robotics, [First Report Summary](#) (HEB)

Artificial Intelligence, Data Science, and Smart Robotics, [First report summary](#) (ENG)

Artificial Intelligence, Data Science, and Smart Robotics, [Companies survey](#) (HEB)

Artificial Intelligence, Data Science, and Smart Robotics, [A report on Ethics, Law and Privacy](#) (HEB)

Soon to be published:

Artificial Intelligence, Data Science, and Smart Robotics, Ethics, Law and Privacy- report summary (ENG)

Artificial Intelligence, Data Science, and Smart Robotics, Knowledge transfer between Academia and Industry (HEB)

This document summarize the results of a survey conducted by the research team at the Samuel Neaman Institute, among managers and senior employees in the Israeli artificial intelligence, data science and smart robotics industry. This survey answers several research questions. Some of the questions deal with issues of demand and supply of personnel, education and training. Other questions relate to various issues, such as the technologies in which the State of Israel has the ability to lead in, within the areas of artificial intelligence, data science and smart robotics and the means required to promote these areas in Israel.

« Acknowledgments

The project team would like to thank Mr. Daniel Singer from StartupHub.ai (<https://startuphub.ai/>) for his help.

Startuphub.ai is the authority of data for Israel's burgeoning ecosystem of startups, corporations and engineers building artificial intelligence technologies. Trusted by the world's leading decision makers and technology pioneers, Startuphub.ai is home to the most accurate data on Israel's artificial intelligence ecosystem.

« List of Figures

Figure 1: Distribution of respondents by company size	6
Figure 2: Respondents population distribution by company's main sector operation	7
Figure 3: Employees profile in sample companies in the areas of artificial intelligence, data science, and smart robotics at different training levels	8
Figure 4: Missing employees' profile in the fields of artificial intelligence, data science and smart robotics in sample companies at different training levels.....	9
Figure 5: Types of training/education of employees specializing in R&D.....	10
Figure 6: Average level of difficulty in recruiting research and development employees	11
Figure 7: Level of suitability of bachelor's degree program in the fields of artificial intelligence, data science and smart robotics	12
Figure 8: Types of technologies in which Israel has the ability to lead in the fields of artificial intelligence, data science, and smart robotics.....	13
Figure 9: Means required to promote the fields of artificial intelligence, data science, and smart robotics	14

« The Survey's Goals, Population and Sample

The goals of this survey were:

1. To validate some of the insights that emerged from the in-depth interviews the project team conducted in the first stage of the research with more than 60 experts.

2. Answer additional questions:

- What are the technologies in which the State of Israel has the ability to become a world leader in, within the fields of artificial intelligence, data science and smart robotics?
- What steps can be taken on a national level to advance the fields of artificial intelligence, data science and smart robotics in Israel?

The questionnaire was formulated by the research team with the consult of Dr. Neil Naimer, Coordinator of the National Committee for Academic-Industrial Relations at the National Council for Civil Research and Development (MOLMOP), Ministry of Science and Technology.

A total of 753 questionnaires were sent to managers and senior employees from 655 companies engaged in the areas of artificial intelligence, data science and smart robotics.

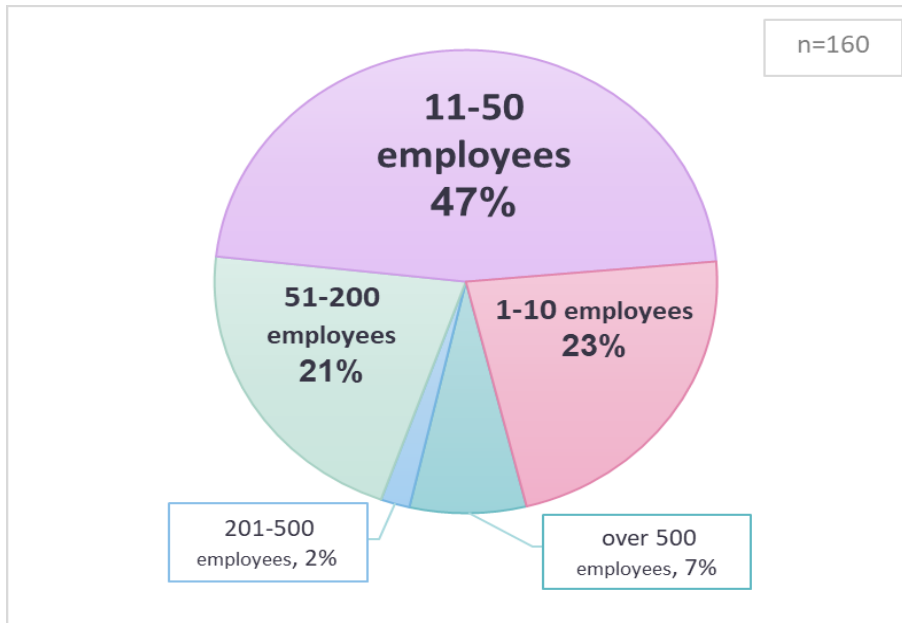
The research database included 176 employees and managers from 160 companies, two consultants and an academic research laboratory.

The response rate was 23% of the total number of respondents and 25% of the total number of companies included in the research population. The companies in the sample represent all the companies in the research population.

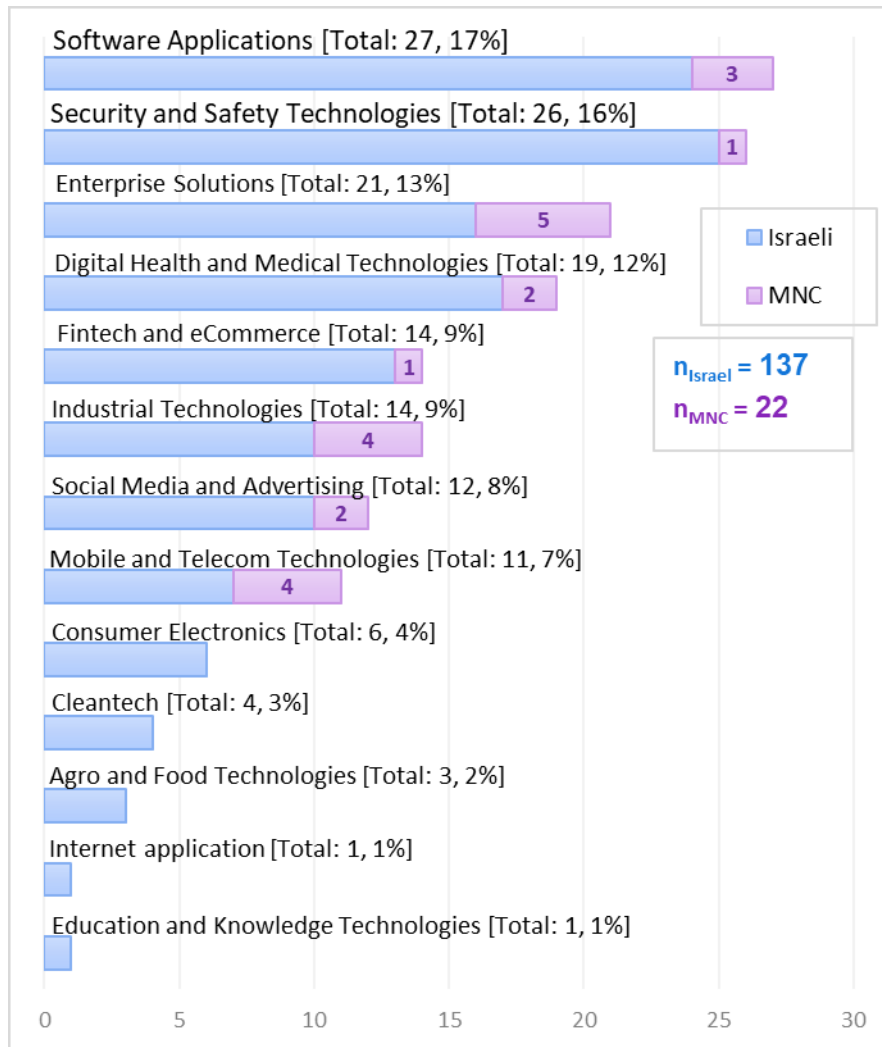
« The Respondents and Their Workplaces

About half of the respondents (47%) work in companies which employ 11-50 employees. 23% of respondents work in companies which employ up to 10 employees, and a similar percentage (21%) in companies which employ 51-100 employees (Figure 1).

Figure 1: Distribution of respondents by company size



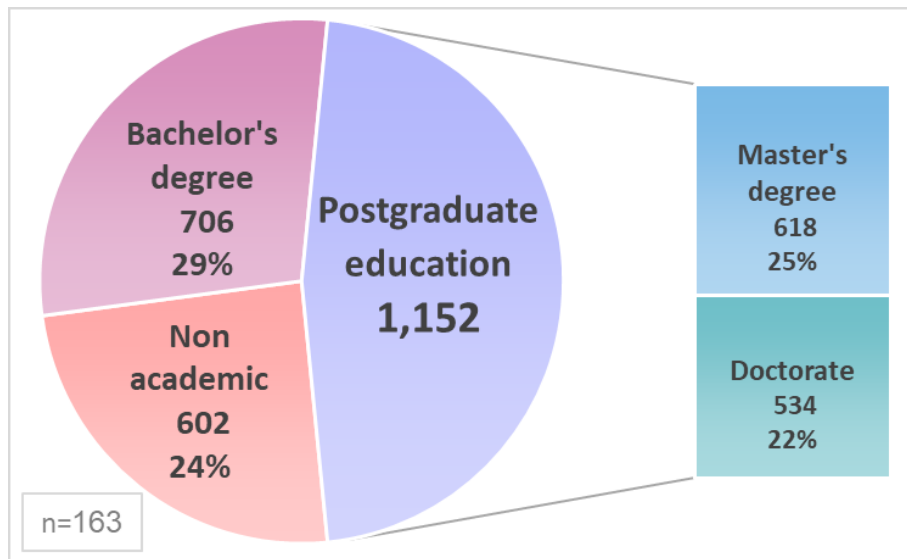
13% of the responding companies (for which there is a sector in the database), are multinational corporations. Most of the multinational companies operate in the Enterprise Solutions, Industrial Technologies and Mobile and Telecom technologies sectors. The highest response rate for Israeli companies is in the Security and Safety Technologies and Software Applications sectors (Figure 2).

Figure 2: Respondents population distribution by company's main sector operation¹

2,414 workers work in the respondent's companies in the fields of artificial intelligence, data science and intelligent robotics. About half of these (47%, 1,152 employees) are employees with advanced degrees (MA and PhD). About 29% have a bachelor's degree, and the remaining 24% have no academic degree (Figure 3). The largest number of employees reported are in the Software Applications sector (490), followed by Security and Safety Technologies (414) and Industrial Technologies (306 employees).

¹ Of the 163 companies (including two consultants and a research firm), 159 have a sector definition

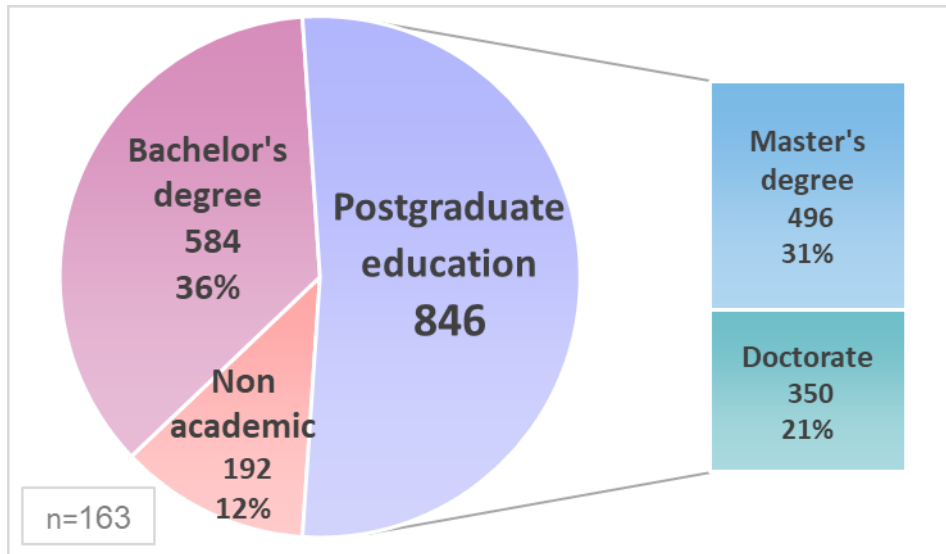
Figure 3: Employees profile in sample companies in the areas of artificial intelligence, data science, and smart robotics at different training levels



It should be noted that the percentage of employees with advanced degrees that work in the artificial intelligence, data science and smart robotics industry is exceptionally high considering that the number of second-degree and third-degree graduates from universities and colleges in science and engineering (2016-2015) is only about 24% of all graduates in science and engineering.

Respondents reported that the companies in the sample are currently looking for 1,622 employees in the areas of artificial intelligence, data science and intelligent robotics. Approximately half of the missing employees (52%, 846 employees) are employees with advanced degrees (MA and PhD), and more than one-third (36%, 584) are employees with bachelor's degree. There was a relatively low demand for non-academic workers (Figure 4). The largest number of missing employees was reported in the Software Applications sector (300), followed by Security and Safety Technologies (296) and Industrial Technologies (216).

Figure 4: Missing employees' profile in the fields of artificial intelligence, data science and smart robotics in sample companies at different training levels



« Estimation for the Number of Existing and Required Employees in the Field of Artificial Intelligence, Data Science and Smart Robotics in Israel

According to our estimate, there are currently about 9,000 employees working in the field of artificial intelligence, data science and smart robotics in Israel, 4,100 of which have advanced degrees.

There are currently some 5,800 employees missing in these fields, of which approximately 2,900 with advanced degrees (Table 1).

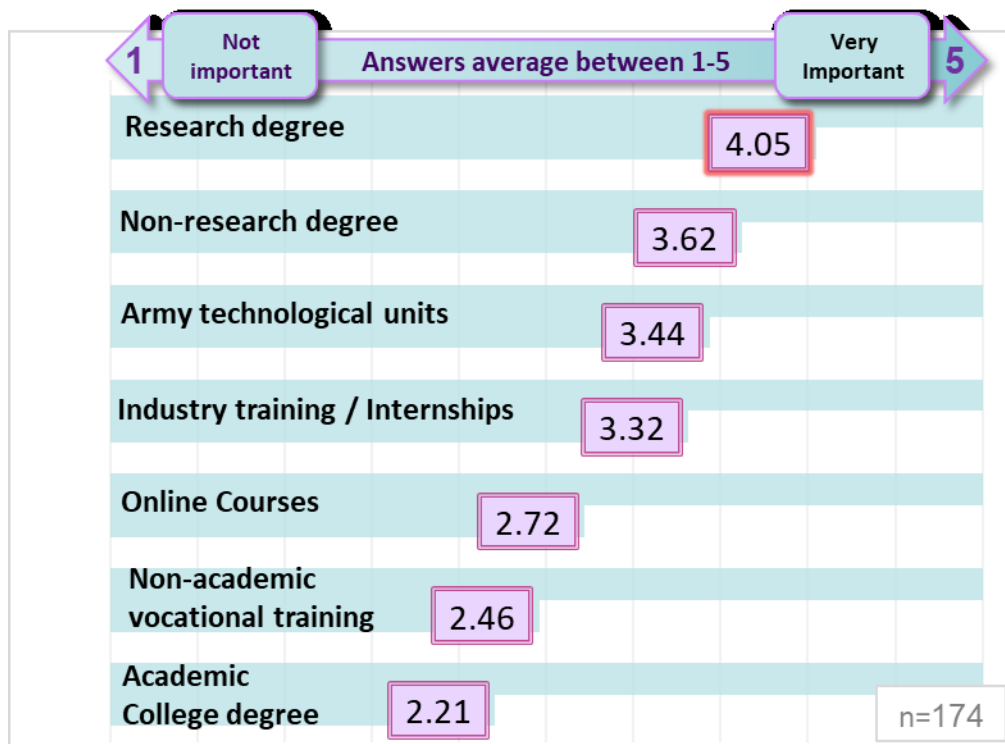
Table 1: Existing and required number of employees by level of education

Education level	Number of employees today	Number of employees required
Doctorate	1,902	1,207
Master's degree	2,202	1,718
Bachelor's degree	2,587	2,161
Non-academic	2,371	717
Total	9,062	5,802

« Importance of the Level of Training

The most important education or training type for workers in the areas of artificial intelligence, data science and intelligent robotics is a research degree (PhD or MA with thesis) followed by a non-research degree (BA or MA without thesis). Online courses, non-academic vocational training and an academic college degree received low grades in terms of their importance (Figure 5).

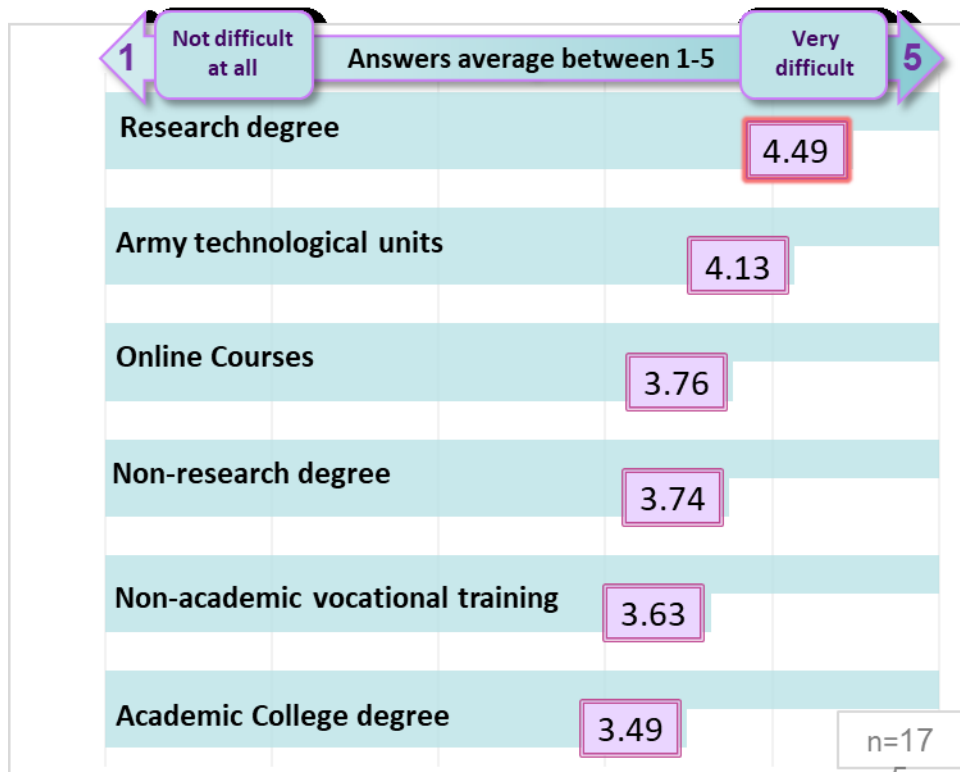
Figure 5: Types of training/education of employees specializing in R&D



According to the findings, it is difficult to recruit workers at all education and training levels, with the greatest difficulty being the recruitment of workers with research degrees (third degree or Master's degree with thesis) and recruitment of employees that graduated from technological units in the army (Figure 6).

About a quarter of the respondents indicated that they did not seek any employees who had undergone online courses (28%), non-academic vocational training (24%) or college degree holders (22%).

Figure 6: Average level of difficulty in recruiting research and development employees

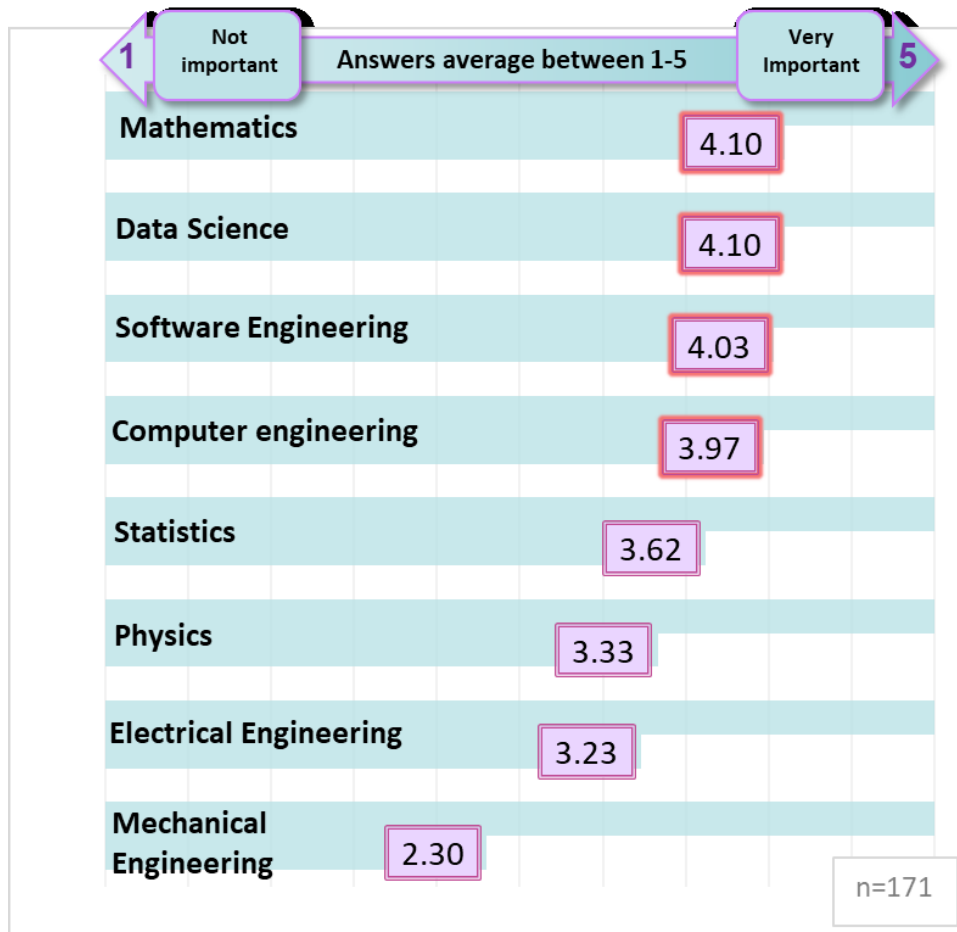


There is a slight difference in the recruiting difficulty between companies in the initial stages of financing and profitable, established or public companies. Companies in the early stages of financing, as well as companies in advanced stages of financing and public companies, find it difficult to recruit workers with a research degree. Companies in advanced stages of financing and public companies find it difficult to recruit workers with a non-research degree more than employees who graduated from military technology units, graduates of online courses, professional training programs or college graduates. Companies in the early stages of financing find it difficult to recruit workers with a non-research degree, as well as veterans of military technology units, graduates of online courses, and college graduates.

« Education and Training Tracks in the Fields of Artificial Intelligence, Data Science and Smart Robotics

According to the respondents, bachelor's degree programs in mathematics, data science, software engineering and computer engineering are the most suitable for research and development workers in these fields. In contrast, mechanical engineering was specified as less suitable field (Figure 7).

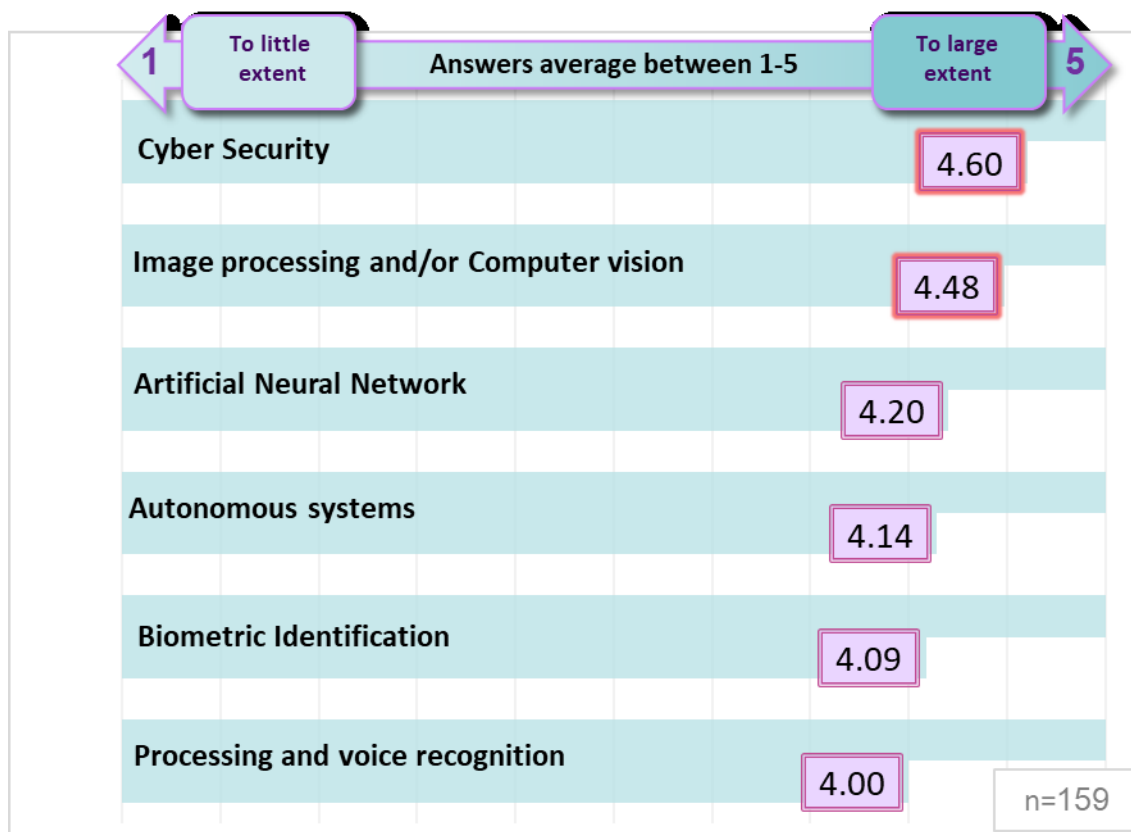
Figure 7: Level of suitability of bachelor's degree program in the fields of artificial intelligence, data science and smart robotics



« Artificial Intelligence, Data Science and Smart Robotics Technologies Which the State of Israel Can Become a World Leader In

According to the respondents, the technologies in which Israel has the ability to become a world leader in, are cyber security and image processing and/or computer vision (Figure 8). Other technologies the respondents mentioned include natural language processing, computational photography, electronic medical databases analysis, recommendation systems, analysis and forecasting of malfunctions and threats, Financial, language and Semitic language processing, automatic driver, military and security technologies, reinforcement learning for large bands of robots, Deep Learning & Machine Learning, Cognitive Analytics, forecasting and prevention of faults in manufacturing processes, Verification and IoT.

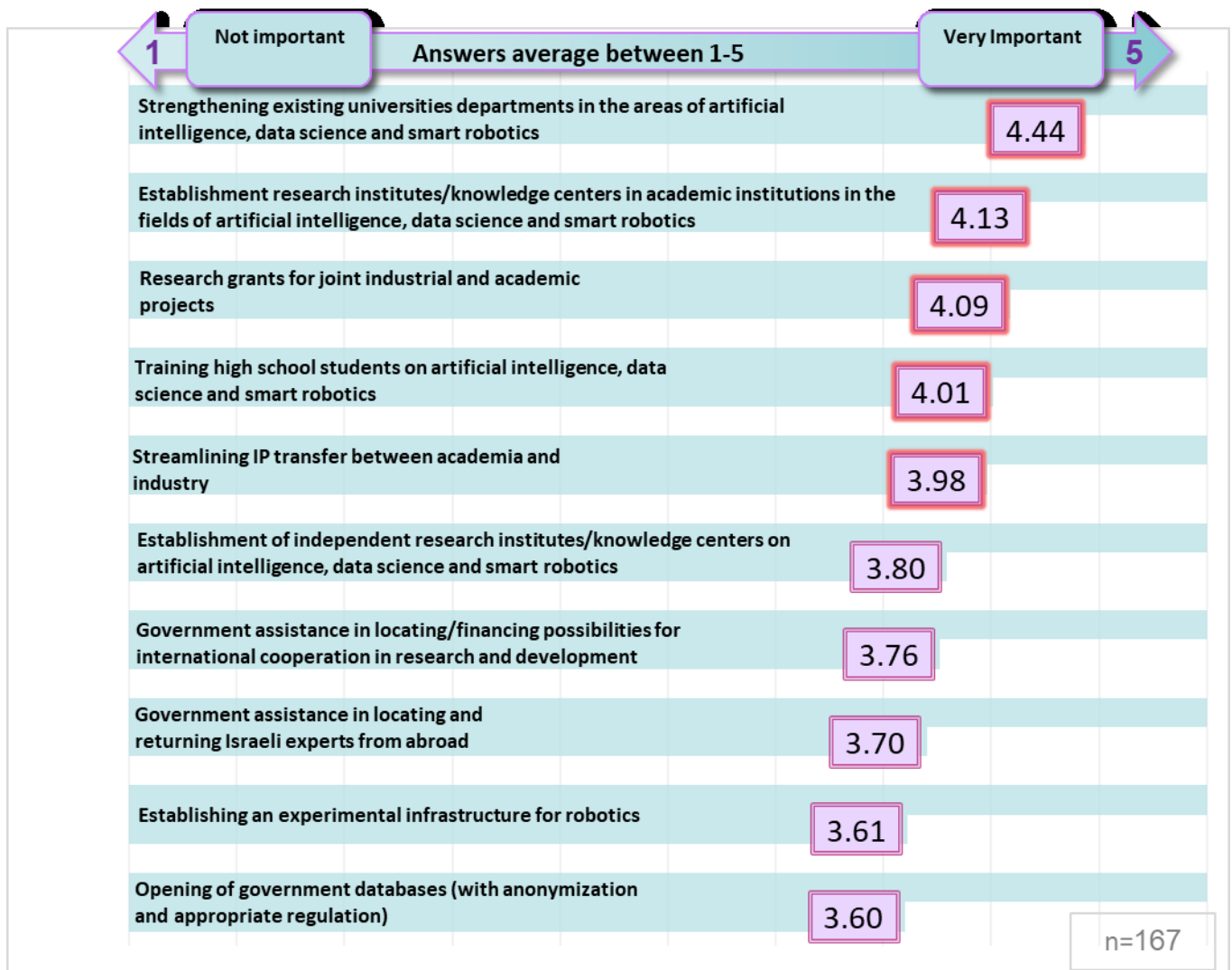
Figure 8: Types of technologies in which Israel has the ability to lead in the fields of artificial intelligence, data science, and smart robotics



« Recommended Steps to Advance the Fields of Artificial Intelligence, Data Science and Smart Robotics in Israel

The means that were mentioned as most important for the advancement of artificial intelligence, data science and smart robotics in Israel are mainly (but not exclusively) linked to academic-industrial relations: strengthening the existing departments in the universities, establishing research institutes/knowledge centers in academic institutions, research grants for joint industrial and academic projects, training high school students in these fields and streamlining IP transfer between academia and industry (Figure 9).

Figure 9: Means required to promote the fields of artificial intelligence, data science, and smart robotics



Science & Technology



Samuel Neaman Institute
for National Policy Research

Tel. 972-4-8292329 | Fax. 97-4-8231889
Technion City, Haifa 3200003, Israel
www.neaman.org.il