Samuel Neaman Institute
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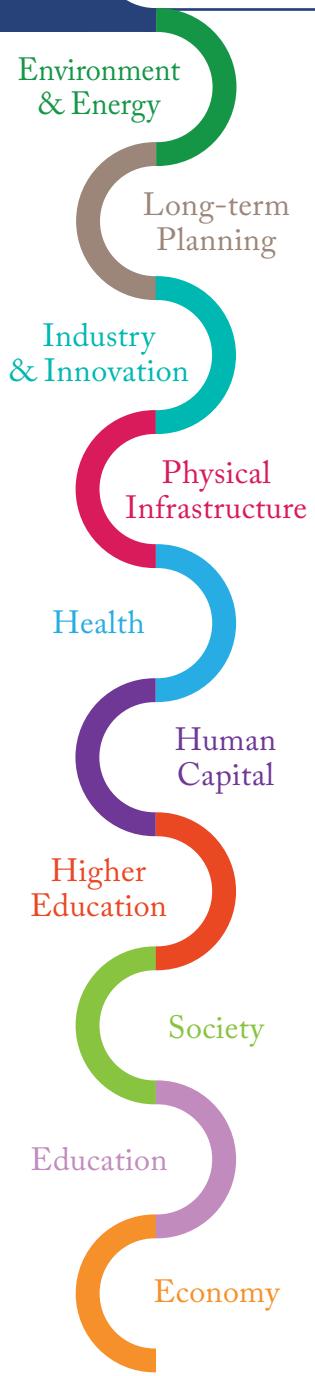

Artificial intelligence, Data science and Smart Robotics

Streamlining knowledge transfer from academia and research institutes in the health care system to industry- report summary

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About Samuel Neaman's Artificial intelligence, Data science and Smart robotics research project:

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)

Artificial Intelligence, Data Science, and Smart Robotics, Companies survey Summary (ENG)

Artificial Intelligence, Data Science, and Smart Robotics, Streamlining knowledge transfer from academia and research institutes in the health care system to industry- (HEB)

Executive Summary

1. Introduction

Many of the insights discussed reflect case studies of various disciplines in which technology transfer was taking place. An in-depth demonstration is high-lighted here in the case of a recent investigation of the processes taking place in the technology transfer in the fields of artificial intelligence, data sciences and smart robotics in Israel. Technologies developed in these fields of activities are implemented in areas such as medicine, energy, agriculture, software, cyber security. The need is two-sided: industry professionals, on the one hand, need access to the most advanced scientific developments that bring solutions to real-world problems, while academic researchers, on the other hand, need business knowledge, access to real-world scenarios and data in order to design innovative solutions (Zahedi, Babar, and Cooper, 2018). In Israel, technology transfer is a key factor in the realization of the country's relative advantage in applying artificial intelligence and data science for medicine and cyber-security (Getz et al., 2018).

Considering this state of affairs, an in-depth investigation was embarked at the Samuel Neaman Institute to analyze the quality and nature of the links between academia and industry in Israel in these fields, based on in-depth interviews with 27 specialists from industry , academia and the Israeli health system hospitals and Health Maintenance Organizations (HMOs) (Getz et al., 2019).

The Fields of artificial intelligence, data science and smart robotics have unique technological and market-structure characteristics which affect knowledge transfer processes :

Technological Characteristics:

- Artificial intelligence and data science technologies are at the core of the broad field of Information and Communication Technologies (ICT), enabling multiple technologies including healthcare, software applications, agriculture, energy, advanced manufacturing, finance, insurance, education and many others.
- Algorithm patenting and patent enforcement is complex. Intellectual proper-ty protection in artificial intelligence and data science (like other topics in in-formation technology) is a challenge and has a different set of rules than those in other fields such as materials, chemistry, engineering and life sciences.
- The rate of technological changes in artificial intelligence and data science is faster than in other technological fields.
- Hospitals and Health Maintenance Organizations (HMOs) differentiate be-tween pharma and medical equipment and data-based technologies. In the field of pharma, commercialization is one step in a multi - year drug discovery process, in response to the need of the patients. In medical equipment, the process often starts with identifying a need, as opposed to data-based processes, in which the data needs to be gathered, arranged, labeled and then analyzed in attempt to draw insights.

- In the fields of artificial intelligence and data science there is a need for data and computing power. Cooperation between academia and industry often includes access to these resources .

Market characteristics

Artificial intelligence and data science are naturally based on data. The global market today has a relatively small number of very large companies (such as Google, Facebook, Microsoft, Amazon and others) which have access to extremely massive amounts of data. Such companies can offer access to their datasets, great computational power, exposure to international research and international recognition, and significant financial compensations to world class researchers choosing to work with them

2. Challenges that Affect Knowledge Transfer Processes

Sample text: The Samuel Neaman Institute is a research institute that focuses on the formulation of national policy on science and technology, industry, education and higher education, physical infrastructure, environment and energy, and other topics of importance to Israel's national strength. The Institute carries out policy studies and surveys, whose conclusions and recommendations serve decision-makers in the economy at all levels. Policy studies are conducted by selected teams from academia, the Technion and other institutions and from the

2.1 Challenges Related to Different Approaches to Applied Research and the Third Mission of Universities

In cases of universities or university researchers lacking commitment to the 'third mission', the industry experts highlighted several challenges:

- There are university researchers who are mainly interested in theoretical or basic research and do not seek collaboration with industry.
- Some researchers refrain from collaborating with the industry because it might interfere with their desire to publish and achieve the scientific excellence required for tenure or promotion.
- Academic leadership at universities does not encourage commercialization.
- There are also challenges that arise from what researchers perceive as industry over-requirements. For example: Industry turn to researchers to be engaged only in incremental development that will solve industrial problems. However, researchers are interested in remaining at the cutting edge of science and technology.

2.2 Challenges Related to Academia and Industry Contractual Relations

These challenges are directly related to the efficiency of commercialization and intellectual property protection processes. Different stakeholders refer to different challenges:

Industry:

- Lack of uniformity across universities, ranging from stringent requirements and inflexible approach to intellectual property in some universities, to more flexible and enabling models in others. Naturally, the industry prefers more flexible models and more favorable intellectual property conditions.
- Expensive financial demands for intellectual property created in the universities .
- The conditions that universities' TTOs/TLOs set for researchers are sometimes perceived as challenging by these researchers. Some researchers argue that universities' IP agreements may even prevent commercial projects .

Healthcare Research Institutes (Digital Health)

Hospitals in Israel, such as Sheba - Tel Hashomer Medical Center and Sourasky (Ichilov) Tel Aviv Medical Center, have recently launched innovation centers associated mainly with digital health, due to the significant differences be-tween commercialization of pharmaceutical technologies and medical devices from that of digital health and medical IT.

The insights and challenges presented by healthcare research institutes are:

- The data found in the healthcare system is an asset that requires investment in collecting, arranging, accessing and in anonymization processes, and therefore its owners are entitled to compensation (this is not always perceived as such by the other parties).
- The best and fastest way for a successful implementation of projects in the field of data science is collaboration of HMOs/hospitals with the industry.
- Collaboration between healthcare providers, industry and academia will only be possible in 'win-win-win' situations

Technology Transfer Offices (TTOs) in Universities

Different Israeli universities have different approaches:

- Some of the TTOs encourage the creation of new intellectual property through consulting processes performed for industrial firms by academia re-searchers. This usually results in an "implied know-how licenses " based on knowledge transfer, rather than in patent applications which is considered more suitable for multidisciplinary fields such as artificial intelligence, in which the researcher's expertise is a key element. Other knowledge transfer contractual models, such as royalty free non-exclusive licensing, are also sometimes applied in the field of artificial intelligence and data science .
- Creating new intellectual property as part of a consulting process is also prevalent in US universities. This model leads to another problem: some of the re-searchers choose to leave the universities being attracted by the benefits that the industry can offer.

2.3 Challenges Related to Lack of Funding and Infrastructure for Translational Research

- Both, industry and universities, have reported the existence of a 'Valley of Death', in which research ends before reaching an appropriate level of maturity or a risk level that the

industry can take on. This happens even though the field of AI is considered an applied field.

- Crossing the 'Valley of Death' requires funds and professional guidance (such as business plan building) .
- Small companies do not have the proficiency of applying and receiving R&D support from government agencies.
- In large companies, there are experts who have in-depth understanding of the processes for applying and getting R&D grants from government agencies. In some cases, these companies are also able to raise funds for developmental activities that would be carried out to complement the working plan of the government supported R&D .
- Knowledge transfer schemes in government agencies in Israel (Kamin, Nofar, Magneton and others) help to narrow the gap between academia and industry.

3. Ways to Overcome Challenges

The industry, academia, and healthcare experts that were interviewed suggest-ed solutions to some of the challenges mentioned above (presented in Table 1):

Table 1: Examples of Ways to Overcome Challenges

Challenges related to different approaches to applied research and the third mission of universities	
Challenge	University researchers who are mainly interested in theoretical or basic research and do not seek collaboration with industry
Possible solution	Encouraging and acknowledging applied research as part of university policy, by mechanisms such as scholarships, diversifying promotion paths to give weight to patents and industry collaborations as well and establishing research institutes / knowledge centers in artificial intelligence, data science and smart robotics in or outside academic institutes

Challenge	Lack of multidisciplinary approach
Possible solution	Academic training courses that will include artificial intelligence (science) together with engineering studies

Challenges related to academia and industry contractual relations	
Challenge	Lack of uniformity across universities
Possible solution	Standardization of contracts (confidentiality, licenses and ownership) along with providing maximum flexibility in each case to achieve win-win situations. Within this solution, collaborations should not be stopped until the recommended contract preparation process is completed (i.e. the contracting process will continue as is customary today until the contract process is finalized).

Challenge	The industry sometimes perceives the high financial expenses that the academy requires for its IP as a barrier to an agreement between them. Researchers sometimes perceive the conditions that universities' TTO/TLO set for them as challenging.
Possible solution	Adopting different technology transfer models such as implied know-how license based on know-how and not on patenting. The extent of consulting, the status of the consultant researcher and the consulting framework are issues that need further examination.

Challenges related to lack of funding and infrastructure for translational research	
Challenge	Both industry and universities have reported the existence of 'Valley of Death', with research ending before reaching an appropriate level of maturity or risk level that the industry can take on.
Possible solution	Continuation of the Digital Health Innovation Support Program (Innovation Authority, Digital Israel, Ministry of Health), to enable companies and hospitals to reduce the risk of technology adaptation

4. References

Getz, D., Katz Shacham, O., Klein, R., Tzezana, R., Rosenberg, S., Shoham, A., Barazani, E., Leck, E., & Tziperfal, S. (2018). Artificial Intelligence, Data Science, and Smart Robotics- First report summary. Neaman Institute, Technion. Retrieved from https://www.neaman.org.il/Files/Summary-ENG-Artificial-Intelligence-Data-Science-and-Smart-Robotics_20190103155717.804.pdf

Getz, D., Katz Shacham, O., Klein, R., Rozenberg, S., & Barazani, E. (2019). Artificial Intelligence Data Science and Smart Robotics. Streamlining the transfer of knowledge from academia and research institutes in the healthcare system to industry. Neaman Institute, Technion (HEB). Retrieved from https://www.neaman.org.il/EN/Artificial-Intelligence-Data-Science-and-Smart-Robotics-First-report-Streamlining-the-transfer-of-knowledge-from-academia-and-research-institutes-in-the-healthcare-system-to-industry

Zahedi, M., Babar, M. A., & Cooper, B. (2018, October). An empirical investigation of transferring research to software technology innovation: a case of data-driven national security software. In *Proceedings of the 12th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement* (p. 10). ACM.

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