Israeli Technology Could Solve the Next Food Crisis

From robotic tractors to satellite photographs, technology is changing the world of agriculture

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Many researchers and professionals around the world warn of worldwide starvation by 2050. Less and less cultivated land will have to supply more food for the population, that is expected to grow two or three-fold by then. Farm lands are being sold as real estate for the expansion of cities. The average age of farmers in the United States in 2007 was 57; thus, the younger generation is abandoning agriculture for more modern and lucrative professions. If solutions are not found for producing an adequate amount of food, then wars will be waged over water and food.

Everyone looks to the world of technology, with the understanding that only a true technological revolution can enable human society to deal with this great challenge. In fact, the last great revolution in agriculture took place in the 1940s and 1950s – the revolution of agricultural machinery. After this came genetic engineering, which encountered fierce public resistance, and has thus failed so far to realize its potential.

The time has now come for the technological revolution to trickle down to agriculture. The beginnings of this move have been seen over the past decade, and it is steadily gaining momentum. The various technological developments which have taken place may now be fused together for the benefit of other, heretofore unexpected uses in agriculture. The advent of the smartphone, the GPS, satellite photographs, robotics and other sophisticated technologies combined with a reduction in their prices and the simplicity of operation of these technologies, as well as the ability to use them in additional areas, open up new possibilities for the agricultural world. Just as Robert Oppenheimer once said; “The history of science is rich in the example of the fruitfulness of bringing two sets of techniques, two sets of ideas, developed in separate contexts for the pursuit of new truth, into touch with one another.”

The immense progress made in computerized vision and image processing is of critical significance in the success of the new technological revolution, called, "precision agriculture". It is thus called because it enables precision in the spatial performance of agricultural tasks, enhancing crops and at the same time economizing the resources needed to produce them.

An organic date grove; Photography: Motti Milrod

Precision agriculture involves flexible thinking, which may be manifested in simpler forms of solutions on the one hand, such as that adopted by Nigerian farmers in increasing the fertility of their parched fields. They use Coca Cola caps for the precise measurement and placement of the proper amount of fertilizer, adjacent to the plant. This solution was developed by researchers from GIAR, which works under the sponsorship of the World Bank, with the goal of eradicating hunger and poverty in distressed regions of the world.

On the other hand, we see the smart technologies of computerized vision and image processing enabling the production of maps of an individual field by means of satellites, airplanes and UAVs, thus providing a complete picture of the field including topographical variance, differences in the type of soil as well as other local conditions such as feed materials and water. Photographs such as these enable the farmer to discern whether a particular field or plot lacks water or nitrogen, or to identify outbreaks of pests or disease in the field.

The ability to utilize local meteorological forecasts and update the farmer with a micro forecast relevant for his own private fields, as well as the ability to adapt the field's cultivation to this forecast, moved Monsanto, a giant corporation dealing in agricultural sustainability, to acquire The Climate Corporation for a billion dollars in 2013.

Getting the most out of the two elements: man and machine

These capabilities fit in well with the area of robotics, the development of which now enables machines to see, diagnose, and respond to needs in the field. As a result, autonomous or semi-autonomous tractors have been developed, which can be operated by the farmer. They perform their tasks while adhering to predetermined routes, or follow the crop rows by cameras, adjusting the implements so as to avoid damage to crops, etc. The application map is fed to the technological systems of the tractor, which operates automatically or semi-automatically in the fields, knowing where, when and at what amount to irrigate, fertilize, and spray pesticide in various dosages.

Blue River of California has developed a robotic tractor that traverses lettuce fields, identifying defective lettuce heads, spraying them with a substance that causes them to wither, enabling the healthy lettuce to grow. California, where 90% of the lettuce consumed in American households is grown, is suffering from a shortage of skilled manpower, which, until now, has performed this work manually.

As with lettuce, human-robotic systems can be developed for more complicated tasks such as automatic orange picking, pruning of fruit trees, and more. Robotic systems with computerized vision guidance may perform difficult, repetitive tasks faster and with greater precision, where the farmer is fed information from the robotic system, and is integrated in the decision making processes. Thus, both elements—man and machine—may be utilized to their maximum effectiveness.

One of the main directions towards which innovative technologies in agriculture are now being implemented is the reduction of loss, which currently diminishes world harvests by up to 30%. Computerized vision technologies discover weeds, diseases and pests as early as possible, in order to prevent serious damage to crops in fields and groves – from the sorting of seeds, to identification and treatment of pests in cultivated areas, and to the harvesting and treatment of produce in packing houses, cold storage of fresh produce and processed foods.

In packing houses, after harvesting, cameras inspect all produce and divides it into groups according to the required storage conditions and quality. This extends storage time and keeps the produce from spoiling. Vision systems are integrated into various stages of treatment of fresh produce and processed foods, such as sorting the good peas from the pod or the best carrot cubes or peanuts at a rate of hundreds of pieces per second. Fish in ponds may be sorted by means of cameras as well.

An opportunity to join the revolution

In Israel there are several companies which have developed innovative systems for the sorting of agricultural produce, such as the Crystal Vision date sorting system developed at Kibbutz Samar in the Arava Valley or the Eshet Eilon sorting systems made on Kibbutz Eilon.

However, all of this is nothing compared to the great potential of technological development in agriculture, and the current acute shortage of such technologies. Israel now has the opportunity to join the revolution, which is currently being led by the major American corporations. The most acute shortage of development of technologies lies in Europe, especially Holland and Italy, with their vast farmlands.

מתקנים של חברת Monsanto צילום Bloomberg

There is much talk about technological innovation in agriculture, but not enough is invested in this channel. The time frame for the development of an agricultural startup is 7-10 years. In order for a technological development to be assimilated in agriculture it must function in unstructured, difficult field conditions. Performance must be reliable and precise, and the price competitive.

The last two to three years have seen a growing interest on the part of investors in Israeli agricultural R&D, on the part of funds such as Pontifax and BIRD, as well as agriculture companies such as FARM of South Africa and Ag Trendlines of Israel. In addition, the Volcani Institute, together with the IAI, is exploring ways of adapting military technologies to agricultural use. The BIRD Foundation has just recently approved two collaborations in agriculture, and increased its activity in initiating and encouraging joint development of agricultural applications by Israeli and American companies.

Over the last few weeks, the Ministry of Economy has made a public appeal to issue tenders for agricultural knowledge aimed at promoting the Israeli agricultural industry. The Ministry has allocated NIS 12 million for the establishment of research centers, for encouraging Israeli startups in various areas of agriculture over the next six years.

Israel's experience in the development of military technologies, its experience in converting them to civilian uses, and the conceptual flexibility and entrepreneurial spirit which characterize us, can enable Israel to once again play a leading role in the development and advancement of world agriculture. These capabilities have yet to be realized in the world of agriculture.

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