The Pharma Innovation Journal 2023; 12(6): 758-761

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(6): 758-761

www.thepharmajournal.com
Received: 12-03-2023
Accepted: 22-05-2023

S Sridevy
Associate Professor, Department of Computer Science, Physical Sciences & Information Technology, AEC&RI, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

M Djanaguiraman
Associate Professor, Department of Crop Physiology, Crop Physiology, Tamil Nadu Agricultural University, Tamil Nadu, India

Corresponding Author:
S Sridevy
Associate Professor, Department of Computer Science, Physical Sciences & Information Technology, AEC&RI, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

A glance at agriculture 4.0: Targeting enhancement of disruptive technologies

S Sridevy and M Djanaguiraman

Abstract
Each of the Industrial Revolutions paced, the agriculture and its allied sector has achieved an increasing trend in the production. Reaching a salvation to the present problems through attaining a stable trend in production as well as in imports and exports have become a key perspective. The articled reviews the needs and challenges of Agriculture 4.0 by demanding the computer science graduates to enhance the disruptive technologies in Agriculture.

Keywords: industrial revolution, agriculture 4.0, disruptive technologies

1. Introduction
Agriculture is the science and art of cultivating plants and livestock and was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that enabled people to live in cities. The history of agriculture began thousands of years ago. So traditional agriculture changed its form as Agriculture Industry so as to meet the demands of society today. This industry is progressing to fulfilling its goals through amalgamating disruptive technologies thus demanding the revolution on par with the industry revolution and destined to Agriculture 4.0. This article gives a glimpse of what Agriculture 4.0 to expose the computer science graduates to update the disruptive technologies leveraged in agriculture.

2. World Government Summit
The world government summit is a global platform dedicated to shaping the future of governments worldwide. Each year, the summit sets the agenda for the next generation of governments, focusing on how they can harness innovation and technology to solve universal challenges facing humanity.

2.1 Oliver Wyman
Oliver Wyman is a leading global management consulting firm founded in 1984, the firm adopted its current form in May 2007, when Mercer Oliver Wyman joined with Mercer Management Consulting and Mercer Delta to become one firm named Oliver Wyman. It is part of the Oliver Wyman Group, a business unit of Marsh & McLennan. Oliver Wyman combines deep industry knowledge with specialized expertise in strategy, operations, risk management and organization transformation.

The World Government Summit launched a report called Agriculture 4.0–The Future of Farming Technology, in collaboration with Oliver Wyman for the 2018 edition of the international event. The report addresses the four main developments placing the pressure on agriculture to meeting the demands of the future:

- Demographics
- Scarcity of natural resources
- Climate change and
- Food waste.

3. Agricultural Industry Challenges
3.1 Demographics
In the coming decades, world population is expected to grow to by 33 percent, to almost 10 billion by 2050, up from 7.6 billion (as of October 2017). By 2100, the global population is expected to reach 11.2 billion.

That figure may understate actual fertility rates-under other scenarios, population could hit 16.5 billion.
Population growth will boost demand for food, even in a modest economic growth scenario, by roughly 50 percent as compared to 2013 agricultural output.

3.2 Natural Resources
The world's farmland is becoming increasingly unsuitable for production: On the basis of certain metrics, 25 percent of all farmland is already rated as highly degraded, while another 44 percent is moderately or slightly degraded. Water resources are highly stressed, with more than 40 percent of the world's rural population living in water-scarce areas. Land has long been recognized as a finite resource, but in earlier times degraded farmland would simply be replaced by bringing new, unused land into cultivation. Such lands are rare nowadays, and what remains often cannot be farmed on a sustainable basis. Land shortage has resulted in smaller farms, lower production per person, and greater landlessness-all adding to rural poverty.

3.3 Climate Change
Climate change is a fact—and it is rapidly altering the environment. The degree of manmade emissions of greenhouse gases (GHGs) has reached the highest in history, according to a 2014 report of the Intergovernmental Panel on Climate Change (IPCC).

3.4 Food Waste
Between 33 percent to 50 percent of all foods produced globally is never eaten, and the value of this wasted food is more than $1 trillion. To put that in perspective, US food waste represents 1.3 percent of total GDP. Food waste is a massive market inefficiency, the kind of which does not persist in other industries.

4. Agriculture Revolutions
4.1 Agriculture during the first industrial revolution
In the 18th and 19th centuries, people started move away from farms and into the cities, where new types of employment were becoming available which led to the farm labour scarcity. Hence the first industrial revolution moved agriculture from agrarian society dependency to mechanisation.

4.2 Agriculture during the second industrial revolution
The second industrial revolution led to the advances such as telephones, light bulbs, diesel engines, airplanes, the Model T and the introduction of assembly lines. Improvements in transportation, especially the expansion of railways, helped to move farm inputs, farm produces, livestock, farming machinery expanded farm markets and made farming more efficient.

4.3 Agriculture during the third industrial revolution
The third industrial revolution, also called digital revolution saw technology advancing from mechanical and analog to digital. Agricultural technology experienced many advances. Farmers started using high-yielding varieties (HYVs), insect- and weed-resistant crops, effective fertilizers and pesticides. Satellite technology and biotechnology enabled farmers to increase their produces as well as record and analyse their production.

4.4 Agriculture during the fourth industrial revolution
Forth Industrial Revolution or Industry 4.0, articulated around the concept of the denominated “Smart Factories” where machines and systems are interconnected with the premises themselves under de leitmotiv of the search of adaptability and efficiency of production system.
In this frame, information is the driver of processes and is obtained thanks to continue data acquisition from sensors deployed all around the place, the availability of high-performance communication networks, high capacity of storage and, processing and analyses of the data to convert them in information.
The Forth Industrial Revolution starts to be present as Agriculture 4.0 in farming scope by means of Smart Farms, that, similar what is happening with Smart Factories, pursue the interconnection of machines and systems with the premises, in this case, agricultural parcels and first processing facilities.

4.5 Agriculture 5.0
Agriculture 5.0 will be based on the integration of robotics and artificial intelligence. It could be visualized that it is going to be a revolutionary scenario of fully robotised agriculture from farm to fork.

5. Agriculture 4.0: Disrupting the system is doable with new technologies
The goal of Agriculture 4.0 is the adaptability of production systems, to improvements in crop rotation to obtain better production levels, and, in the other hand, efficiency of production systems, by means of optimization in the use of water, fertilizers and phytosanitary products, originating what is denominated as Precision Agriculture. In this scenario, information is again the driver axis of processes. However, challenges are quite different from those of industrial environment. At the same time, the use of disruptive technologies in agriculture called as future technologies like remote sensing and geographical information systems, internet of things (IoT), cyber physical systems (CPS), plant and animal genomics, advanced data analytics etc. could lead to farming practices more productive and precise in deployment and thus more sustainable agriculture.

6. Applications of Disruptive Technologies
6.1 Crop production forecasting: To forecast the expected crop production and yield over a given areaand determine how much of the crop will be harvested under specific conditions. Researchers can be able to predict the quantity of crop that will be produced in a given farmland over a given period of time. Thereby directing the farmers to cultivate right crop for the forthcoming season in order to increase farmers income and ensure food availability.

6.2 Assessment of crop damage and crop progress: assessing the crop damage due to diseases, nutritional deficiency, weed infestation appropriate site specific, time specific agronomic practice recommendation can be given to the farmers in order to increase the yield.

6.3 Crop Identification: when the crop shows some mysterious characteristics, the data from the crop is collected and communicated to the labs where various aspects of the crop including the crop culture are studied. Based on which the agronomic practices are recommended to the farmers to protect the crop.

6.4.Identification of planting and harvesting dates: Because of the predictive technology available especially the IoT data integrated with meteorological data and big data analytics farmers can now observe a variety of factors including the weather patterns and the soil types to predict the planting and harvesting seasons of each crop.

6.5 Crop yield modelling and estimation: Allows farmers and experts to predict the expected crop yield from a given farmland by estimating the quality of the crop and the extent of the farmland. This is then used to determine the overall expected yield of the crop.

6.6 Identification of pests and disease infestation: plays a significant role in the identification of pests in farmland and gives data on the right pests control mechanism to be used to get rid of the pests and diseases on the farm.

6.7 Soil moisture estimation: Soil moisture can be difficult to measure without the help of technology and gives the soil moisture data and helps in determining the quantity of moisture in the soil and hence the type of crop that can be grown in the soil.

6.8 Irrigation monitoring and management: Moisture quantity of soils is used to determine whether a particular soil is moisture deficient or not and helps in planning the irrigation needs of the soil.

6.9 Soil mapping: Soil mapping is one of the most common yet most important uses in farming. Through soil mapping, farmers are able to tell what soils are ideal for which crops and what soil require irrigation and which ones do not. This information helps in precision agriculture.

6.10 Monitoring of droughts: Remote sensing technology is used to monitor the weather patterns including the drought patterns over a given area. The information can be used to predict the rainfall patterns of an area and also tell the time difference between the current rainfall and the next rainfall which helps to keep track of the drought

6.11 Climate change monitoring: play an important role in the determination of what crops can be grown where.

7. Challenges of agriculture 4.0

7.1 Implementation of sensors on field: It´s true that, in theory, we can deploy as many sensors as we wish, but there are two main problems: energy supply for sensors, that can be solved using low-consumption sensors and alternative mechanisms to answer energy needs; and the transfer of data to the storage and processing systems, that could be difficult to solve in environments where broad-band networks (3G and superior) are practically inexistent and, sometimes, there are not even 2G coverage.

7.2 Leveraging drone technology: Although some big factories have already started to use drones to get data, it is in farming context where obtaining long distance data is really efficient and profitable. Satellites and drones are today and in years to come basic tools to get necessary data to support agriculture development.

7.3 Data storage and processing are very relevant issues: A drone equipped with a last generation camera is able to cover 200 Ha in about two hours taking data with 2 cm2 resolution. That means about 50 million of points with several data level. Their processing is not obvious and remote sensing, a disciple that has been developing potent basis over big processing systems (supercomputers) for years, faces now the challenge to be able to offer massive-consumption services.

7.4 The interconnection of all the elements among them and with de territory: Over the basis of the implementation of cloud-based services, the barrier outlined before regarding to the availability of connection to high capability mobile communication networks, requires the development of ad-hoc systems capable of providing access to services in situations of low or inexistent coverage. In addition, it´s necessary to address the psychological barrier that has always existed among professionals of farming sector to incorporate new technologies to their daily work, by applying a high level of empathy to design experiences in accordance with their necessities and working environment.

8. New trend in agriculture 4.0: Cyber Physical Systems (CPSS): Cyber-physical systems (CPSs) are interconnected systems of physical, autonomous and intelligent components able to monitor and interact with physical entities by managing data flow and operations. The CPSs have been applied in a wide range of domains including industrial control systems and factory automation, energy production and management, traffic control and transportation systems, public safety, healthcare and assisted living applications, food control and precision agriculture. The CPSs demonstrate their capability to enhance the performance obtained by simple recent embedded systems and introduce a new class of collaborative systems.

Agricultural cyber-physical systems (ACPSs) are the agricultural scenario applications of the CPSs. The applications are based on advanced electronic technologies and agricultural facilities to build integrated farm management systems that are able to interact with the physical environment in order to maintain ideal environmental values. They are expected to be able to gather the essential and appropriate information about climate, soil and crops, with high accuracy. The gathered data are used to manage the external resources such as watering, humidity, plant health etc.

9. Conclusion

Challenges based by the agricultural industry is to be given with prime importance in giving solution is obvious. The agricultural revolution must ensure not only food availability, safety and security but also having a responsibility of preserving the natural resources and as well protecting the environment. The future with interdisciplinary integration of technologies need to be developed and deployed to assure the life in future generation. Non-agricultural discipline professionals need to be educated to preserve nature and feed the future.

10. References

1. https://www.worldgovernmentsummit.org
2. https://www.oliverwymangroup.com
3. https://en.wikipedia.org/wiki/Oliver_Wyman
4. https://www.oliverwyman.com/our-expertise/insights/2018/feb/agriculture-4-0--the-future-of-farming-technology.html
5. http://foundations.uwgb.org/agriculture/
6. https://www.cambridge.org/core/books/cambridge-economic-history-of-modern-britain/agriculture-during-the-industrial-revolution-17001850/5DBC1F2D7CDDE24E0806D0C1602B68FB
7. https://www.slideshare.net/DishantJames/agriculture-40-the-future-of-farming-technology/6
8. https://www.geoslab.com/en/blog/agriculture-40-industry-40-technologies-farming-context
9. https://www.researchgate.net/publication/319351677_The_Revolution_of_Agriculture_40_and_Sustainable_Agriculture_Development_in_Vietnam
10. https://www.eolasmagazine.ie/disruptive-technology-in-agriculture-alternative-futures/
11. https://grindgis.com/remote-sensing/remote-sensing-applications-in-agriculture
12. https://www.oliverwyman.com/content/dam/oliver-wyman/v2/publications/2018/February/Oliver-Wyman-Agriculture-4.0.pdf