Towards Future Farming: The Emerging Trends

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Agriculture, like every other element of our modern life, is being influenced by technology. In its most basic form, technology can be defined as a set of skills that enable us to create items and machines to meet our requirements. Agriculture technology, commonly known as AgTech, has revolutionized the business in recent years. Farming technology is assisting farmers in increasing efficiency and production. Harvest automation, autonomous tractors, planting and weeding, and drones are just a few of the primary technology used by farms. In the coming years, emerging technologies have the potential to completely revolutionize the agricultural environment. On a small and large scale, emerging technologies ranging from robots to machine language have totally altered modern agriculture. They'll take farming to new heights. We may explore new ways to grow and provide food to the public by introducing these game-changing technologies. Engineers are investigating automation as a means to cut expenses and improve quality in greenhouses dedicated to fruit and vegetable production.

In today's agriculture, technological improvements are critical to achieving sustainability goals. Satellite and GPS technologies, sensors, smart irrigation, drones, and automation, to name a few, all contribute to precision agriculture, which aids in resource efficiency. They reduce the usage of toxic agrochemicals while also assisting in the conservation of non-renewable resources. They also assist farmers in preparing for unseasonal or extreme weather events days in advance, lowering crop losses during such events.

The Technologies Of Future

Farmers are under pressure to produce more with less in order to feed a growing global population, reduce environmental threats, cope with rising global temperatures, survive water and energy shortages, and meet the new food preferences of a growing generation of digital natives and tech-savvy customers. Emerging technology may be able to assist in addressing these issues. We'll look at some of the newest agricultural technology [1-5].

1. Vertical farming:

Vertical farming has made its way to the city. Indoor vertical farming is the process of producing vegetables in a closed and regulated environment, layered one on top of the other. Artificial lights are utilized in place of natural sunlight in the growing process. Within a decade, vertical farming will not only be technically possible, but also commercially viable. It is a type of urban agriculture that produces food in layers that are vertically stacked. It isn't only restricted to metropolitan settings. It can be applied to any situation in order to make better use of available land. Vertical farming can boost agricultural yields, overcome land

constraints, and lessen farming's environmental impact. Indoor farms are becoming more popular in the United States as a result of their ability to grow year-round [6].

2. Smart farming:

Agriculture's future is bright. Smart farming is a use of Internet of Things (IoT) technology. They entail collecting real-time data on weather, soil, crop maturity, equipment, and labour costs in order to use predictive analytics to make better agricultural decisions. The use of information and communication technology (ICT) to improve and automate agricultural processes and operations is referred to as smart farming. All of these components of precision agriculture are covered by smart farming technologies. It is applicable to both small (family farming) and large (complex family farming) farms, as well as organic farming. Traditional agricultural techniques are being replaced by smart farming, which is more efficient, consistent, and reliable. Its goal is to improve the efficiency of specific farming tasks. It makes use of wireless sensor networks to continuously monitor soil qualities and environmental conditions. It uses a smart irrigator system to spray the required nutrients according to the crops' needs [7].

3. Sensor technology:

This is by far the most widely used technology. Farms are finding it cost-effective to strategically deploy sensors around their land in order to gain a variety of benefits. Farmers can observe their crops from anywhere in the world thanks to sensors and image recognition technology. Agriculture benefits from sensors since they allow for real-time traceability. They would provide a real-time picture of the current state of a farm, forest, or body of water. They assist in the management and monitoring of livestock and crop production. They also contribute to the farm's environmental sustainability by conserving water, controlling erosion, and lowering fertilizer levels in local rivers and lakes.

4. Drones:

Drones are multipurpose airborne vehicles that are autonomous or remotely controlled and propelled by aerodynamic forces. They are gadgets that can fly for an extended period of time without the presence of a human on board. Drones are increasingly being employed in agriculture as creative instruments. A plane or a drone is the only method for farmers to gain a bird's eye perspective of their land. Drones are used to monitor crops and spray chemicals on them. They can also create 3D images that can be used to anticipate soil quality. Drone sensors can be used to monitor crop health, soil health, and weed detection in crops. AgEagle, AeroVironment, and Sentera are among the agricultural drone producers [8].

5. Radio Frequency Identification (RFID) technology:

It refers to technology that identify objects, animals, or humans using radio waves. RFID has found uses in a variety of fields due to its low energy consumption and flexibility to various settings.

Drones	Vertical farming

Sensor technology

Machine learning in Agriculture

Robots

Robots

Radio frequency waves are used to identify and track tags attached to items. RFID is used to track a wide variety of objects. Agricultural stocks can be managed with RFID tags and RFID readers. As an example, barcode on a bag of rice can be scanned with a smartphone to obtain information about the rice.

6. Robots:
These are generally called as Agbots. Robotics is the employment of robots or automated equipment to undertake physical tasks instead of humans. Farmers use robots to automate agricultural tasks that were previously thought to be too delicate for robotics, such as harvesting, fruit picking, soil care, weeding, planting, irrigation, spraying, weeding, and so on. Robots increase productivity and thereby increase yields. They also lower the number of people on the job [9].

7. Machine Learning:
Machine learning (ML) is a new branch of artificial intelligence (AI) that has applications in agriculture. It is the process of automatically detecting meaningful patterns in a set of data. Modern agriculture tries to conserve water, better utilize nutrients and energy, and adapt to climate change. In agriculture, machine learning enables for more precise disease diagnostics and crop disease prediction. Farmers are using AI and machine learning algorithms to comb through data and derive valuable insights that will help them enhance efficiency, production,

and yields. Agriculture's manufacturing sector can potentially benefit from machine learning algorithms [10].

Benefits:

The agricultural industry is advancing thanks to technological advancements. It's an exciting moment to be a farmer, thanks to rising technologies. Microsoft, the computing behemoth, is now venturing into agriculture. Its agricultural experts are aiming to improve the growth of a wide range of food crops.

- By allowing producers to boost output, technologies increase productivity and competition.
- More land can be farmed in a single growing season than ever before.
- Food is healthier and cheaper when water, fertilizer, and pesticides are used less.
- Machines can be used to sow seeds and harvest crops, minimizing the amount of effort required by farmers.
- Notify farmers of impending storms or other potentially hazardous weather conditions.

Conclusion:

Agriculture has changed dramatically during the last century as a result of the use of contemporary technologies. New machinery and process techniques for production, postharvest management, and agribusiness are being developed as a result of these innovations. They're also leading to agricultural technologies that make farming more sustainable, profitable, and competitive. The agricultural business will continue to be pushed towards technological advancements by the problems posed by today's and tomorrow's global food demand. Despite the fact that new and emerging technologies have the potential to help farmers (who are facing increasing pressures such as climate change, land scarcity, animal feed availability, price stress, and soaring input costs), a number of economic, infrastructure, and regulatory barriers prevent farmers from adopting them. [11-18].

References:

1. Lova Raju, K., & Vijayaraghavan, V. (2020). IoT technologies in agricultural environment: a survey. *Wireless Personal Communications*, *113*(4), 2415-2446.
2. Sadiku, M. N., Ashaolu, T. J., & Musa, S. M. (2020). Emerging technologies in agriculture. *Int. J. Scient. Adv*, *1*(1), 31-34.
3. Newman, D. (2018). Top six digital transformation trends in agriculture. *Forbes Web*, *14*.
4. Russo, J. (2013). Top 5 trends in agriculture technology. *March2013, http://www. croplife. com/management/top-5-trends-in-agriculture-technology*.
5. Ku, L. (2019). New agriculture technology in modern farming. *Plug and Play Tech Center*.
6. "Six technology trends in farming this year," https://www.21stcentech.com/agriculture-new-technologies-food-security-21st-century/
7. Walter, A., Finger, R., Huber, R., & Buchmann, N. (2017). Opinion: Smart farming is key to developing sustainable agriculture. *Proceedings of the National Academy of Sciences*, *114*(24), 6148-6150.
8. "Agricultural drone," *Wikipedia*, the free encyclopedia, https://en.wikipedia.org/wiki/Agricultural_drone.
9. "4 Agriculture technology projects to transform the industry," http://ennomotive.com/agriculture-technology-projects/
10. M. N. O. Sadiku, C. M. M. Kotteti, and S. M. Musa," Machine learning in agriculture," *International Journals of Advanced Research in Computer Science and Software Engineering,* vol. 8, no. 6, June 2018, pp. 26-28.

11. Yahya, A. (2020). *Emerging Technologies in Agriculture, Livestock, and Climate*. Springer.
12. National Research Council. (2009). Science and decisions: advancing risk assessment.
13. Subramanian, B., Chen, S. S., & Reddy, K. R. (2020). *Emerging Technologies for Agriculture and Environment*. Springer Singapore.
14. Ahmad, P., & Rasool, S. (2014). Emerging technologies and management of crop stress tolerance.
15. Yamano, T., Otsuka, K., & Place, F. (Eds.). (2011). *Emerging development of agriculture in East Africa: Markets, soil, and innovations*. Springer Science & Business Media**.**
16. Einsiedel, E. F. (Ed.). (2009). *Emerging technologies: From hindsight to foresight*. UBC press.
17. Toronto, Canada: UBC Press, 2009. A. Rakshit (ed.), *Emerging Innovations in Agriculture: From Theory to Practice*. Athens, Greece: Athens Institute for Education and Research. 2015
18. Goyal, M. R. (Ed.). (2017). *Emerging technologies in agricultural engineering*. CRC Press.