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INNOVATIVE DEVELOPMENT OF THE AGRO-INDUSTRIAL COMPLEX ON THE BASIS OF DISRUPTIVE TECHNOLOGIES

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Technological progress has led to the emergence of new disruptive technologies: mobile Internet, artificial intelligence, Internet of things, cloud technology, advanced robotics, autonomous and semi-autonomous vehicles, next-generation genomics, energy storage, 3D printing, advanced materials, renewable energy, exploration, advanced oil and gas exploration and recovery. Implementing most of them in the agro-industrial complex (AIC) should be considered promising. These technologies will provide a way out of crisis in the cluster, as well as innovative development, radically transforming the agricultural sector.

In recent years, the adoption of digital technologies in precision agriculture has been adjusting the ways that farmers treat crops and manage fields. One doesn't have to be an expert to see how the technology has changed the concept of farming making it more profitable, efficient, safer, and simple. Among other technologies, farmers have picked five they seem to be the best:

- GIS software and GPS agriculture;
- Satellite imagery;
- Drone and other aerial imagery;
- Farming software and online data;
- Merging datasets.

As a result, modern farms get significant benefits from the ever-evolving digital agriculture. These benefits include reduced consumption of water, nutrients, and fertilizer, reduced negative impact on the surrounding ecosystem, reduced chemical runoff into local groundwater and rivers, better efficiency, reduced prices, and many more.

- **GIS-Based Agriculture**

Since fields are location-based, GIS software becomes an incredibly useful tool in terms of precision farming. While using GIS software, farmers are able to map current and future changes in precipitation, temperature, crop yields, plant health, and so on. It also enables the use of GPS-based applications in-line with smart machinery to optimize fertilizer and pesticide application; given that farmers don't have to treat the entire field, but only deal with certain areas, they are able to achieve conservation of money, effort, and time.

Another great benefit of GIS-based agriculture is the application of satellites and drones to collect valuable data on vegetation, soil conditions, weather, and terrain from a bird's-eye view. Such data significantly improves the accuracy of decision-making.

- **Satellite-Derived Data**

Predicting yields, as well as conducting almost real-time field monitoring, with a view to detect a variety of threats with satellite data in service has never been so easy.

The sensors are able to give imagery in various spectra, allowing for the application of numerous spectral indices, such as the Normalized Difference Vegetation Index (NDVI). NDVI allows for the detection of vegetation content, the amount of wilting plants, and overall plant health. Next is the Canopy Chlorophyll Content Index (CCCI) that helps with nutrient application. Then, the Normalized Difference RedEdge (NDRE) detects Nitrogen content. And lastly, the Modified Soil-Adjusted Vegetation Index (MSAVI) is designed to minimize soil background impact at the earliest developmental stages of plants; the list goes on.

- **Data From The Sky – Drones**

With the assistance of drones farmers have an opportunity to define crop biomass, plant height, the presence of weeds, and water saturation on certain field areas with high precision. They deliver better and more accurate data with higher resolution in comparison to satellites. When they are locally operated, they provide valuable information even faster than scouts. Drones are also considered to be unrivaled aides in the battle against insects; the invasion is prevented by applying the insecticide on the hazard areas using drones, all while reducing the likelihood of direct exposure leading to chemical poisoning.

Despite the fact that drones are easy to use and are capable of collecting large amounts of data within short time frames, there are still challenges when using them on a constant basis as they don't come cheap. Drones are almost helpless where mapping or monitoring of large areas is required, and it is better to complement the technology with satellite monitoring among already mapped areas, where specific zones need to be cross-checked.

- **Online Data – The Key To Precision Farming**

To simplify field observation, EOS has designed Crop Monitoring – a digital Platform that employs satellite monitoring in order to speed up a farmer's decision-making so that he does not miss a crucial point of field treatment.

- **Crop Monitoring allows the use of the Normalized Difference Vegetation Index (NDVI) for tracking crop health.** This index monitors the amount of chlorophyll in plants which makes it possible to obtain information about their condition.
- **Another important feature of Crop Monitoring is a Scouting app.** It is both a mobile and desktop app that employs digital field maps. While using this app, a farmer is able to assign multiple tasks to scouts in few clicks activities etc., immediately making records in the app.
- **Weather analytics.** By analyzing weather data in-line with the data on plant condition obtained from satellite imagery, farmers can precisely apply irrigation and prevent frost or heat damage.
- **The strongest benefit of Crop Monitoring is the fact that it is based on satellite imagery.** It helps to analyze field conditions or the state of specific areas and extract valuable information on-the-fly, thereby speeding up optimal reaction time as well as making reliable decisions –

what crops to plant, when to harvest, how to effectively plan for the next season, what amount of nutrients and fertilizers apply, and many more.

- **Combining Data**

Occasionally Crop Monitoring has to mash various data sets in order to get valuable insights for your fields. For a start, the user is able to compare the performance of his field with the average performance of all fields in the given district. To face this challenge, multiple datasets obtained from all of the fields in your district are compared. For now, such comparisons are only available using the NDVI vegetation index, but in the near future we will expand the analytical opportunities of the Platform by adding new indices.

The next valuable feature that employs numerous data sets is weather data analysis.

“Winter kill” notifies you about low temperatures that threaten your winter crops.

“Cold stress” highlights the days when the temperature dropped below -6 ℃ to assess the damage to early crops from frost.

“Heat stress” reflects the days with temperatures above +30 ℃ to assess the damage from heat stress.

The feature provides the ability to monitor precipitation and temperature as well.

Promising agricultural technologies are moving into the future by leaps and bounds. They offer substantial help for farmers in their endeavour for optimizing inputs, simplifying farm management, and increasing productivity. Increased yields, as well as reduced maintenance costs, help boost profit margins. In the context of smart solutions, precision agriculture offers a Swiss army knife of farming techniques for today’s, and tomorrow’s farmers.

References

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