The need for introducing new technology in agriculture to ensure a sustainable future

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Abstract. This article discusses the need to integrate new technologies into agriculture. Precision Agriculture and its use in modern agriculture is reviewed. With changing weather and growth of population, sustainable agriculture is a priority. Therefore, the article focuses on the approaches utilized in agriculture to increase both yield and profitability of farmers and similarly reduce production cost. Global Position System, Variable Rate Technology and Autosteer are covered as they are the commonly used components of Precision Agriculture. Illustrated results showed, that Precision Agriculture proved to be effective when used properly.

1. Introduction
Recent decades can be directly related to the enormous improvements that they have brought to society by introducing life changing technologies. The new emergences can be named as follows: artificial intelligence, Blockchain, collaborative robots, the Internet of Things and many more. These new emergences are broadly utilized in every aspect of human being. The usage of these can be found in varies areas such as manufacturing, business, education, healthcare, agriculture etc. The implementations of them guarantees, if in a skilled hand, automatization of all processes and thus boosting the production rate. By employing these technologies one can obtain cost cut, reduction of time waste, easy access to all data and control over the systems. The technologies’ advantages vast if correctly used. As mentioned earlier, the implementation of new emergences in different fields are endless. Therefore, this work will go into narrative study and look into the usage of inventions in agriculture.

Agriculture is more complex and diverse in the modern time than it was previously. At the early stage, the most valuable consistency of agriculture was crops (rice, wheat, corn etc.), meat animals (sheep, goats, pigs and so on), poultry and animal products. However, at present, agriculture depend on new appliances and uses engineering and both physical and biological sciences [1].

The implication of new technology in agriculture provides much higher yield and optimizes the work flow. Nevertheless, the usage of them needs to be implemented even more, by covering all the vital parts, that can be automated and digitized [2]. Therefore, sustainability will be in control. The biggest concern related to agriculture sustainability is population growth and global warming. Overpopulation already hit its highest peaks and it is continuous to be challenge in some countries. According to data gathered by the researchers shows, that by 2050 overpopulation will reach around 9 billion people. Consequently, to meet the demands of overpopulation, food production needs to be increase by 70 % [3,4]. It is not a secret, that the climate change is already happening and it is getting worse over the years...
and certain action needs to be taken to lessen greenhouse gas emissions. Changing weather condition will directly lead to reduction in food (food production). Similarly, food production is directly influencing on the global warming, and not in the positive way [5]. It was estimated that agricultural emissions, make approximately 25% of global greenhouse gas emissions. Henceforth, it can be said that the essential for higher rate growth of food product not the only problem to face in the future, but the necessity of finding ways to decrease greenhouse gas emissions as well.

To conclude, sustainability and improvements of agriculture are in demand as the population is growing rapidly and weather patterns are changing each coming year. Therefore, the implementation of technology into agriculture is essential, not just for the boosting of the production rate only, but also implementing technology that will reduce the effect (greenhouse gas emissions) on the environment.

2. New emergences used in agriculture

Here and forth the implementation of the new emergences (invention/technology/appliances) in farming will be covered. The types of appliances used and their benefits to farming.

The main three mechanisms that are required for digitization and further progress in agriculture are the Internet of Things, nanotechnology and digital education. In the present days, Precision Agriculture (PA) is used for improvement and digitalization in farming. PA is considered one of the main elements of the third wave of the modern agricultural revolution. First revolution in agriculture occurred at the beginning of the 19th century with the advancement of machinery. The second one came at the end of the 20th century with the occurrence of genetic modification methods and it was named as Green Revolution (GR). The second revolution or GR, with its advantages, also brought some drawbacks. The negative influence on the environment associated not just by increase in GHG emissions but also with land degradation, which makes it barren for future crops. Therefore, the need for eco-friendly approach is required and PA is a promising integration. The development and implementation of PA differs in different parts of the world. The method was first utilized in the USA, Canada and Australia. Likewise, UK, France and Latin America followed [6]. Summing up, the new approach is in the demand, to sustain the future needs, with the population rise and Global warming.

There are various components and devises which goes into PA. However, this article will cover only frequently used: GPS (Global Positioning System), VRT (Variable Rate Technology) and Autosteer.

2.1. Global Positioning System

The Global Position System is a navigation system, that utilizes satellites to track precise position data. The GPS is used to gather the correct position data in real time, which allows the user to analyze large geospatial data. The collected geospatial data can be utilized to study the needs of the soil and plants and, thus, choose the right actions to eliminate the problem. Precision Agriculture utilizes not just GPS itself, but also products (components/equipment) that use GPS. Under the guidance of GPS, machineries can be used to lessen the number of human interaction and, thus, reducing the human errors. Under the direction of GPS, farmers are now able to work day and night, in difficult conditions (dust, rain, fog etc.) that before constrained the working processes. The usage of GPS is vast and similarly its role in Precision Agriculture. Technology can be the key point of optimization, sustainability and reduction of GHG emissions [7].

2.2. Variable Rate Technology

Variable Rate Technology, as the name implies, gives capability to the applicants to use different fertilizer rate for different parts of the field. From ancient times to the present day, the application of fertilizers in farming has remained commonplace. Fertilizer application can be automated with proper use of Variable Rate Technology with its components. In order for the method to work in full mode, a combination of the following elements is necessary: computers, specific software, fertilizer equipment and GPS. In addition, for the Variable Rate technology to work properly, the correct data must be provided. Data for Variable Rate Technology can be calculated (gathered) using map-based or sensors-based approach. In map-based approach, a map is generated and the necessary data is imbedded [8].
This means that fertilizers will be applied in the specific selected area in the map where they were input. Sensor based approach is relied on data that is collected in the area where the sensor is installed. Both approaches are used in Variable Rate Technology, and both differ in the data gathering and specifics of use. Therefore, the implementation of Variable Rate Technology requires knowledge of the technique itself and decision making as well.

2.3. Sensors
Sensors in PA are used to monitor and send real-time information about area where they are installed. PA is all about automation and easy access to all processes and data, which ultimately leads to increased crop yields. Similarly, results in reduction of cost. For example, at the very beginning, crops are monitored by the usage of sensors and thus, any deviations are detected at an early stage. This allows one to gather abnormalities data and take actions. There are various types of sensors: optical, electrochemical, location, dielectric soil moisture etc. [9]. Each one of them has its own task, and in skillful hand they can positively effect agriculture.

2.4. Autosteer
Like any new technology, Autosteer offers many agricultural benefits. Autosteer is used in PA to automate vehicles (tiller, combine, planter etc.). The implementation of the technology allows farmers to reduce cost associated with fuel, overuse of chemicals, human error etc. [10].

For more efficient use of the new emergences, one needs to understand that these technologies intersect each other. Therefore, to maximize yields, technology must be correctly employed. With the unity of technology comes the weakness. If one piece of the whole system is broken, it can effect the overall system. Hence, skilled workers are required to monitor (analysis) the system.

3. The profitability of using precision agriculture
This paragraph focuses on the profitability of employing PA. It is known that the implementation of new emergences (inventions) requires a large amount of investment and transaction from traditional to PA can be complex and not profitable at the moment. However, over time, PA will profit in growth of productivity and lessen cost and material waste etc. As the first users of PA, the following countries- USA, Canada and UK have high market shares in the global PA market according to the “Report and Data”. North America holds 41.2% of the global PA market share, followed by Europe and the Asia-Pacific region with a market share of 36.9% and 17.2%, respectively. Suggesting that the use of PA increases yield and thus profitability.

![Figure 1. Use of PT over time.](image-url)
Similarly, according to the data, it was estimated that in 2018, the market income from PA was approximately $5.3 billion. And it is predicted that at each coming year (from 2019 to 2026) CAGR will be around 12.3% [11]. By the data collected “Allied Market Research” in 2016, profits in 2022 will amount to $7.8 billion, and CAGR during this period around 14.9% [12]. By observing the figure 1 [13], one can see that the use of new appliances is increasing every year. There are some dawns, but overall an increase is observed. As mentioned before the implementation of PA in agriculture might be complex and expensive, but ones the process is correctly set up.

4. Conclusion

In conclusion, the following work was carried out to illustrate the importance of integrating new technologies into agriculture. Precision Agriculture in agriculture was analysed. With population growth and changing weather, technology promises to sustain agriculture with these events.

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