Deepanjali Gerangal

BTR 820

19 July 2018

Annotated Bibliography

Precision Agriculture: The Future of Farming

The goal of precision agriculture is to ensure profitability, food sustainability and protection of environment. The summaries presented below, cover a wide variety of information about precision farming practices from its history to present day applications and future aspects. Precision agriculture is being practiced commercially since 1980s and farmers have been taking advantage of saving their resources to grow better crops ever since. The availability of various types of remote sensing technologies in the market has helped farmers to get access to better information and farming methods. Drones are being used for various field works such as monitoring live farms, collecting images, spraying pesticides and analyzing soil and plant breeds. Researchers are working to advance this technology due to its highly useful applications. The global climate changes are negatively impacting the agricultural sector as farmers don’t have sufficient resources to grow crops. The data collected using precision agricultural practices can be used to determine best farming methods which can be adopted during challenging weather conditions. Even with such advancements, many countries in the world have not adopted the latest farming practices. Farmers come across literacy barriers while seeking help to adopt precision agriculture.

Bilali, Hamid El, and Mohammad Sadegh Allahyari. “Transition towards sustainability in agriculture and food systems: role of information and communication technologies.” *ScienceDirect*, 2 July 2018, <https://www.sciencedirect.com/science/article/pii/S2214317318301367>. Accessed 10 July 2018.

In this article, authors write about food sustainability and how digitization is one of the most important transformation processes in agriculture. The document begins with the introduction of information and communication technology (ICT). It includes mobile/cloud computing, Internet of Things, remote sensing, drones and other technologies used in agriculture which makes it a building block for sustainable farming practices. Many farmers around the world are using big data to improve crop productivity. Precision farming technologies are currently rising up with an expected annual growth rate of 12% by 2020. It helps farmers to understand the composition of their field and enables them to use less resources to generate more crops. ICT is also used in facilitating retailing ways to allow better coordination of food distribution. It is claimed that ICT have the capability of increasing the transparency of supply chains and traceability of agro-food products. Despite of these positive implications of ICT, it can also bring some negative impacts. The article entails more details about these impacts, some of which include generated e-waste, disconnecting producers and consumers through virtual relations, and many others. ICT do come with some challenges along with its benefits. One of the major drawbacks of technology in agriculture is lack of universally available software. Global connectivity of equipment can cost the industry billions of dollars. This resource provides insights of how technology is shaping the future of agriculture along with its prevailing restrictions.

Jack, Kelsey, and Julia Tobias. “Seeding success: Increasing agricultural technology adoption through information.” *IGC International Growth Centre,* 19 December 2017, <https://www.theigc.org/wp-content/uploads/2017/12/IGCJ5833-Agriculture-growth-brief-171214-Web.pdf>. Accessed 4 July 2018.

This document is focussed on how agricultural technology has the potential to improve economic growth and reduce food scarcity, however its adoption still remains low in many countries. The authors talk about sub-Saharan region of Africa and mentions that Green Revolution bought improved technology for farming but bypassed sub-Saharan Africa. They further discuss the methods to encourage the adoption of profitable agricultural technologies. They provide three key messages and recommendations. Firstly, information barriers can prevent the uptake of agricultural technologies. Significant investments have been made by government, NGOs and other institutes in the past few decades to provide agricultural information to farmers. Information must be accurate and tailored to individual farmer to strengthen the effectiveness of information provision. Information must be new, accessible, from credible resource and provided at the right time to the farmers. The authors talk about an example of SMS advice to cotton farmers in India where study revealed high demand of agricultural advice services, with 80% farmers calling the hotline within a two-year period. Farmers with access to information were more likely to adopt precision agricultural practices and recommendations. The second key message is that risk of poor quality agricultural inputs poses a major barrier to technology adoption as input quality is often hard for farmers to detect. Studies show that quality of seeds and fertilisers is way lower than it is presented by the sellers. This leads to lower than expected crop quality and comes out unprofitable for the farmers. The article briefs more about such barriers and concludes with practical recommendations.

Jawad, Haider Mahmood, and Rosdiadee Nordin, and Sadik Kamel Gharghan, and Aqeel Mahmood Jawad, and Mahamod Ismail. “Energy-Efficient Wireless Sensor Networks for Precision Agriculture: A Review.” *PubMed Central*, vol. 17(8), no. 1781, August 2017, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5579920/>. Accessed 25 June 2018.

The article covers information about wireless communication technology used in agriculture. The efficiency of wireless sensor networks is majorly determined by their power consumption and obtained range of communication. The authors contrast various wireless protocols and standards which are nowadays used for farming. A total of six protocols are discussed in detail and compared using parameters such as frequency band, latency, modulation type and many other factors. The writers have put together tabulated data to represent multiple schemes and techniques used for prior research in agricultural applications. Proceeding further in the article, the authors write about already existing energy efficient schemes in agriculture which consist of two categories, namely power reduction and energy harvesting. This elaboration helps reader to understand the purpose, advantages and limitations of each technique. Precision agriculture can also take advantage of IoT to increase crop produce, reduce negative ecological impact, alert farmers about fires and protect crops from insects. The writers mention different types of sensors, microcontrollers and wireless technology which are currently available in the market. Even with the latest technology and equipment available to perform better agricultural practices; limitations still persist for farmers to observe different agricultural climates. The document states a diverse range of challenges faced by precision farmers which include propagation losses, reliability, cost, data management and others. The provided breakdown of information about wireless sensors used in the agricultural sector makes this article an excellent resource.

Mulla, David J. “Twenty-five years of remote sensing in precision agriculture: Key advances and remaining knowledge gaps.” *ScienceDirect,* vol. 114, no. 4, April 2013, pp. 358-371, <https://www-sciencedirect-com.libaccess.senecacollege.ca/science/article/pii/S1537511012001419?_rdoc=1&_fmt=high&_origin=gateway&_docanchor=&md5=b8429449ccfc9c30159a5f9aeaa92ffb&ccp=y>. Accessed 30 June 2018.

Precision agricultural practices originated during the 1980’s. David is the author of this journal article who has provided the information about evolution of precision agriculture. The document consists of nomenclatures that are crucial for readers who are trying to learn about precision agriculture. The gist of precision agriculture is the right management of resources at the right place and the right time to produce better crops. It is one of the top ten revolutions in agriculture which was adopted to achieve sustainable farming practices. It involves data collection and information management, as well as technological advancements in computer processing, field monitoring and remote sensing. The author states that more than 30% of the growth of agribusiness in US in the future is expected from precision agriculture. Therefore, remote sensing is an early and important part of precision agriculture. Remote sensing applications are typically classified according to the type of the platform used for the sensor, including satellite, aerial, and ground-based platforms. The sensing technologies developed in these respective platforms are discussed thoroughly in this article. The author also puts light on some knowledge gaps for remote sensing in precision agriculture. Significant progress has been made in the remote sensing technology and this can be used to bridge the gap between current sensors and real-time data sensors. Hence, this document is a good resource to understand the evolution of remote sensing technologies in precision agriculture.

Smith, Ron. "How will a drone assist in crop management?" Delta Farm Press, 19 July 2017. Agriculture Collection, <http://link.galegroup.com/apps/doc/A499754214/PPAG?u=king56371&sid=PPAG&xid=3fcd1afb>. Accessed 13 July 2018.

This is an interesting article where discussion is about unmanned aerial vehicles, commonly known as drones. In present times, researchers can successfully take beautiful pictures of the fields within 10 to 15 minutes. But it takes them several hours to analyze the crops using those images. Multiple studies are discussed in the article where researches and learners talk about their goals to move forward towards big data using drones in farming. Such an example is Pelham, a graduate student at the University of Georgia who is evaluating disease and phenotype relationships in peanuts using drones. She mentions that different peanut genotypes show different color in the field which helps evaluate count and characteristics of each plant. The author writes about the evolution of drones’ adoption. Technology is becoming an integral part of commerce. Giving the example of Japan, the author says that widespread use of drones for more than imaging can be tough for large farms. Other tasks such as crop monitoring and chemical applications could be done more effectively using manned aerial vehicles. On the other hand, hard regulations continue to limit the use of drones in fields. Researchers are working towards the integration of precision agriculture with big data. The document states that big data is a crucial part of the future of agriculture.