



Digitalization and Mechanization in Agriculture Industry

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Agriculture is a major industry contributing to the gross domestic product of any country around the globe. Especially for developing countries like India, it is not only the most important source of income but is necessary to feed their populations. With the increase in population, the global agriculture industry needs to increase too, currently at 10% of the global GDP, the global agriculture industry needs to grow at least 60% by 2030 in order to keep up with the global demand of agricultural products. The article analyses the main areas of technology implementation in the agricultural industry.

Introduction

Despite of its massive importance, the agriculture industry has been far behind any other industry when it comes to digital transformation and integration of technology into it. Till this day, almost all of the agriculture industry in developing as well as third world countries rely on old and conventional ways of doing agriculture. This not only yields a low revenue for the farmers but also creates a massive gap between the supply and demand of the agricultural products. There have been however a few recent developments in the field of agriculture especially in the developed countries and these developments are changing the way agriculture has been done. The industry has finally turned to technology and is using more digital and mechanized solutions to make the agriculture sector sustainable. Amongst all these digital transformations, here are the six major transformations that have taken the agricultural industry to a whole new level.

Integration of IoT into the Fields: Believe it or not, Internet of Things is the next big thing and it is taking the whole world by storm and agriculture sector is no exception. IoT systems and sensors have a huge potential when it comes to agriculture industry and a report presented by Cisco has given us an estimate of this potential which totals around 15 trillion US dollars. It is to be kept in mind that this amount is only the value at stake with the emergence of IoT systems in agriculture industry alone. Like any other industry or commercial use of IoT, its use in agriculture industry has unlimited benefits. From simplifying the collection process of the product to streamlining the inspection and distribution of fertilizer etc. IoT systems and sensors can help your agriculture business in every way possible. What most farmers are doing is that they place the IoT sensors and cameras in their fields at strategic positions which makes their crop only a click away whenever they feel the need to check on it. These pictures are transmitted anywhere around the world for inspection purposes etc. however, special image recognition technologies have to be utilized to yield satisfactory results from these images. In this way, farmers can have the real time data of their farms at their disposal all the time, which helps them in making better decisions when it comes to the nourishment of the crop. This technology is helping the farmers react quickly to any epidemic that might damage their crop thus decreasing the amount of agriculture products that are wasted every year (Kumar *et al.*, 2019).

Integration of IoT with Farm Equipment: Much like the IoT systems and sensors that were installed in the fields, IoT sensors can also be installed on the agriculture equipment that is in use of farmers. These days many equipment manufacturers are already manufacturing smart agriculture and farm equipment including smart tractors with built in GPS technology, spray machines and harvesters with built in IoT technology on them. These IoT sensors serve a number of purposes including everything from maintenance of the machine to precision farming. Like any other industry equipment farm equipment also needs regular maintenance especially considering the intense wear and tear, which the equipment suffers during the farming process. In such a situation, most farmers cannot keep up with the repetitive maintenance schedules, IoT sensors on this farm equipment can help the farmers stay on top of the maintenance needs of their equipment and can result in thousands of dollars saved in the form of healthy equipment. IoT sensors on these farm machines can also help in precision farming. A spray machine with IoT sensors will know exactly how much fertilizer or pesticide a crop needs and would supply that exact amount, thus saving the extra fertilizer that would have been spent using conventional ways as well as making sure the crop does not absorb more fertilizer than needed. These process help optimize the whole farming process and can result in more yields and less money spent on fertilizer etc (Magomadov, 2020).

Drones for Crop Monitoring: If you have ever worked in your garden, you would typically observe all your plants at the glance of an eye and know if any of the plants needed cutting or watering etc. but this is not the case with farmers. Most farmers usually work in fields that span over hundreds of acres making it impossible for the farmer to observe the crop all at once or even over a long period of time. In such a situation they need some kind of aerial view of the crop in order to know what's going on. Some bigger corporations are maybe able to afford small aircrafts or helicopters but for an average farmer it is impossible to do so. That is where the drones come in, modern drones are cheap, light in weight and easy to operate for anyone without any formal training or license. These drones help the farmers get a bird eye view of their complete fields even if they span over hundreds of acres. They can fly over the crop and identify any hazard that can destroy the crop ranging from a drought, a pest attack or any other harmful environmental factor. Modern drones also come equipped with 3D imaging technology and thus can help in more advanced applications such as helping the farmers in predicting the quality of the soil as well as seed planting patterns. Another application that drones find in the agriculture industry is for spraying the pesticide or other chemicals necessary for plant growth. Drone sprays are significant over other sprays because they strictly spray on the surface of the crop and there is no chance of seepage of the chemical into the ground water. This process also uses less chemical as compared to other spraying methods thus saving the farmer a lot of money and being safe for the environment at the same time (Rad *et al.*, 2015).

Use of Robotics in Farming: Although robots and artificial intelligence are probably the most feared technological advancement out there but the way in which robotics and artificial intelligence have helped humanity overcome barriers has no match. Robots have taken the repetitive and boring work out of the hands of a human and has only left us to do the creative job. As in any other industry, robots do the similar i.e., repetitive and time-consuming work that otherwise needed a lot of manpower. This could include anything from spraying to removing weeds from hundreds of acres wide crops which was seemingly impossible for human to do. There are start-ups that are currently working on laser and camera guided robots that not only identify specific types of weeds in a crop but also remove them without any human intervention needed in the process. This whole development could be revolutionary as it could totally eliminate the role of chemicals that were previously being used to get rid of weeds, not only reducing the cost of the whole operation but also making

our crops healthier and organic. Another application that robots find are in vegetable and fruit farms where the monotonous work of fruit picking from the plant needs a lot of time and manpower. More and more companies are coming up with various robotic solutions for this process in order to make it easier, cheaper and faster than it currently is. There are some robots in testing phases that can perform operations as delicate as nut harvesting.

Use of ML and Big Data in Farming: Machine Learning and Data Analytics are a major part of any digital transformation taking place in every industry right now. It is impossible to talk about digital transformation and industry 4.0 without talking about the use and benefits of machine learning and big data analytics. This technology is very simple yet complex i.e., previous manufacturing/market data is used to design newer more optimized procedures. Machine learning and big data have unlimited potential in the agriculture industry as the research in this industry has always been slow but there have always been countless opportunities to explore. Machine learning is now making that easier and faster. One of the biggest examples of that is when it comes to plant breeding, there are unlimited possibilities to which extent this field could be studied and produced and machine learning is fixing that. ML takes out the best plant traits from different breeds and generations of that particular types and help farmers and scientists produce the perfect seed which then grows into the plant with all the desirable traits. Machine learning and big data can also help in market research about which produce is most in demand. This way farmers can focus more on developing that particular produce or that particular trait of the produce in future crops. Thus, machine learning and the use of big data open endless opportunities in the agriculture industry (Magomadov, 2019).

Conclusion

While these technological advancements seem very far in future, it is already happening. It may not be that common around the world, but this development is around the corner and soon all these technologies would not only be available but widely in use in developing countries as well. This could be a very positive step towards a sustainable agriculture industry as the current practices cannot be forecasted to meet our future requirements even with the current rate of growth of population. So, we hope that soon, farmers around the world would integrate these technological products into their farms and better the quality and quantity of their produce. If these technological advancements are made in the agriculture industry, resulting in higher yields of the crops from the same amount of agricultural land in use, scientists predict that there is a way that the industry output could be increased by 60% by the year 2030 which would be right in line with the current rate of increase in population.

References

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