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Precision Farming in India with a View to Reduce Suicidal Rates of Farmers

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Abstract:- Agriculture has been the core source of support for meeting basic requirements of people in all countries and their economy around the world including India. It has also been a source of employment to the people and enhances the Gross Domestic Product (GDP) of India. The phenomenal increase in the population of human beings and animals since from the previous decades and the quick growth in urbanization and industrialization have excessively strained the natural base in which agriculture is included and this has resulted to its faster degradation than before. Consequently, the world's attention is highly focused on the means of maximizing production to cater to the basic requirements of the increasing population. Therefore, people get involved in identifying ways in which they can produce more and sufficient food in a sustainable manner without affecting the natural base.In this paper, the aim is to evaluate the producer's perceptions and adoption of technologies involving the internet of things and artificial intelligence in precision farming in accomplishing future goals. It is also focused on examining the suicidal effects on the farmers that are emanating from climatic changes.It provides a detailed review of the technologies applied in the fields including their capabilities to perform various practices.

Keywords:- *Internet-of-Things, Precision-Farming, Technology,Data, Sensors, Mobile-Computing, Cloud Computing.*

I. INTRODUCTION

Precision farming is termed as the application of technology and principles in managing spatial and time-based variability linked with the agricultural production aspects for enhancing environmental and production quality. Precision farming involves the use of the internet of things and artificial intelligence. Internet of things refers to the extension of the connectivity of the internet into devices that communicate and interact with each other over the internet while Artificial Intelligence is the creation of intelligent machines that react and function as human beings. Despite the fact that precision farming is a backbone of India, it remains to be questioned how will it be able to cater to the increasing demands of the continually increasing population of India?Precision farming primarily relies on the measurement and understanding of variability and of which it should be addressed by its major components.

II. METHODOLOGY

A survey was conducted on a farm in the fields to collect data from various crop farmers about their perception and preferences on the technologies used in the fields. The study was also aimed at investigating the causes of the suicides among the farmers in India. A study population of 250 farmers was sampled to be interviewed.In this study, the respondents were asked several questions concerning the usage and preferences of use, and the impact of the technologies precision agriculture and the services that observable on farms. Moreover, the experiment of pairwise best-worst choice was suitable to define the preferences of the respondents concerning technology importance on precision agriculture. To encourage producer responses, the survey was designed to be completed by respondents in a short period using short and easy questions that are easy to understand.

III. RESULTS AND DISCUSSION

Precision farming as the backbone of the economy of India, is taking advantage of the new technologies to ensure maximized production and the reduction of costs. The accurate evaluation of the variability and its management and crop production space-time continuum are the determinant factors of the success of precision farming. Successful application of precision farming relies on various factors, such as the understanding of the conditions in the field and their management, the appropriateness of input recommendation and the level of control implementation (Gebbers, 2010). For a precision farming focused on technology, information and decision making, it may include enabling technologies or components such as the variable-rate technology, Geographical Information System (GIS), the remote sensing, yield monitors and soil testers and global positioning system(GPS) (Singh, 2010). Farmers in India have shown the concern in including technology in the farm processes according to their responses.

Precision Agriculture Technology/Service or Statement	Percent of Respondents
Farm uses variable rate fertilizer application	73
Farm uses variable rate seed application	60
Farm uses yield monitors	93
Farm uses autosteer	91
Farm uses precision soil sampling	66
Farm uses drones or unmanned aerial vehicle	25
Farm uses satellite/aerial imagery	56
Agrees that precision farming technologies and services are an important contributor to their farm's current financial profitability	88
Precision farming technologies and services have made them a better farm manager	80
Precision farming technologies and services have made their job as a farm manager easier	77
Would consider their farming operation an early adopter of precision farming technologies and services	68

Fig 1:- The Rates of the Responses in Percentage

From the responses given by the farmers, it is clear that they embrace technology and greater expectations in advancements which are all aimed to maximize production and reduce costs in the precision farming. Precision farming needs the application, management, evaluation, and analysis, and a large amount of output of time-based and spatial data. In India, systems in mobile computing were required in addition to the desktop systems to work on farm operations (Jain, 2015). As it is known that precision farming is concerned with temporal and spatial variability and also its' decision focused and based on information, the precision agriculture is enabled by the spatial analysis abilities of the geographical information systems (Jain, 2015). Internet of things is a corporation of technologies such as sensors, actuators, cloud computing, networks, and wireless communications.

With the amalgamation of the cloud computing, internet of things and wireless sensor networks have been gaining importance in precision farming as they are used in monitoring the environmental parameters and the growth of plants in an agricultural setting. The reason behind their use is that they can provide spatiotemporal sensing information of high resolution from the real world physical signals. With the use of cloud computing and wireless sensor networks, all sensing information can be included in the agricultural cloud services (Savale,2015). Systems that monitor the environment have been introduced in data monitoring to perform data mining activities and statistical evaluations. For instance, control pest sensors and monitoring systems and the pest population forecast systems have been suggested for use to collect and analyze data on pests for the purposes of identifying ways to reduce pests (Shahzadi, 2016).The choice of the actuators and sensors is determined by its application. Other than the above discussed sensors, there are other types of sensors that are used in the field, such as gas sensors to monitor pollution, fires in the forest among other issues, water monitoring quality sensors (for dissolved oxygen and dissolved ions), cameras, humidity, temperature and pressure sensors, cameras among other sensors (Shahzadi, 2016). Farmers have been embracing the value of data as they are aware that the secret sauce for profitability in the future lies within the mounds of the digital data.

Given the tablet technology, it will enable the farmers to access their data, manage and query their data in different dimensions and enhance their farm produce from the agricultural cloud services (Wolfert *et al*, 2017). In addition, mobile technology adoption, the farmer is in a position to access data that he or she owns anywhere in the world. Precision farming data must come from and deliver to sources other than just a sole farmer and the desktop computer that he owns (Raj, 2015). However, these technologies can only be implemented via training to the agricultural officers. Internet of things can be helpful in all the stages of the ecosystem in agriculture. It can be applied for real-time monitoring process and controlling environment in greenhouses and also monitoring and decision support systems for field parameters such as soil and environmental parameters (Raj, 2015).

In the future, remote sensing will have an effect when one opts to retrieve information. In this case, remote sensing uses aerial images to aid deliver the right and better information for the crop consultant and the farmer (Wolfert, 2017). High resolution images a good to aid in identifying the affected areas that can be put on a map and at be discretely treated. These images can only be obtained via the use of unmanned aerial vehicles that are expected to

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have a greater role in the coming years. These devices are small, light and battery powered and can provide the low costs of obtaining the information with high-resolution images (Ray, 2017). The data got from the aerial imageries and remote sensing satellites can further complement the decision-making process.

Artificial intelligence is also known as machine learning and it all involves the creation of algorithms that show self-learning characteristic. Applying cognitive technologies in the sector of agriculture aids in determining the best crop for various climatic conditions through analyzing and comparing various factors including the type of seeds, weather, soil, etc (Raj, 2015). Farmers are so much involved in identifying ways of maximizing return on crops with the deployment of the machine learning technology (Jaiganesh, 2017). In this technology, devices have been modeled to perform the tasks that human beings can do. Such technologies include the use of drones and unmanned air vehicles that capture high-resolution images and collect data from the fields and thus lower the cost of operations and monitor the environment(Raj, 2015).

Planting has been one of the major and tedious activities on large scale farms and establishes the results of the rest of the season of growing. Separate row control on planters will be one of the essential technologies that will enhance crop production in days to come as row units are controlled independently versus the entire planter being controlled simultaneously (Ray, 2017). If the size of the planters does increase, there is the likelihood of the risk of off- rate inaccuracies. However, vacuum planters are among the planting technologies that are currently used and that provide good performance (Jaiganesh, 2017). The distinctive capabilities of these technologies are inclusive of varied rates of seeding and row control automation among other capabilities.

The outcome of the capabilities of these technologies enables farmers to tailor rates of seeding and enhance seed placement. In addition, there are other technologies such as the automated irrigation systems that are designed to utilize machine learning to keep the needed soil conditions in order for the purposes of increasing the average yields (Jaiganesh, 2017). There are those tractors that are fitted with sensors and do all the farm practices automatically without a driver. The sensors perform the necessary activities, monitor hindrances and know where to apply the inputs (Jaiganesh, 2017). The future of artificial intelligence in precision farming if very crucial for a nation like India where almost half of the population is not applying technology and three-quarter of it depends on agriculture for their survival.

The chart shows the various technologies and the extent of their applicability in precision farming.

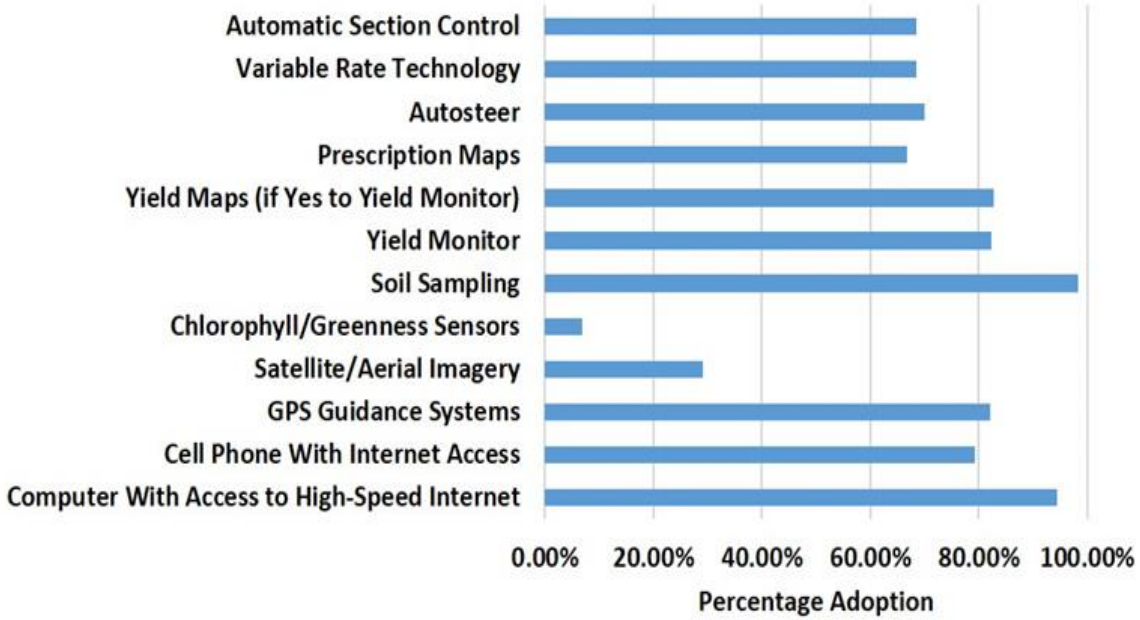

Fig 2:- Percentage of Adoption of the Various Technologies

Suicide is midst the primary causes of deaths in the world. There is a rising recognition that preclusion plans need to be custom-made to the region explicit demographics of a state that require application in a socially sensitive way(Das, 2011). According to the reports from the World Health Organization, approximately a million people die as a result of suicide (Mohanty, 2013). Over the years, there has been a rate escalation of suicide in India, even though trends of both escalations and deterioration in rates of suicide have been present. The suicides from Indian farmers may possibly prolifically be defined as public deaths (Muenster, 2015).In regard to ethnographic research in the district of South India,indicates that suicides committed by farmers become 'public deaths' simply through the arithmetical practices of the country of India and their media scandals(Mohanty, 2013).

The dogmatic nature of suicide as public death consequently relies wholly on rates of suicide and the state's production. But the power of exemplifications obscures the ethnographic assessment of arithmetical suicidal knowledge. In regard to a situation in Wayanad district, which was considered a zone prone to suicides by the state of India, suicides' public illustrations have taken their own life(Muenster, 2015). Arithmetic groups together with elucidations of the media of the statistics have had an inquisitive response to the placed connotations of specific suicides (Mohanty, 2013). Confined elucidations of distinct suicides typically remarked on individual failures of the suicide and on the dangers of hypothetical smallholder farming.

Other than the benefits of technology in the farms, there arises a problem among the farmers in India where it is reported that they are committing suicide and has terrified the nation as its rate has gradually been escalating from the previous decades to date. The change in climate has been identified to play a major role in this epidemic where results show that over 10,000suicides being attributed to an increase in temperatures as from 1980 (Das, 2011). Farming makes 14% of the Indian's GDP and employs almost 33% of the rural population. Most of these farmers have got no good access to irrigation and only depend on rain to grow their crops, therefore living them vulnerable to drought and other climatic adverse effects such as increasing temperatures (Muenster, 2015). It is believed that if there would be future warming, it would increase the risks of the suicides. Suicides have been reported to result in those farmers growing a genetically modified cotton called Bt cotton(Das, 2011). It is found that this type of cotton is expensive and needs various pesticides which increased the risks of the farmers becoming bankrupt.The study reveals that there is a connection between the rates of suicide and the increased temperatures in the season of growing (Muenster, 2015). Results showed that the degree days over 20 degrees Celsius was the major threshold for the Indian's suicide rates among farmers where the degree days have been increasing since 1980 leading to increased temperatures responsible for the many suicide cases (Muenster, 2015).

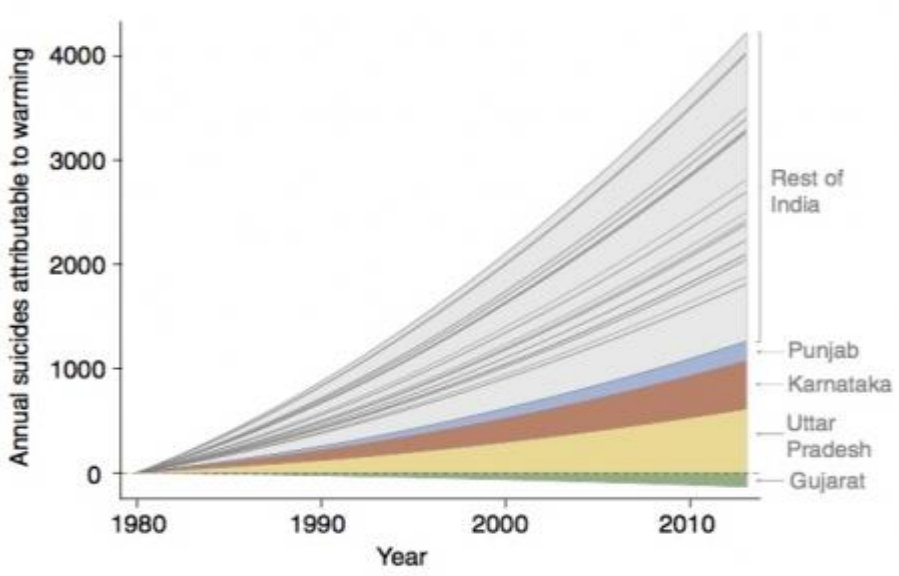

Fig 3:- Annual Deaths Attributed to Trends of Warming, (Using the Effects of the Degree Days on Rates of Suicide).

Ethnography suicide on farmers in relation to case studies only, conversely, would soon come acrossprecinctscorrespondinglycrucial as the restrictions of arithmeticalstudy(Muenster,2015). Not only is the sense of suicide at the artiste level off ethnography bounds, but as well as that the denotation of suicide is co-strongminded by the government practice together with arithmetical accounting.

IV. CONCLUSION

Through the use of technology and the internet of things (IoT), India has got the chance to open new opportunities in the sector of agriculture via monitoring agricultural activities of production. People in India have can opt to install technology in their farms and incorporating unmanned devices such as the unmanned aerial vehicles and drones to collect data through capturing high-resolution images, analyzing and transmitting real-time intelligence to keep a look on how chemicals are being used and irrigating fields to produce bearable and high production yield. The internet of things and artificial intelligence have been an opportunity to make the Indian farming modern and get a different stage of continued growth via the applications.India has been experiencing high temperatures that affected farming in various parts. It has been associated with the increasing suicides though there are other factors that can result in suicide. It is believed that climate change will affect crop production and escalate the economic distress, thus it wouldn't be unexpected that the rate of suicides in India would increase.For India to cope with suicide, one of the suggestion is to increase their import on grains to cope with a certain percentage of warming.

ABBREVIATIONS

- GDP Gross Domestic Product
- GPS Global Positioning System
- GIS Geographical Information System
- IoT Internet of Things

FIGURES

- *List of Figures*

- The rates of the responses in percentage
- Percentage of adoption of the various technologies.
- Annual deaths attributed to trends of warming

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