

Application of Internet of Things in Agriculture.

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Abstract: In India, the most imperative issue ascends in conventional technique is the unevenness in the configuration of climatic conditions (occasional precipitation, soil disintegration and so on) because of which the efficiency is diminished to a noteworthy degree. Another real disservice is these gadgets are yet to reach in the Indian market. The mindfulness is inadequate in the Indian farmers. To decide the dirt ripeness and profiling he needs to movement to adjacent agriculture focuses, which might possibly be available. The data in regards to the dirt conditions are not adequately utilized by the Indian farmers. (**Mortenson, M.J., Doherty, N.F., Robinson, S. 2015**). The main objective of the study is to analyse the level of awareness among farmers about Internet of Things process. For this purpose a sample of 75 was collected from the farmers of Coimbatore region based on random sampling method were Percentage Analysis, One Way Anova, Multiple Regression and Kruskal Wallis test were used as samples to analyse the data.

Index terms: Agriculture, Awareness and Farmers, Internet of Things, IoT, Sensor, Precision Agriculture, Smart Agriculture, Networking.

INTRODUCTION

Internet of Things is shaped out of squares working in which sensors, e-gadgets are incorporated. There won't be any human to human communication because of the inclusion of IoT. It is a self - mechanized process. The IoT innovation is more powerful (**Peter J.P., & Ryan, M.J., 2017**) because of:

- Effective administration of Time.
- Communication and Connectivity.
- Faster get to and decreases human endeavors.

IoT gadgets are relatively utilized as a part of each segment including agriculture. These gadgets give answer for the angles like enhancing the nature of the harvests, soil quality, robotizing water for water system lastly the imperative part – estimating of climate.

Empowering these gadgets in agriculture would help us to balance out our generation and supply, it starts to make more request and draws out an appropriate harmony between the request and supply. A reasonable development is guaranteed by empowering the utilization of IoT gadgets in the agriculture area. In spite of the fact that Indian market is considered as a monster in the agriculture division they are still in the early stages level in productively utilizing the most recent advancements, particularly IoT gadgets (**Gubbi J ., 2013**)

REVIEW OF LITERATURE

Shahzadi R (2016) presented an ES for Cotton crop based on the concept of IoT. They attempted to create and starting casing for IoT-based farming. They built up an IoT-based ES. It's based ES comprises of three modules; the initial segment comprises of the sending of WSN in the cotton fields. WSN has utilized for the checking of the cotton edit condition. The Waspnote agribusiness sensor board has utilized for the checking of the cotton trim condition. It comprises of temperature sensors, stickiness sensors, leaf wetness sensors and soil sensors.

Malavade V, N., (2016) focused on position of IoT in agriculture that leads to smart agriculture. It was found out that IoT minimizes human efforts. Hence, to gain high productivity, IoT works in synergy with agriculture to obtain smart farming.

Sethi P & Sarangi S,R.,(2017) proposes a novel taxonomy for IoT technologies, highlights some of the most important technologies, and profiles some applications that have the potential to make a striking difference in human life, especially for the differently abled and the elderly. As compared to similar survey papers in the area, this paper is far more comprehensive in its coverage and exhaustively covers most major technologies spanning from sensors to applications.

Ryan P,J & Watson R,B., (2017) The Internet of Things (IoT) is an extension of the Internet in which large numbers of “things”, including sensors, actuators and processors, in addition to human users, are networked and able to provide high resolution data on their environment and exercise a degree of control over it. It is still at an early stage of development, and many problems/research challenges must be solved before it is widely adopted.

Dijkman R,M.,Sprenkels B., Peeters T & Janssen A., (2015) The Internet of Things is the connection – via the internet – of objects from the physical world that are equipped with sensors, actuators and communication technology. This technology is looked at by a large variety of domains, such as manufacturing, healthcare and energy, to facilitate the development of new applications and the improvement of existing applications. To also enable the commercial exploitation of these applications, new types of business models must be developed. Frameworks exist to facilitate the development of business models.

NEED OF THE STUDY

The Internet of Things (IoT) has the capability to transform the world we live in; more-efficient industries, connected cars, and smarter cities are all components of the IoT equation. However, the application of technology like IoT in agriculture could have the greatest impact. The need of the study is that lack of knowledge among the Indian farmers in adapting the latest technology for better growth.

RESEARCH GAP

The past studies regarding IoT in Agriculture were conducted through secondary data .This paper consists of primary data with questioners regarding the awareness and acceptance of IoT with a sample size of 75 collected from the farmers in Coimbatore district.

THEORETICAL FRAMEWORK

The worldwide populace is set to touch 9.6 billion by 2050. Along these lines, to nourish this much populace, the cultivating business must grasp IoT. Against the difficulties, for example, outrageous climate conditions and rising environmental change, and natural effect coming about because of concentrated cultivating hones, the interest for more nourishment must be met.

Brilliant cultivating in light of IoT advancements will empower cultivators and farmers to diminish waste and improve efficiency extending from the amount of compost used to the quantity of voyages the ranch vehicles have made.

In IoT-based brilliant cultivating, a framework is worked for observing the harvest field with the assistance of sensors (light, stickiness, temperature, soil dampness, and so on.) and mechanizing the water system framework. The farmers can screen the field conditions from anyplace. IoT-based brilliant cultivating is profoundly proficient when contrasted and the traditional approach. **(Flannery T, F. 2006)**

OBJECTIVE OF THE STUDY

- To analyse the level of awareness among farmers about IoT process
- To analyse about the acceptance towards IoT process among farmers
- Improving quality in terms of production and supply, avoid wastage and better understanding of environmental conditions (soil quality, weather & climatic changes).

RESEARCH METHODOLOGY

The research methodology deals with the research design, data collection methods, sampling method, fieldwork, and the analysis and interpretation of research work.

Research design: The study was conducted in order to find out the farmers awareness towards IOT.

SAMPLING DESIGN & TOOLS APPLIED

Sampling techniques

Sampling Unit:

Sampling unit can be defined as the basic unit containing the farmers with Coimbatore city.

Sampling Size:

In this research, the sample size amount to 75, which are surveyed from farmers with Coimbatore district. And also, the statistical tool are applied viz.

- (a) Percentage analysis.
- (b) One-Way Anova
- (c) Kruskal Wallis
- (d) Multiple regression

Independent variable: Demographic factors (Age, Gender, Educational qualification, Place of living, and Occupational income).

Dependent variable: usage of IOT with various parts of agriculture, awareness towards IoT among farmers, acceptance towards customer perception with IoT.

DATA COLLECTION

The primary data the respondents which or collected with a questionnaire schedule and secondary data were collected from the manuals, journals, magazines and newspapers etc.

Research Tool: Structures self-administered questionnaire had been used as a research tool for collecting.

PERCENTAGE ANALYSIS

		Frequency	Percent
Gender	Male	46	61.7
	Female	29	38.3
	Total	75	100.0
Age	Below 28	16	20.8
	28-35	38	50.0
	36-45	22	29.2
	Total	75	100.0
Place of living	Semi-rural	18	23.3
	Rural	26	34.2
	Urban	15	20.0
	Semi urban	17	22.5
	Total	75	100.0
Income	Below 5000/month	36	48.3
	5000-10000/month	26	35.0
	10000-20000/ month	9	12.5
	Above 20000/month	3	4.2
	Total	75	100.0

Interpretation

Most of respondents were male (61.3 %) because female respondents were not found on a high ratio in Coimbatore region. Females were not actively involved in the farming sector in and around on Coimbatore district on a high ratio.

The data collected from the respondents belonged to the age group from 20-45. Aged famers (Above 45) were not able to analyze and answer the questions as they were involved with technical aspects to a certain extent in the questionnaire model.

The respondents (famers) were mostly belonging to rural and semi-rural outskirts of Coimbatore district as the farming practices were identified rarely in the urban areas of Coimbatore as the majority of the city are based on manufacturing hubs.

The income level of most of the respondents were below 5000/- as they were just an employees who gets paid on an hourly-basis and most of them donot go to work on all days in a week. Only a few respondents (4.2 %) have their own land for cultivation.

One way anova

Comparison between age and acceptance towards usage of IoT with various parts of agriculture

Descriptives

		N	Mean	Std. Deviation	Std. Error	F	Sig
Acceptance towards maintaining Agriculture warehouse based on IOT	Below 28	16	3.28	1.595	.319	.504	.006
	28-35	38	3.15	1.560	.201		
	36-45	22	2.89	1.659	.280		
	Total	75	3.10	1.590	.145		
Acceptance towards farm monitoring based on IOT using CCTV cameras	Below 28	16	2.84	1.491	.298	.328	.021
	28-35	38	3.13	1.567	.202		
	36-45	22	3.00	1.553	.263		
	Total	75	3.03	1.539	.140		
Acceptance towards IOT helping in real time monitoring of milk levels	Below 28	16	3.04	1.620	.324	.046	.955
	28-35	38	3.15	1.549	.200		
	36-45	22	3.09	1.687	.285		
	Total	75	3.11	1.592	.145		
Acceptance towards IOT used for Indoor Irrigation	Below 28	16	3.24	1.535	.307	.253	.777
	28-35	38	3.17	1.553	.201		
	36-45	22	2.97	1.654	.280		
	Total	75	3.12	1.569	.143		

Acceptance towards IOT used in remote control	Below 28	16	2.96	1.620	.324	1.803	.169
	28-35	38	3.43	1.630	.210		
	36-45	22	2.83	1.562	.264		
	Total	75	3.16	1.619	.148		
Acceptance towards IOT is used in agriculture for harvesting crops	Below 28	16	3.32	1.520	.304	.429	.652
	28-35	38	3.15	1.614	.208		
	36-45	22	2.94	1.571	.266		
	Total	75	3.12	1.575	.144		

Interpretation

The respondents in the age group of 20-30 feel IoT technologies can be introduced in warehousing and monitoring through CCTV as it do not affect their employment on a greater extent. But the remaining factors are considered as a threat to their employment as the respondents from the age group of 30-45 feel that they earn through the traditional farming in which the technologies are supposed to be introduced. They also fear for the cost factor and feel these technologies involves too much of cost but they are not so.

\The major problem is the mindset of the respondents vary according to the age group. The experienced farmers do not accept to go by latest IoT technologies, as the respondents fear these technologies would destroy the traditional farming methods which they are practiced too. Also they donot feel satisfied by using the IoT technologies.

Kruskal Wallis

Comparision between gender and awareness towards factors related to IoT

Ranks

	Gender	N	Mean Rank	Sum of Ranks	Assumed Sig
Awareness towards Access to Web	Male	46	62.08	4594.00	0.516
	Female	29	57.96	2666.00	
	Total	75			
Awareness towards E-Mail	Male	46	64.78	4793.50	0.089
	Female	29	53.62	2466.50	
	Total	75			
Awareness towards Electronic Communication to users	Male	46	61.30	4536.00	0.743
	Female	29	59.22	2724.00	
	Total	75			

Interpretation

Majority of the respondents especially female respondents have not crossed their basic education level. Also they were not aware of the latest technologies on electronic gadgets like mobile and computers. The farmers were not that much accessed to the usage of computers and other gadgets as most of them are from rural background. They still use the mobile phones which only contains basic features in it and some of the female respondents even don't have their own mobile phones. Only a few of the male respondents were accessed to the usage of web and E-Mail that too not frequently.

Regression analysis

Comparison between gender and acceptance towards IoT with various parts of agriculture

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
	Acceptance towards maintaining Agriculture warehouse based on IOT	-.035	.040	-.117	-.856	.395
	Acceptance towards farm monitoring based on IOT using CCTV cameras	.017	.042	.055	.416	.678
	Acceptance towards IOT helping in real time monitoring of milk levels	-.021	.043	-.066	-.487	.628
	Acceptance towards IOT used for Indoor Irrigation Project	-.004	.038	-.012	-.099	.921
	Acceptance towards IOT used in remote control	.008	.037	.027	.220	.826
	Acceptance towards IOT is used in agriculture for harvesting crops	.036	.039	.116	.930	.356

Interpretation

Most of the respondents are employees and they consider these technologies as a threatening factor as it would affect their employment opportunities. The female respondents don't recognize what these technologies of IoT are based on and how it would help them to improve the production and cultivation of crops. Compared to the female respondents, the male respondents gave a positive response and few of them clearly understand the benefits of these technologies and how it would reduce their efforts. Even though some of the respondents have a clear idea on these factors but they are not ready to accept these IoT based technologies as it would affect their employment.

FINDINGS

- Most of the respondents are not aware of the technologies of IoT in agriculture.
- The respondents prefer to follow traditional way of farming and are not satisfied with the IoT technologies that can be used effectively.
- The water utilized for irrigation purposes are not used effectively.
- The farmers in Coimbatore region prefer to produce cash crops and food crops more than the horticulture crops and plantation crops.

- Most of the farmers in Coimbatore deals through middle-man on a commission basis to sell their products in the market.

LIMITATION

- The research was conducted within Coimbatore district.
- The study time was conducted for a period of three months.
- The data collected from the respondents were limited to 75.

CONCLUSION

This study clearly analyzes the awareness level of farmers regarding implementation of IoT in agriculture. This study indicates that we are still in the infant stage of using technologies in agriculture sector. The base stage is that the farmers should be aware of technologies and their benefits to proceed for further process of implementing them. Though Indian market is considered as a giant in the agriculture sector they are still in the infancy level in efficiently using the latest technologies, especially enabling IoT in agriculture. Enabling these devices in agriculture would help us to stabilize our production and supply, initiates to create more demand and brings out a proper balance between the demand and supply. A sustainable growth is ensured by enabling the use of IoT devices in the agriculture sector.

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