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Social diversity of IoT adopting farmers and challenges in adoption

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Abstract - *Males outplayed females with 66.4 and 36.6% owner ship, respectively, but the trend of distribution across farm size was similar for both the sexes under present study ranging from 30 to 40% in all the cases revealing no dependency of gender on farm size. However, significant dependency was established between farm size and all other social factors viz. age, education and marketing. High initial cost in IoT was found to be the most important/vital constraint in the present study and maintenance of IoT was the least important one, taking all the farmers into account. Other constraints like financial support of government, power requirement and enhanced production cost were placed in between these two with rankings of II to IV, respectively.*

Keywords: Adoption, Challenges, Diversity, Poultry

Introduction

Growth of poultry sector is fast increasing in Odisha for last ten years [1]. Broiler farming has gained enormous popularity. Temperature, humidity and ammonia in poultry house act as major hurdles in poultry production system in this part of India [2] it is difficult during summer due to the hot and humid climate in the state. Besides, the summer is realized over six months for broiler farming in Odisha. The combination of high ambient temperatures (often exceeding 40°C) and high humidity results severe heat stress, which is a major recurring problem in the state. Temperature exceeding 30°C leads chickens' inefficiency in maintaining their internal body temperature, leading to heat stress, prostration and high mortality rates.

Heat stress significantly reduces feed consumption, leading to lower weight gain and poor feed conversion efficiency (FCE), particularly at last stage of growth. Heat stress weakens the immune system, making birds more susceptible to diseases. High temperature also leads to reduction in meat quality and commercial value.

Internet of thing (IoT) for temperature monitoring is gaining popularity for small holders as environmental control device is not affordable. IoT-enabled automated control of fans and misters has experienced smooth summer management maintaining desired and optimal temperature, decreasing stress and mortality rates and labor costs. Besides, animal welfare is ensured.

The present study analyses the social factors associated with adoption of IoT in broiler farming and ranking the challenges with respect to its adoption.

Methodology

The study was carried out on IoT adopted broiler farms in Odisha. Information on social status of farmers and challenges in adoption of IoT was collected from 235 farmers rearing broiler chicken utilizing IoT-enabled automated temperature control.

Data for each farmer was classified according to gender (male, female), age (Up to 30years, 31 to 45 years and above 46 years), education (up to HSC, Graduation and more than graduation) and marketing option (local market and nearby town). The strength of farm was categorised in three groups viz. < 2000, 2000 to 5000 and > 5000 capacities.

The constraints in IoT adoption were analyzed with regard to different factors. Different points on constraints were raised by farmers at the time of survey. Then those constraints, thus listed were put to farmers or respondents to rank the

constraints and challenges through the questionnaire. Garret's Ranking Technique was adopted to rank the challenges in this study. The prime advantage of this technique over simple frequency distribution is that the preferences are arranged based on their intensity from the point of view of respondents. Hence, the same number of respondents on two or more preferences may have been given different rank. Garrett's formula for converting ranks into percent is:

Percent position = 100 * (Rij – 0.5)/Nj

Where, Rij = rank given for i^{th} factor by j^{th} individual;

Nj = number of factors ranked by j^{th} individual.

The percent position of each rank was converted into scores referring to the table given by [3]. For each factor, the scores of individual respondents were added together and divided by the total number of the respondents for whom scores were added. These mean scores for all the modes were arranged in descending order; the challenges were accordingly ranked.

The respondents were asked to rank the five constraints identified for the purpose of this study as 1, 2, 3, 4 and 5 in order to know their preference. The calculated percentage position for the rank 1, 2, 3,4 and 5 and their correspondent Garrett table are shown in Table 1. For individual constraint, the total score was calculated by multiplying the number of respondents ranking that factor as 1, 2, 3,4 or 5 and then the mean score of the individual constraint was calculated by dividing the total number of respondents and further ranked with regard to the mean score.

Table 1. Percent position vis-à-vis garret table score

Sl. No.	Rank	Per cent Position	Garret table
1.	100 (1- 0.5) / 5	10.00	75
2.	100 (2- 0.5) / 5	30.00	60
3.	100 (3- 0.5) / 5	50.00	50
4.	100 (4- 0.5) / 5	70 .00	40
5	100 (5-0.5) / 5	90.00	24

Results and Discussion

Frequency distribution of farmers

Frequency distribution of poultry farmers with regard to their social divbersity across farm size along with Chi-square test of independence to examine the dependency between farm size and individual social factors of IoT adopted broiler farmers is presented in Table 2.

It was revealed that, 86 (36.6%) of all farmers were found to be females against 149 (66.4%) males. Gender of farmers was independent of farm size, indicating the fact that, the trend of distribution across farm size was similar for both the sexes under present study ranging from 30 to 40% in all the cases.

Maximum farmers (65.5%) were found to be under moderate age group in pooled sample and corresponding proportions of younger and older farmers were estimated as 20.9% and 13.6%, respectively. In other words, out of 20 farmers 13 were middle aged farmers and 4 from young and 3 from old group. However, significant dependency was found between the two factors viz. farm size and age, revealing that, younger farmers aged below 30 years have opted for large farms (53.1%), but more elderly farmers preferred for small farm sizes in the present study. It has been revealed that, the frequency of larger farms decreased as the age of farmer increased.

Farmers having qualification of more than graduation were 119 against 71 and 45 having graduation and up to HSC level, respectively in the present study. Besides, there was dependency of farm size on education of the farmer. It is ascertained that, education level below HSC opted for small farm size but graduates and more than that level opted more for larger farms in the present study.

Very highly significant dependency was realized between farm size and selling option, revealing that, very large farms opted to sell the birds more in nearby town (53.4%) than in local market (9.2%). However, both the smaller farms often sold their produce locally with almost similar trend.

Most of the above findings are in line with the opinion of [4] in Haringhata black chicken farmers, [5] in native chicken farmers in Mizoram, [6] among tribal farmers in Odisha and Vasanthakumar and [7] on a study in Tamilnadu.

Table 2. Frequency distribution of IoT enabled broiler farmers across social factors and farm size.

Factors	Sub-factors	< 2000	2000 to 5000	> 5000	Total	χ^2
Gender	Female	27(31.4)	29(33.7)	30(34.9)	86(100.0)	1.259
	Male	46(30.9)	60(40.3)	43(28.9)	149(100.0)	
Age	Up to 30years	18(36.7)	5(10.2)	26(53.1)	49(100.0)	27.349*
	31 to 45 years	41(26.6)	70(45.5)	43(27.9)	154(100.0)	
	Above 46 years	14(43.8)	14(43.8)	4(12.5)	32(100.0)	
Education	Up to HSC	24(53.3)	13(28.9)	8(17.8)	45(100.0)	14.022*
	Graduation	18(25.4)	31(43.7)	22(31.0)	71(100.0)	
	More than Graduation	31(26.1)	45(37.8)	43(36.1)	119(100.0)	
Marketing	Local market	47(39.5)	61(51.3)	11(9.2)	119(100.0)	53.878*
	Nearby town	26(22.4)	28(24.1)	62(53.4)	116(100.0)	

Figures in parentheses indicate percentage across row under a factor, *p<0.01

Table 3. Ranking of different challenges in IoT adoption

Sl. No.	Mode of communication	1	2	3	4	5	Total Score	No. of Respondents	Mean	Overall Rank
1	High initial cost	65	55	44	58	13	14747	235	62.75	I
2	Power requirement	54	46	37	54	44	13496	235	57.43	III
3	Maintenance	18	24	72	65	56	12284	235	52.27	V
4	Financial support of government	85	64	47	36	3	14077	235	59.90	II
5	Enhanced production cost	41	38	56	62	38	13407	235	57.05	IV

Analysis of challenges in IoT enabled poultry production system

Distribution of responses with regard to individual rankings along with mean Garrett scores and final Garrett rankings are presented in Table 3. High initial cost in IoT was found to be the most important/vital constraint in the present study and maintenance of IoT was the least important one, taking all the farmers into account. Other constraints like financial support of government, power requirement and enhanced production cost were placed in between these two with rankings of II to IV, respectively. This has an alignment with the attitude of farmers that farmers often give priority to initial cost involved from their own funds. Besides, the farmers wanted some subsidy or support from government in adopting a new technology. As the IoTs are installed within last one to three years, maintenance requirement was in very few cases. Hence, it was kept low as a challenge.

The present trend of constraint analysis was broadly at par with reports of [8] in Goa and [9] on a similar study in Bangladesh.

Future Scope

Present findings on frequency distribution of farmers across social parameters and ranking of challenges in adoption of IoT could be used in decision making strategy under state policy triggering livelihood enhancement of poultry farmers.

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