Adoption of Aquaculture Management Techniques among Fish Farmers in Two Selected Farm Sites in Igabi Local Government Area of Kaduna State, Nigeria

Onwuegbunam N.E, Suleiman, R., Danbaki, C.A. and Olukotun, O.

Federal College of Forestry Mechanization P.M.B. 2273, Afaka-Kaduna, Nigeria

Abstract: - This study was carried out to ascertain the level of adoption of aquaculture management techniques in Igabi Local Government Area of Kaduna State. Data were collected from 53 respondents in Airforce Base and National Eye Centre fish farming sites in Igabi LGA of the sate by use of a well structured questionnaire. Descriptive statistics such as percentage, frequency distribution, mean and multiple regression analysis were used to analyze the data. It was found that 56.60% of the fish farmers adopted Monoculture, 39.60% of the fish farmers also adopted concrete pond and 35.8% adopted polyculture system. On management of the ponds; liming of pond and pH check, disease treatment, supplmenetary feeding and fertilization of pond had the highest adoption percentage scores that is 62.26%, 50.90%, 49.10% and 41.51% respectively. Weed control, checking pond temperature, use of Net/Siene net, checking of oxygen content recorded low adoption score. None of the eight independent variables showed any significant contribution to adoption of aquaculture techniques using the regression analysis. However, gender, income level, fishing experience, contact with extension agent and number of pond owned positively influenced adoption of aquaculture management techniques in the study area. The major constraints to fish famring were; inadequate credit facilities (64.15%), fish poaching/theft (49.05%)t, fingerling mortality due to poor handling(45.15%), expensive fish feed (45.28%), inadequate fishery extension service (45.28%) and water supply problem (43.39%). The study noted that a key aspect of addressing malnutrition problem in Igabi LGA is the promotion of fish farming as a source of protein. The study also recommended that farmers should form themselves into cooperative society so that they can pool their resources and knowledge together in solving most of the problems identified in this study.

Keywords: Adoption Level, Management Techniques, Fish Farmers, Factors. Multipl Regression, Constraints

I. INTRODUCTION

In Nigeria, fish production is not only important as a source of rich protein, but it also can be used to bring about institutional change. These changes can offer access to production assets and resources, which can help to empower the poor and directly promote their livelihood. There is now an increasing realization among Nigerians of the importance of fish as a preferred source of protein supply in human diet. Okorie (1978) stated that, although fish contain no carbohydrate, they are rich in fats,phosphorus, sulphur, potassium, iron, calcium and copper. Nigeria is not producing enough fish for consumption; also, the fish industry is not providing the much needed financial empowerment that the fish farmers need. According to FAO (2006), there is a huge supply- demand gap for fish and fishery products in Nigeria. According to the report, there is about 400,000 tonnes of supply in comparison to the 800,000 tonnes of demand. This makes Nigeria one of the largest importers of fish in the developing world, importing **600**,000 metric tonnes annually (Moehl, 2003). It is therefore necessary to ensure that production practices are adopted, in order to increase fish production. According to Federal Department of Fisheries (2002) in the year 2000, total domestic fish production in Nigeria stood at 476,098 metric tonnes, out of which .aquaculture fish accounted for 25,720mt, representing 5.5% of total domestic fish production. Federal Department of Fisheries (2004) also reported that in 2003 domestic fish production from aquaculture accounted for only 9.9% with 52,000 metric tonnes out of Nigeria's total domestic production of 524,706 metric tones. With increase in population growth, demand for fish and fish products will increase astronomically and it is expedient for more people to get involved in aquaculture development in order to increase its share of total potential annual fish yield and help to meet the demand for fish in Nigeria. The adoption of aquaculture technologies is one way to boost fish production, improve self-sufficiency in fish production and contribute to food security in Nigeria.

Rogers and Shoemaker (1971), described the adoption process as a mental process through which an individual passes from learning of new idea. The decision to adopt or reject the new idea depends on farmers and their environment, the appropriateness and gains of such innovation. These factors are therefore pre-requisite for adoption of improved farm technology and cultural practices essential for the achievement of self sufficiency in the production of food and fibre Peace Corps (1976), postulate that farmers must pass through five stages of adoption before the idea is accepted. If they are not aware of the ideas, they will not be interested; if they are not interested they cannot evaluate its usefulness; if

they do not evaluate, they will never try it, if they do not try it they would certainly not adopt it. These five stages of adoption are inseparable as a link of a chain. : Adoption takes place after people have successfully passed through the five stages. Williams (1968), explained the adoption process with the following steps: awareness; interest; action; desire; conviction and satisfaction.

This study therefore is aimed at investigating factors influencing the adoption of aquaculture management techniques in selected fishing site in Igabi local government area of Kaduna state, Nigeria.

II. MATERIALS AND METHODS

A. Study Area

The study was conducted in Igabi Local Government Area of Kaduna state. Igabi is one of the four local government area which constitute Kaduna metropolitan city, an important commercial and administrative centre in Northern Nigeria and comprises of different sets of people with diversified socio-cultural characteristics. Igabi local government is located in guinea savannah of Nigeria on latitude 10^0 $32^"$ N and longitude 7^0 $17^"$ E (Otegbeye,2001). The headquarter of Igabi Local Government Area is Turunku. The population of Igabi local government area according to 2006 population census was estimated at 570,000 people (NPC, 2006). Annual rainfall is between 250mm-1000mm and usually begins early May and ends in October and the dry season is between October-April. The major crops produced in the area are cowpea, yam, cassava, maize, millet, guinea corn and cocoyam. Livestock/animals that are reared in the Local Government Area are poultry, cattle, goat and sheep.

B. Sampling Techniques and Frame

Air force Base and National Eye centre fishing site were selected purposively for the study. All fish farmers in the sites constituted the sampling population. Random sampling was used to select a total of 60 fish farmers specifically those producing catfish in the study area. Due to incomplete information seven questionnaire were discarded, so only fifty three (53) fish farmers were used for the study.

C. Data Collection

Primary data was used for the study. The primary data were obtained from fish farmers in the study area with aid of well structured questionnaire and personal interview. The questionnaire was designed to collect information on socio-economic characteristics of the farmers, some institutional variables of the farmers, level of adoption of

aquaculture management techniques that have been develop and disseminated to fish farmers.

D. Analytical Tools

The following under listed analytical tools were used to analyze the data generated

- Descriptive statistics
- Multiple regression analysis

1). Descriptive Statistics: Descriptive statistics such as percentage, frequency distribution, table and mean were used to describe the socio economic characteristics of the farmers and level of adoption of aquaculture management techniques.

2). Multiple Regression Analysis:

Multiple regression analysis was used to achieve factors influencing the adoption of aquaculture management techniques by the fish farmers in the study area.

The multiple regression equation is express implicitly as:

$Y = f (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, U)$

Where

Y = Numbers of aquaculture techniques adopted by a farmer:

X1	=	Age (years)
X2	=	Gender (Male = 1, Female = 2)
X3	=	Educational Level (No Formal = 1)
		(Primary= 2)
		Secondary = 3)
		Tertiary = 4)
X4	=	Household size (Number)
X5	=	Income Level (Naira)
X6	=	Fishing experience (Years)
X7	=	Contact with extension agent (Number)
X8	=	No fish pond owned (Numbers)
U	=	Error term

The explicit forms of the multiple regression is given below:

Linear Model

$Y = b_0 + b_1X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_s + b_6 X_6 + b_7 X_7 + b_8 X_8 + U$

Semi –Log Model

$Y = bo + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_s + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + U$

Double Log Model

$\log Y = bo + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_s + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + U$

\Where:

Log	=	Natural logarithm
Y	=	as specified above
$X_1 - X_8$	=	as specified above
b_0	=	Intercept
$b_1 - b8$	=	Parameters that were measured
U	=	as specified above

III. RESULTS AND DISCUSSIONS

A. Social-Economic Characteristics of Poultry Farmers in the Study Area.

1). Age of Respondents: Table 1 revealed that 32.08% of the respondents fall within the age group of 20-29 years, 28.30 % were between the age of 40 and 49 years, 22.64% were 30-39 years old. 13.21% fall within the age range of 50-59 years while 3.77% were 60 years and above. This implies that most of the fish farmers are in their youthful age which makes them to be strong and capable of carrying out the fish farming actively.

2). Gender of Respondents: Table 2 showed that 60.40 % of the respondents are male while 39.60 % are female. It shows that male is more than female in the aquaculture practices in the study area. These In Table 4 32.07% of the respondents have a household size that fall within 6-10 persons, 26.42% of the respondents household size fall between 1-5 and 11-15 persons respectively, while 15.09% of the respondents are having household size that ranged between 16 and 20 persons. These implies that most of the fish farmers about 86 % had household size that is over 5 persons which is of great importance in the area of supplying family labour.

May be due to the belief that male are more into farming activities than the females.

3).Educational Status of Respondents: Table 3 indicated that 43.40 % of the respondents are tertiary certificate holders, 41.51% of the respondents are secondary school certificate holders while 15.09% have primary education. On the average the education level is above that of primary education with the majority of the fish farmers (about 85%) having secondary education and above.

`4).Household size of the Respondents:*. In Table 4 32.07% of the respondents have a household size that fall within 6-10 persons, 26.42% of the respondents household size fall between 1-5 and 11-15 persons respectively, while 15.09% of the respondents are having household size that ranged between 16 and 20 persons. These implies that most of the fish farmers about 86 % had household size that is over 5 persons which is of great importance in the area of supplying family labour.

5). Annual Income of Respondents: Table 5 shows that 37.74% of the respondents falls within 80,001-200,000 naira annual income which is a low annual income level, 33.96% of the respondent were within 200,001 - 320,000 naira which is

a moderate annual income, 16.98% of the respondents fall within the range of 320,001 - 4440,000 naira which is a good income level but the percentage of the farmers is low, 11.32% of the respondent fall between the range of 440,001 and 560,000 naira which is the highest income level. This is to say that majority of farmers in the study area are subjected to low income which in time may affect their standard of living as well as their investment in fish farming.

6). Fish Farming Experience of Respondents Table 6 shows that 35.85% of respondents fall within 1-5 years of fish farming experience, 32.07% of respondents fall between 6-10 years. 20.76% of respondents were between 11 and 15 years while 11.32% of respondent fall within 16 years and above. This means the respondents has experience in fish farming which also implies that majority of the fish farmers are highly experienced which serves as an advantage in the area of identifying problems and proffering solution. This is in line with the study of Agbamu and Orhorhoro (2007) in which they reported average fishing experience of 7 years for fish farmers in Delta State.

7). Contact with Extension Agents by the Respondents Table 7 shows that 33.96% of the respondents had 3-6 contact/year with extension agent,26.42% of the respondents had 12 contact/year with the extension agents, 22.64% of the respondent had zero contact with extension agen while 16.98% of the respondents have 20 contact/year. Therefore this implies that most of the fish farmers has a good numbers of contact with extension agents, which is fair for the dissemination of fish farm innovations.

8). Type of Fish Pond Owned by the Respondents Table 8 shows that 45.20% of the respondents owned concrete pond and 35.90% of the respondents owned earthen pond while 18.90% of the respondents owns a re-circulatory system of pond. This implies that most of the fish farmers have concrete-type pond which also was in line with the finding of Agbamu and Orhorhoro (2007) in which 55% of the farmer has concrete pond.

9). Number of Fish Pond Owned by the Respondents Table 9 shows that 45.28% of the respondents have between 1 and 4 ponds, 28.30% of the respondents have within 9-12 ponds while 26.42% of the respondents have within 5-8 ponds. This implies that most fish farmers have average ponds of above 1-4 ponds.

Table 1 Frequency Distribution of Fish Farmers on the Study Area based on Age

Age	Frequency	Percentage (%)
20-29	17	32.08
30-39	12	22.64
40-49	15	28.30
50-59	7	13.21
60and above	2	3.77
Total	53	100

Table 2 Frequency Distribution of the Respondents based on Gender

Gender	Frequency	Percentage (%)
Male	32	60.40
Female	21	39.60
Total	53	100

Table 3 Frequency Distribution of Respondents according to the Level of Education

Educational Level	Frequency	Percentage (%)
Primary Education	8	15.09
Secondary	22	41.51
Tertiary	23	43.40
Total	53	100

Table 4 Frequency Distribution of Fish Farmers in the Study Area based on Household Size

Household size	Frequency	Percentage (%)
1-5 persons	14	26.42
6-10 persons	17	32.07
11-15 persons	14	26.42
16-20 persons	8	15.09
20 persons and above	0	0.00
Total	53	100

Table 5 Frequency Distribution of Respondents according to their Annual Income

Income Level	Frequency	Percentage (%)
N80,001-N200,000	20	37.74
N200.001 -N320.000	18	33.96
N320,001 -N440,000	9	16.98
N440,001 -N560,000	6	11.32
Total	53	100

Table 6 Frequency Distribution of Respondents according to their Experience in Fish Farming

Fishing Experience	Frequency	Percentage (%)
1-5 years	19	35.85
6-10 years	17	32.07
11-15 years	11	20.76
16 years and above	6	11.32
Total	S3	100

Table 7 Frequency Distribution of Respondents according to their Contact with Extension Agent

Contact with Agent	Frequency	Percentage (%)
20 contact/year	9	16.98
12 contact/year	14	26.42
3-6 contact / year	18	33.96
Zero contact	12	22.64
Total	53	100

Table 8 Frequency Distribution of Respondents according to the Type of Fish Pond Owned

Type of fish pond owned	Frequency	Percentage (%)
Earthen Pond	19	35.90
Concrete Pond	24	45.20
Re-circulatory system	10	18.90
Total	53	100

Table 9 Frequency Distribution based on the Number of Fish Ponds Owned

No of Fish Pond Owned	Frequency	Percentage (%)
1-4 ponds	24	45.28
5-8 ponds	14	26.42
9-12 ponds	15	28.30
Total	53	100

B. Level of Adoption of Aquaculture Management Techniques by the Fish Farmers

10). Adoption of Pond Construction Techniques and Stocking Methods by the Respondents: Result in Table 10 shows that fish farmers .have adopted and were using a number of pond construction techniques and stocking methods. The level of adoption were high in monoculture which is 56.60% while adoption of construction of concrete pond is 39.60%., earthen pond (35.85%), appropriate stocking density (28,30%) and sealing of pond bottom was low (18.90%.)

11) Adoption of the Pond Management and Harvesting Techniques: Data in Table 11 also showed that, fish farmers have adopted and were using a number of pond management harvesting techniques. Adoption level were high for liming of pond and pH check, 62.26%, disease treatment 50.90%, supplementary feeding 49.10%/ fertilization of pond 41.51%. There were low level of adoption for weed control 37.70%, repair of leakages in Ponds 16.95%), checking pond temperature 32. 96%, checking of oxygen content 32.08%) use of hooks for harvesting 26.42%, use of baskets *22.64%,* use of Net/seine net 30.20%) and also the use of water pump to aid harvesting 23.30%. The low adoption rate listed in table 10 and 11 could be attributed*to .the high cost and problem associated with the use of these technologies.

C. Factors Influencing Adoption of Aquaculture Management Techniques by the Fish Farmers.

The contribution of eight (8) independent variables to adoption of aquaculture management techniques were determined by multiple regression analysis. The result of the multiple regression analysis is presented in Table 12. The result of the production function analysis shows that the double log regression model was chosen as the lead equation because it has the highest coefficient of multiple determination of 0.62, standard error of 0.26 with an F statistic of 3.41. The entire variable combined explained 62% of the total variation in the adoption of management techniques. The eight variable examined does not make any significant contribution at 1%, 5% and 10% level to adoption of aquaculture management techniques which negate the finding of Agbamu and Orhorhoro (2007) tha found education level, income level, contact with agent and No of fish pond owneds to be significant at 5%o for the adoption of aquaculture techniques in Delta State., however, Gender, income level, fishing experience contact with extension agent, no of pond owned have positive regression coefficient. These indicate that an increase in any of these variables will lead to increase in the level of adoption of aquaculture management techniques. This finding is in harmony with that of Ladebo (1999) who found that farmers enjoying high income would be expected to be favourably disposed to try out new ideas that would yield them optimum returns. This study has shown that the more the extent of contact with agricultural extension agent, the more the fish farmers are likely to adopt aquaculture management techniques. This study also discovered that fish farmers with more number of ponds are more likely to adopt new techniques.

Table 10: Distribution of Respondents According to Adoption of Pond Construction Techniques and Stocking Methods

Techniques	Tried (%)	Adopted (%)	Non-Adopted (%)
Earthen Pond	52.83	35.85	11.32
Concrete pond	49.10.	39.60	11.30
Sealing of pond bottom	43.40	18.90	37.70
Monoculture	18.90	56.60	24.50
Polyculture	45.28	35.85	18.87
Appropriate stocking density	50,94	28.30	20.76

Table 11: Distribution of Respondents according to Adoption of the Pond Management and Harvesting Techniques

Techniques	Tried (%)	Adeopted (%)	Non-adopted (%)
Fertilization of pond	47.17	41.51	11.32
Liming of pond and pH Check Weed	32.08	62.26	5.66
control	43.40	37.70	18.90
Supplementary feeding	35.80	49.10	15.10
Disease treatment	30.20	50.90	18.90
Repair of leakages in pond	35.85	16.95	47.20
Checking pond temperature"	32.08	33.96	33.96
Checking of oxygen content	33.96	32.08	33.96
Use of hooks for harvesting	39.62	26.42	33.96
Use of baskets	50.94	22.64	26.42
Use of net/seine net	43.40	30.20	26.40
Water pump to aid harvesting	41.51	28.30	30.18

Table 12 Summary of Multiple Regression Analysis (Double-log Model)

Predictors	Regression Coefficient	T-ration	P
Age (X_1)	-0.2082^{NS}	-0.0717	0.943
Gender (X_2)	-0.0302^{NS}	0.0117	0.991
Educational level (X_3)	-0.3314^{NS}	-0.2244	0.823
Household Size (X_4)	-1.8480^{NS}	-1.166	0.250
Income Level (X_5)	2.1977^{NS}	1.437	0.128
Fishing Experience (X_6)	1.9928^{NS}	1.355	0.182
Contac with Extension Agent (X_7)	1.6981^{NS}	0.9164	0.364
Number of Ponds Owned (X_8)	0.1086^{NS}	0.0450	0.960
Constant	-5.5816^{NS}	-0.7439	0.461
Coeffecent of Multiple Determination (R)	=0.62	$R^2 = 0.38$	
Standard Error (SE)	=0.26	F = 3.41	

NS: Non Significant at 5% and 1% probability levels

D. Constraints Affecting the Adoption of Aquaculture Management Techniques.

Table 13 above present the result of the constraints militating against the adoption of management practices in fishing, percentage score was used to present the result in which the mean percentage score was calculated to be 42.32%. So any constrains above the mean percentage score were assumed to be critical and will slow the rate of adoption of aquaculture management techniques by the fish farmer. Inadequate credit facilities (64.15%), fish poaching/theft (49.05%), fingerling mortality due to poor handling (47.17%o), inadequate fishery extension services and expensive fish feed (45.28%) and water supply problem (43.39%>) were the only six constraints that were perceived to be serious. The inadequate credit facilities, fish poaching/theft and   fingerling mortality due to poor handling was in support of the finding of Aphunu and Akpobasa (2009) in their study in which they reported that lack of credit/fund, fish poaching/theft, fmgerlings mortality due to poor handling were the major constraints facing adoption of aquaculture management practices in Ugheli in Delta State. Other constraints that were found to be important and crucial to adoption of aquaculture techniques are inadequate land space (39.62%), high cost of pond construction, cost of disease treatment, cultural restriction, inadequate labour, poor sales of fish (37.74%o) and prevalence of fish parasite and predator (35.85%). All these identifiedl constraints were in conjunction with the finding of Agbamu and Orhorhoro (2007) findings in which most of the constraints were also identified to be the major problems facing adoption of aquaculture management techniques in Delta State.

Table 13. Constraints Affecting the Adoption of Aquaculture Management Techniques

Constraints	Percentage (%)
Inadequate credit facilities	64.15
High cost of Fingerlings	33.96
Water Supply Problem	43.39
Inadequate Land Space	39.62
High cost of Pond construction	37.74
Inadequate fishery extension service	45.28
Inadequate labour availability	37.74
Fish Poaching/Theft	49.05
Cost of disease treatment	37.74
Cultural restriction for a given species	37.74
Expensive fish feed	45.28
Prevalent of fish parasite & predator	35.85
Poor sales of fish	37.74
Fingerling mortality due to poor handling	47.17
Mean percentage score	42.32%

IV. CONCLUSION

The profile of the fish farmer in Igabi Local Government Area of Kaduna State that emanated from this study showed that male dominated fish farming in the area and majority of them have over 5 years experience in fish farming with about 85 % of the farmers having secondary education level and above. The study also revealed that had rare access to fishery advisory service and has low income. The overall average adoption percentage for all the eighteen aquaculture techniques stands at 35.95% which in simple terms is an adoption level of 35%. In general, it can be concluded that 35%o of the fish farmers in Igabi LGA particularly, Airforce base and National Eye Centre fishing site adopted the recommended aquaculture management techniques since a good number of the adopters were considered to be above the average level of 35%.From the finding of this study, it is therefore concluded that the highest adoption percentage were recorded in liming of pond & pH check 62.26%, monoculture 56.60% as a stocking method, disease treatment 50.90%, supplementary feeding 49.10% and fertilization of pond 41.51%). Inadequate credit facilities 64.15%, fish poaching/theft 49.05%, fingerlings mortality due to poor handling 47.17% expensive fish feed 45.28%, inadequate fishery extension service 45.28% and water supply problem 43.39%o are the most critical constraints to adoption of the aquaculture management techniques under study. Income level, fishing experience, and contact with extension agent are the most significant predictors of adoption of aquaculture management techniques. Given that fish is a preferred source of protein, the promotion of fish farming is a key aspect of solving malnutrition problem in Igabi local Government Area.In light of these findings, it is recommended that adequate extension agents be provided for the farmers so that they can offered services in aspect that showed low adoption rate in this study, including training fish farmers in fish multiplication techniques such as hormone injection, care for eggs/ fries and stripping of fish.The fish farmers should also be encouraged to form strong cooperative societies and pool their financial resources together from where members can borrow for reinvestment and through cooperative societies they can also benefit from government sponsored micro credit scheme to boost aquaculture business.

REFRENCES

[1]. **Agbamu, J.U and Orhorhoro, W.C (2007)**: Adoption of Aquaculture Management Techniques in Delta State. *Nigerian Agricultural Science Journal*, 38(2): 125 – 134.

[2]. **Aphunu, A and Akpobasa B.I.O (2009):** Adoption of Improved Poultry Management Practices in Ughelli Agricultural Zone of Delta State. In *Proceeding of Nigerian Society of Animal Production* held at University of Uyo, Uyo, March,. Pp 250-253

[3]. **Federal Department of Fisheries(2002):**Fisheries Statistics of Nigeria .Federal Ministry of Agriculture and Rural Developent, Abuja, Nigeria.

[4]. **Federal Department of Fisheries(2004):** Fisheries Statistics of Nigeria .Federal Ministry of Agriculture and Rural Developent, Abuja, Nigeria.

[5]. **Food Agriculture Organization (2006):** Nigeria's Fisheries Profile. *www.fao.org/ fi/fcs/en/nga. Retrieved on February 2.*

[6]. **Ladebo, O.J.(1999)**. Determinants of Adoption of New Technology Among Rice Farmers in Ifo Local Government Area of Ogun State, Nigeria. *ACTA Universitalis Agriculturae Silvivulturae Mendelianae Brumesis (Czech Republic),* 47(2): 83-97.

[7]. **Moehl, J.(2003)**:Gender and Aquaculture Development in Africa . FAO Aquaculture Newsletter, July, No 29, Rome.

[8]. **Okorie, J.U.(1978)**: "*A guide to Livestock Production in Nigeria"* Macmillan Publisher, London

[9]. **Otegbeye, G.O, Owonubi, J.J and Oviasuyi, P.K (2001):** Inter Specific Variation Growth of Eucalyptus Growing in Northern Nigeria: In *Proceeding of the 27ᵗʰ Annual Conference of Forest Association of Nigeria* held in Abuja. pp. 12- 16.

[10]. **Peace Corps (1976)**: Contribution to Agricultural Development through Extension. USA

[11]. **Roger, E. M. and Shoemaker, F.F. (1971)**:*Communication of Innovations. A Cross Cultural Approach . 2nd Edition .* The Free Press.New York. PP 20 - 26

[12]. **Williams, D.**B.(1968): *Agricultural Extension Farm External Services in Australia, Britain and United* **State** *of America.* Melbourne University Press.