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CONTENT

Determinants of Smallholder Farmers' Participation in Community-Based Onion Seed Producing and Marketing Cooperatives in Northwest Ethiopia

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Abstract

Onion seeds are mainly supplied by community based seed production and marketing cooperatives in Ethiopia. The problem of seed marketing which was faced by the onion seed producer and marketing cooperatives of Mecha district of Amhara regional state is the major reason for undertaking this study. The study analyzes the main factors for members' participation in their cooperatives. This objective serves as an indicator for the general performance of the cooperatives in running the seed business. The research used descriptive statistics and binary logistic regression model to assess members' socio-economic, demographic and institutional factors determining members' participation in cooperatives and describes seed quality status. A Semi-structured questionnaire was employed to collect primary data. A total of 120 members were randomly selected from three cooperatives in February, 2018. The study indicated that the cooperatives have been weak in making profit from the seed marketing due to their poor involvement in onion seed distribution and supply of other inputs. The findings show that there exists significant difference between active and inactive members of the cooperatives in terms of land ownership, duration of membership, information and training access, dividend obtained, satisfaction on management and communication channels used. The logistic regression result indicated that land holding, access to training for members and communication channel used were significant in determining the level of members' participation. The cooperatives should improve their scope and performance so as to enable members to engage more in production and marketing of seeds and enhance their participation.

Key words: seed producers, cooperatives, participation, onion seed, Mecha district, Ethiopia

Introduction

Agriculture is the mainstay of Ethiopian economy because it serves as a means of livelihood for more than 80 per cent of the population, is the major contributor for GDP and a source of raw materials for the industrial sector (Zewde et al., 2008). This also holds true for Amhara regional state as around 88 per

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cent of the population`s livelihood depends on agriculture which contributes 70 per cent to the regional GDP (Kerealem et al., 2009). These are some of the major reasons for the Government of Ethiopia to give a primary focus for the sector through its different economic development policies. Growth in crop production and productivity has also a huge impact to bring change in other spheres of the sector in Ethiopia. To attain this growth, the availability and timely supply of productive and quality seed is decisive among all other inputs.

The current Ethiopian seed supply system is weak in meeting the diversified seed demand of its smallholder farmers (Abebe and Ligalem, 2011). The formal seed supply system which is dominated by the public breeding and seed suppliers has its focus on a few crops like bread wheat, hybrid maize and Teff. Though the participation of the private sector has been encouraged the problem has not yet been solved. Above all the supply by this system in volume from the producing area in the country is well below 10 per cent (ATA, 2016).

Community based seed businesses are considered as a crucial means in narrowing the gap between the demand and supply scarcity of improved seed in the country. They are also a means to answer the diversified seed demand of smallholder farmers. In Ethiopian seed system, they are considered as an intermediary system between the formal and the informal system (Hamsalu et al., 2013). They are considered partly as a formal system because they can be licensed and can go through the formal process of seed supply. They can be also informal because they can produce local seed of selected crops and can declare the quality of seed produced for distribution within their locality.

The major gap that initiated this research is the poor marketing of seed produced by the primary cooperatives found in *Mecha* district. These are located in *Koga* irrigation project and are engaged in the production of onion seed (Koga irrigation project, 2017). There are three onion seed producing and marketing cooperatives; two of them have been established by Bahir Dar University, ISSD program while the third cooperative was established by the farmers themselves.

Even though the role of cooperatives has been well studied (ISDD, 2015; ATA, 2016 and Dawit et al., 2017) the intensity of participation of their members (which indicates the performance of the cooperatives) is not yet well studied in *Mecha* district. The satisfaction level of end users from the quality of seed supplied by these cooperatives in comparison with other suppliers is not analyzed. Therefore, the study contributes to fill the literature gap in identifying the determinants of farmers' participation in onion seed producing and marketing cooperatives to further understand the performance of cooperatives.

Materials and methods

Description of the Study Area

The study was conducted in Mecha district, one of the 13 districts of West Gojjam zone of the Amhara regional state in Ethiopia. The district is located in the Northwestern part of the country. The town of the district, *Merawi* is found at 535 km northwest of the capital, Addis Ababa and 30 km southwest of Bahir

Dar, the regional capital. The district lies between $11^0$05` to $11^0$38`N and $37^0$00`E to $37^0$23`E with an area coverage of 159,027 hectares. The altitude of the district ranges between 1800 and 2,500 m.a.s.l. This means that 80 per cent of the district lies in mid altitude area and the remaining 20 in the highland. The study area has mono-modal rainfall distribution pattern with highest rainfall from May to October. The mean annual rainfall ranges between 1000 mm to 2000 mm (Ibid). The annual temperature is 5.7^0c, 30.6^0c, 18.8^0c, which is minimum, maximum and mean score (*Mecha* district finance and economic development office, 2018).

Methods of Sampling and Data collection

Mecha district is selected because of its accessibility and high potential in onion seed production using *Koga* irrigation project. There are three farmers` onion seed producers and marketing cooperatives in three different *kebeles** of the *Koga* irrigation zone. 120 member households were selected out of the total 255 member households from the three cooperatives (Table 1). Out of the selected members, 30 of them are categorized as inactive and 90 of them are active members. Both groups constituted the sample for comparison purposes. Both primary and secondary data sources were used in the study. A household survey employing a semi-structured questionnaire was the main data collection method. Observation and field evaluation was also employed at different working sites and offices of the cooperatives.

Table 1. Sample size and Sample Frame (data from 2018 register book of cooperatives)

Cooperative	Location (Kebele)	Total member size			Sample Size		
		Male	Female	Total	Male	Female	Total
Kudmi	**Kudmi**	140	10	150	41	4	45
Bered Gafera	**Kolela**	62	1	63	44	1	45
Kedimeh Tenesa	**Andinet**	40	2	42	30		30
Total		**242**	**13**	**255**	**115**	**5**	**120**

Methods of data analysis

The collected qualitative and quantitative data were analyzed using both qualitative and quantitative analysis tools. Econometric model of binary logistic regression was used to analyze the determinants of members' participation in different activities of the cooperatives. "Members' participation" is the dependent variable, which is dummy i.e. either members participate actively or inactively in different activities of the cooperatives. The independent variables were both categorical and continuous. SPSS software, version 16 was used for data analysis.

*Kebele is the lowest administrative unit in Ethiopia

Specification of econometric model

To analyze the factors influencing the intensity of members' participation in the seed producer and marketing cooperatives, logistic regression has been employed as the dependent variable is dichotomous, i.e. either active member or inactive member based on the level of their participation. Following Gujarati (2004) the logit model is given as:

$P_i = f(Zi)$ (1)

$Z_i = \beta_0 + \Sigma_i^n \beta_j X_{ji} = [\log (p/1- p) = Z_i = \alpha + \beta_i X_i + \ldots \beta_i X_n]$ (2)

$$Logit(p) = Log\left(\frac{Pi}{1-Pi}\right) = \alpha + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \cdots \beta iXn \quad (3)$$

Where;

Pi =1 the probability that an individual actively participates in the cooperatives (active member),

Pi = 0 if inactively participate

$\left(\frac{Pi}{1-Pi}\right)$ = is the odds ratio of the probability of participation to no-participation.

Zi = estimated variable for the i^{th} observation

f= the functional relationship between pi and zi

Xj*i* = the jth explanatory variable for the ith observation, j = 1, 2 …n,

ßj = a parameter, j = 0,1…n

j = 0, 1…, n where n is the total number of explanatory variables

Definition of variables, measurements and hypothesis

Dependent variable

The dependent variable is dichotomous, i.e. 1 if a member is actively participating and 0= if inactively participating.

Independent variables

1. Individual and Household Characteristics

Age of member farmer (AHH): Continuous: represent the age of the member farmer at the time of the interview. It is a continuous variable and expected to have significant impact on participation of farmers in their cooperative matters. Young farmers have more efficiency in gathering new ways of operation than older farmers (Getachew, 2010). But the experience that farmers had accumulated about the disadvantages and advantages of the cooperatives has more influence on participation (Ahmedine, 2008).

Sex (SEX): Dummy: which will take the value 1 if male, and 0 if the respondent is female. Even though the participation of females in seed production operation is high, their participation in different operations

and decisions of the cooperatives is not active. Females' participation in cooperatives is expected to be passive in most events of the cooperative given their roles at the household. So sex of the member farmers has an important link with the extent of participation.

Educational level (EDUL): Categorical: level of literacy the respondent farmers have at the time of interview. It is a categorical variable which could be categorized according to the level of education of the respondents. For illiterate, read and write, elementary school, and high school educational level of participants, the categories are 0, 1, 2, and 3, respectively. Education is a crucial factor for skill development; hence education has been shown to be positively correlated with members` intensity of participation in cooperatives (Kirub, 2008). Illiterate members may not read reports and hence are passive participants (Habtamu, 2014). Hence level of education has a significant and positive influence on the level of members` participation.

Family size (FS): Continuous: It is assumed that farmers with high family size have good participation in cooperative matters due to the available labor force that could handle their farming activity. The family size should also go with the proportions of working age against dependents.

Marital status (MS): Categorical: It is categorized as married, divorced, unmarried and widowed from 1 to 4 categories, respectively. Since households with married status have good chance of discussion on the economic importance of the cooperatives, marital status could have an impact on the extent of participation of farmers in their seed cooperatives.

2. Socio-Economic variables

Farm size (TLAND): Continuous: this is the size of cultivated land (in ha.) owned by the respondent household. It is expected to have a positive relation with the participation of the farmers in their seed cooperatives. Farmers with large land size actively participate in seed multiplication operation and thus the expected participation on the decision at planning and implementation is high.

Number of oxen owned (NOXE): Continuous: this represents the number of farm oxen the respondent owns at the time of interview. It is expected to positively affect farmers` participation in cooperative participation. Farmers use oxen as the main traction material and their number indicates the economic status of the farmers. The more oxen they own the more would be their participation in seed multiplication and other decision matters. The points which should go with this are the total livestock holdings which indicate the wealth status that could influence participation positively. It is measured in tropical livestock unit (TLU).

Gross income level of farmers (GINC): Continuous: it is the total income level of the interviewed farmers. Members in cooperatives are the owners and their ownership can be explained by the amount of investment in the form of shares they bought. Farmers with better income are likely to purchase more

shares, hence their participation in election, decision making of cooperatives is expected to be active (Kirub, 2008)

3. Services obtained from the Cooperatives

The different services offered by the cooperatives to their members have great influence on their level of participation. There are many services provided by cooperatives for their members such as access to information, trainings, patronage share obtained, input access like basic seed which are the major ones. The services or benefits obtained are the major reasons for farmers` participation in cooperatives. If no benefits exist, there are no cooperatives (Minilek et al, 2012).

Access to information (IA): Dummy: cooperatives act as a source of information for different technologies and agricultural activities. Access to new information could be taken as dummy variable. That is 1 if a member has better access to information because of being a member of a cooperative and 0, otherwise. Access to information has a positive influence on members' participation in cooperatives.

Training access (TRACC): Dummy: access to seed production and marketing training is a dummy variable in this study, which could be represented by 1 if the respondent has got different training opportunities in relation to seed and cooperatives, and 0 otherwise. Training is a continuous process of capacity building which enables the households to increase their knowledge and skill on seed production and marketing. Hence the training they obtained from professionals on importance of cooperatives, seed production and marketing is expected to influence their participation positively.

Dividend Obtained (DVO): Continuous: it is the probability the members receive the share of profits from the cooperatives. 1 if the respondent gets the patronage at least once every year, and 0 otherwise.

The level of satisfaction on price determined by cooperatives (SATPR): Categorical: this represents the level of satisfaction the members feel about the total amount of prices determined per kilogram for his/her seed after selling to the cooperative. It is used to compare the differences in benefits with respect to grain markets, and the price obtained by working with other formal seed suppliers as being contract growers. The satisfaction level could be represented from very dissatisfied to very satisfied, with 0 to 3 categories, respectively. The higher price offered is expected to influence member farmers to have active participation in their seed production cooperatives.

4. Organizational environment of the cooperatives

Under this section the main organizational conditions which have influence on members` participation will be explained. From review of different literature it is possible to take the duration since membership, members' satisfaction with the cooperative management and communication channel of Board of Directors as major explanatory variables (Ahmedine, 2008, Kirub, 2008 and Getachew, 2010).

Duration since membership (DURMEM): Continuous: refers to the number of years that a farmer is a cooperative member. The more the number of years the farmers was a member of the cooperative the more the experience and knowledge they gained about benefits of the cooperatives. Longer duration since membership is thus expected to positively influence extent of participation in cooperatives.

Members` satisfaction with the cooperative management (MEMSAT): Categorical: Members' participation is directly related to their satisfaction on how the cooperative is running (Kirub, 2008). When members are dissatisfied on cooperative organization and management, they may react by non-participation. The attitude of members towards their organization management body's competitiveness and trustworthiness are important factors that influence their level of participation. The variable takes the values from 0 to 3 for the levels of 'very dissatisfied', 'dissatisfied', 'satisfied' and very satisfied, respectively.

Communication channels of the Board of Directors (COMCH): Dummy: this is the information communication system that the Board of Directors use. It indicates how the managing teams of the cooperatives openly communicated the performance and decisions of cooperative members. Channels of information communication have got high impact on members` participation. It is a dummy variable which takes 1 for open communication and 0 other wise.

Distance to cooperative service center (DISCOP): Continuous: As the farmers are nearer to the cooperative service center, they have the opportunity to get more information. So distance to the service center has an inverse relationship with members' participation. It can be measured in the minutes it takes in walking for the farmers to reach the center.

Results and Discussion

Results of Descriptive Statistics: Comparisons between active and inactive participants.

Age and total family size

As can be observed from Table 2, the mean age of active member group is 41.21 and that of inactive member participants is 40.54 years. So their mean difference is small indicating that the majority of the cooperative members are found in the active working age. The variation in average total family size between the active and inactive members in participation is also very low. The contribution of age and family size in bringing a difference in the level of participation is found to be insignificant.

Table 2. Summary of result of mean comparison between active and inactive members

Level of participation						
Active			**Non- active**		**sig**	**t-value**
Variables	**Mean**	**St.Dev.**	**Mean**	**St.Dev.**		
Age	41.21	9.481	40.53	10.947	0.745	-.326
Family size	5.88	2.11	5.35	2.157	0.256	-1.141
Land holding	0.88	0.477	0.71	0.49	0.097*	-1.672
Oxen ownership	1.93	0.65	1.93	0.74	1.000	0.000
Gross income level	47,096	16,334	43,352.4	21,313	0.37	-1.004
Duration since membership	4.82	2.075	3.07	2.625	0.002***	-1.756
Distance from home to the cooperative	14.36	12.33	16.77	17.246	0.406	2.411

***, **,* Significant at 1%, 5%, and 10%, respectively

Land holding, Oxen ownership and Gross annual income

The average land holding of active members is 0.88 hectares, where as it is 0.71 hectares for the inactive ones. Land ownership is found to bring significant difference in the level of participation of farmers. The other two continuous socio-economic variables, viz., oxen holding per household and gross income level have also brought no statistically significant variation on participation.

Duration since membership and distance from the Cooperative Office

About 58 per cent of the members have more than five years of membership and 26.7 per cent have scored only one year since they joined the cooperatives. The maximum was in Kudmi cooperative which is seven years and the minimum at Kedimeh Tenesa cooperative, which is one year.

The active members have mean of 4.8 years stay in the cooperatives, but the inactive members have the mean membership of only 3 years. Therefore, members with more years of membership are active members. This indicates that the longer the period a member stays in the cooperatives, the better the level of understanding about the objectives and mission of cooperatives. They have more experience of the gains and losses of working as cooperatives than new members. The t- test result also indicates that the number of years of membership has a significant contribution in members' participation.

The distance of the cooperative office from the members dwelling has an impact on extent of participation which can be tied with the poor information communication of the cooperatives. Due to limited market volume, the cooperatives have members participating only from irrigation blocks which are found in their vicinity. The actively participating members have taken on an average 14.36 minutes of walk, whereas the inactive ones have taken 16.77 minutes' walk from their home to the cooperatives` office. Therefore,

distance from cooperatives office to home is one of the important factors for farmers to participate in cooperatives. However, the contribution of the variable to participation was found to be insignificant on participation from the test result.

For categorical variables, Pearson chi-square test for independence is used to assess their mean difference on participation. This test is used to explore the relationship between two categorical variables (Pallant, 2005). Taking into account the data collected, some categories of responses given under the variables are minimized into two categories. These are marital status -married and unmarried. Similarly, educational status is categorized as literate and illiterate. The other variables which measure satisfaction level from very satisfied to very unsatisfied are re-grouped to satisfied and dissatisfied. These relate to satisfaction on total price obtained and satisfaction levels on cooperatives management bodies.

Sex, Marital status and Educational attainment

From Table 3, it is possible to see that out of the 5 females included in the random sample three of them (60%) were actively participating in their cooperatives. This implies that if chances are given to females, their participation could be high. However, statistically sex difference is not significant in influencing participation between active and inactive members. The remaining two personal characteristics variables, viz., marital status and educational attainment were also found to have insignificant contribution for difference in participation in the area.

Services obtained and organizational environment of the cooperatives

Out of the six categorical variables under the different services obtained from the cooperatives and the organizational environments, five of them are found to be statistically significant to influence members' participation on their cooperatives governance issues. These are access to agricultural information, training access, attainment of dividend share annually, their satisfaction level on the management of the cooperatives and the communication channels used by the cooperatives management. The results imply that the services the members obtained from the cooperatives and their attitude towards the managers of their cooperatives are found to be more significant than other personal and socio-economic factors in determining their level of participation.

Farmers usually use their cooperatives as a source of information for their different agricultural operations. From the result of the analysis, it is possible to see that farmers who got access to information have participated better. Out of the total respondents 78 per cent of them have agreed they got better information for their work. Out of these farmers, 85 per cent of them have actively participated in the cooperatives. Hence, access to agricultural information is positively and significantly connected with participation.

Training access on seed production, marketing and cooperative issues can contribute to the better understanding of seed business and also the importance of working together. Out of the 120 members 61.7 per cent of them have attended these trainings and hence their participation in the cooperative is active. Farmers who lack this training access are found to be poor in participation. Out of farmers without access to training, only

38 per cent are found to be active in participation. Farmers who got more dividends annually, which is attained from their higher shareholding, were found to be higher in their level of participation. However, the satisfaction level from the price set from sale of onion seed was found to be not statistically significant for participation. Out of the 120 respondents, 71 of them confirmed that the price obtained from onion seed is better than other crop sales of the area. However, 49 participants showed their dissatisfaction, which is connected with the current marketing problems on onion seed in the area.

The satisfaction level of the respondents on their management is also found good in the study area. About 91 of the respondents are satisfied with their managers out of which 74 of them showed active participation in their cooperatives. Besides the communication channel used by the cooperatives managers is found to be accessible to the majority of the respondents. Of 120 respondents, 97 respondents have confirmed the accessibility of the channels. This is in connection with their vicinity to the cooperative office and the means of communication which is accessible to the majority of the members. They use churches, letters and personal communications.

Table 3. Chi square test result for services obtained from the cooperatives, organizational Environments and personal characteristics

		Level of participation				
Variables	**Categories**	**N**	**Active**	**Not active**	**Sig.**	**Chi- sq.**
Information access	Better access	94(78.3%)	80(85%)	14(15%)	0.000	21.211***
	No access	26(21.7%)	10(38%)	16(61.5%)		
Training access	Got training	74(61.7%)	66(73.3%)	8(26.7%)	0.000	18.801***
	No training	46(38.3%)	22(47.6)	24(52.2%)		
Dividend obtained	Got dividend	73(60.8%)	64(87.7%)	9(12.3%)	0.000	14.282***
	No dividend	47(39.2%)	21(44.7%)	26(55.3)		
Satisfaction on seed price	Satisfied	71(59.2%)	55(77.5%)	16(22.5%)	0.592	0.287
	Dissatisfied	49(40.8%)	35(71.4%)	14(28.6%)		
Satisfaction on management	Satisfied	91(75.8%)	74(81.3%)	17(18.7%)	0.01	6.684**
	Dissatisfied	29(24.2%)	16(55.2%)	13(44.4%)		
Communication channel used	Accessible	97(80.8%)	79(81.4%)	18(18.6%)	0.002	9.485***
	Not accessible	23(19.2%)	11(47.8%)	12(52.2%)		
Sex	Female	5 (4.2%)	3(60%)	2(40%)	0.792	0.070
	Male	115(98.5%)	87(75.7%)	28(24.3%)		
Educational level	illiterate	90(75)	68(75.6%)	22(24.4%)	1.000	0.000
	literate	30 (25%)	22(73.3%)	8 (26.7%)		
		Level of participation				
Variables	**Categories**	**N**	**Active**	**Not active**	**Sig.**	**Chi- sq.**
Marital status	Married	111(92.5)	85(76.6%)	26(23.4%)	0.317	1.000
	Unmarried	9 (7.5)	5(55.5%)	4(44.4%)		

***,**,* Significant at 1%, 5%, and 10%, respectively

Determinant Factors Influencing the Extent of Participation

Out of sixteen explanatory variables considered in the binary logistic model, three of the variables were found to have significant influence on participation of members in their cooperatives (Table 4). These variables are total land holding of the respondent member farmers (TLAND), the communication channels used by the cooperatives managing bodies (COMCH) and access of members to different trainings (TRACC).

Table 4. Parameter estimates for binary logistic regression

Variables	B	S.E.	Wald	p-value	Exp(B)
SEX	.281	1.764	.025	.874	1.324
AHH	-.059	.039	2.338	.126	.942
MS	2.294	1.421	2.604	.107	9.911
FS	.095	.171	.313	.576	1.100
DURMEM	.084	.187	.201	.654	1.088
EDU	.368	.726	.257	.612	1.445
NOXE	-.260	.499	.271	.603	.771
GINC	.000	.000	.859	.354	1.000
IA	-.633	.770	.676	.411	.531
TRACC	-1.191	.711	2.803	.094*	.304
DVO	-1.402	1.001	1.963	.161	.246
SATPR	.164	.668	.060	.806	1.178
MEMSAT	-.606	.686	.781	.377	.545
COMCH	1.538	.755	4.156	.041**	4.657
DISCOP	.027	.023	1.297	.255	1.027
TLAND	2.203	.926	5.664	.017**	9.055
Constant	.085	2.000	.002	.966	1.089

Model fit summary

Cox and Snell R2 0.320, Nagelkerke R2 0.474: -2 log likely hood 38.687
Pearson chi square 7.325, and P-value 0.502
Correctly predicted R2 value indicated from the analysis is 83%
***, **, * Significant at 1%, 5%, and 10%, respectively

Total land holding of the members (TLAND)

The findings show that the odds of participation increase by a factor of 9.055 for every additional unit of land members own, keeping the other factors constant. It is possible to see that the land holding has a positive association with the level of participation. The larger the size of land, the more capability the farmers would have to produce seed and purchase more inputs such as improved seed that could enhance their participation.

Communication channel used by the cooperative (COMCH)

For every information members receive from their cooperatives, their participation would increase by a factor of 4.657, depicting a positive association between the accessible communication channel and level of participation. The finding has approved the importance of communicating the activities of the cooperatives to the members through accessible means of communication channels. This could keep them up-to-date in every activity of the cooperatives, which in turn brings positive impact for their chance of participation.

Access to training for the members (TRACC)

Although access to training on seed production technology was expected to positively influence members to participate more in the governance of their cooperatives, the result of the analysis indicated that there is negative association between access to training and participation. In addition, the odds ratio indicated that there is a decrease in participation by a factor of 0.304 for every access of training on seed technology keeping other factors constant. This might be because the farmers were inclined more to economic participation and reduce governing their cooperative after seed technology training. The finding is in line with (Kirub, 2008) who concluded that access to training by cooperative members is statistically insignificant. However, Getachew (2010) found a significant difference between farmers to participate in cooperatives with respect to their access to seed related training.

Concluding Remarks

Community based seed production and marketing is one of the major ways used to tackle seed supply scarcity in the country. Among the crops, vegetable seed particularly seed of onion and potato is mainly supplied by this system. The research tried to assesses the factors affecting the extent of participation of members in their cooperatives, which is one of the major indicators for the performance of the cooperatives in serving the community. Making profit for the cooperatives is also very important, which enables the members to get more return on their share. This is one of the factors which enable the members to actively participate in their cooperatives. The overall findings also depict that there exists significant association between active and inactive members of the cooperatives in terms of land ownership, duration of membership, information and training access, dividend obtained, satisfaction on management and communication channels used. Land holding, access to training for members and communication channel used were also found significant in determining the level of members' participation. The overall findings imply that seed producers and marketing cooperatives should improve their scope and performance to enable them engage more in production and marketing of seeds and thereby enhance the participation of members. On top of these, the seed producing and marketing cooperatives should be managed by efficient managers for success in the business of seed production and marketing.

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Socio-economic Factors Influencing Utilization of Manual Screw Press for Gari Production in Kwara State, Nigeria

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Abstract

This study investigated socio-economic determinants of utilization of manual screw press for cassava mash dehydration for gari production in four local government areas across the ADP zones in Kwara state, Nigeria. Using multistage sampling technique and a semi-structured questionnaire as an instrument, data for the study were collected from a sample of three hundred and eighty four (384) gari processors who use the screw press in the state. Multiple regression analysis shows that a correlation (R=0.678) exists between utilization of the screw press and independent variables which include age, household size, level of education, years of processing experience, extension visits, and income from gari processing. R^2 value of 0.460 indicates that about 46 per cent of the variation in utilization was explained by socio-economic variables included in the regression model. Three variables significantly influenced the decision of the respondents to utilize the manual screw press: age, level of experience, and income; the most important predicator being income with a Beta value of 0.699. Conclusively, it was recommended among others that research, extension, and policy makers consider the significant determinants identified in the study seriously if increased utilization is to be achieved by gari processors and others similar to them in the study area and the region.

Key words: Improved technology,Manual screw press, Socio-economic factors,Utilization.

Introduction

Improved agricultural technologies exist in all facets and stages of agriculture; be it at production or at postharvest stages, and have played a major role in developing the agricultural industry (Solomon, 2010). Agricultural innovations are an important part of any agricultural system and are vital in all circumstances, whether there is surplus or deficit (Vilane, Shongwe, Motsa, &Shongwe, 2012). However, increasing the efficiency of agriculture both at production and at postharvest stage through improved agricultural technologies depends on the extent to which farmers and processors incorporate these technologies into their operations (Sasore, 2005).

Most of the evidence about effect of improved technologies in agriculture comes from South-East Asia (Japan, Taiwan, and South Korea etc.). In South-East Asia, growth in agricultural productivity has been

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rapid, largely as a result of the extensive utilization of modern agricultural technologies, and for millions of poor people the technological advances of the Green Revolution provided a route out of poverty (Ravallion & Chen, 2004). In Africa however, there are very few examples where agricultural technology has benefited smallholder farmers on a national scale (Lanjouw& Stern 1998). Particularly,Doward, Kydd, Morrison, & Urey (2003) maintained that utilization of agricultural innovation has been inadequate in most parts of Africa. Nevertheless, facts from Zimbabwe reveal a post-independent Green Revolution amongst smallholder farmers which has had a significant influence on poverty through the introduction of hybrid maize, expanded access to credit, guaranteed prices and marketing subsidies (Eicher, 1995).

The implications of understanding the factors that influence farmer's decisions to utilize improved technology are enormous. Understanding these factors is essential in planning and executing technology related programmes for meeting the challenges of food security in developing countries. To enhance technology utilization by rural agro processors, it is important to understand factors that influence their decision to utilize technology in order to come up with technology that will suit them. Simply put, understanding some of the dynamics in improved post harvest technology utilization decision can help researchers working in the cassava processing sector to design innovations. Consequently, the variables that would be identified as key indicators towards explaining utilization of the manual screw press can be utilized within this context.

The main objective of the study is to investigate socio-economic factors influencing utilization of manual screw press for dehydrating cassava mash for gari production in Kwara state, Nigeria.

Material and Methods

The study was conducted in Kwara State, Nigeria, located between Latitude $8^0\,05'$ and $10^0\,05'$ North and Longitude $2^0\,50'$ and $6^0\,05'$ East of Greenwich Meridian (Oyebanji, 2000).According to National Bureau of Statistics (2012) Kwara state has a land mass of 35,705 square kilometres (km^2). The 2006 population census by the National Population Commission put the population of the state at 2,371,089 (Federal Government of Nigeria, 2007).This study is a cross-sectional survey.Multi-stage sampling technique was used to select respondents for the study.For this study, necessary sample size of 384 was calculated and adopted using the formula by Smith (2013) for determining necessary sample size when population is unknown or approximated.

One local government area (LGA) each from the four agricultural zones of the state namely Kaima, Edu, Asa, and Ifelodun was purposively selected to ensure that the study cuts across the ADP zones in the state.Simple random sampling technique was used to select three (3) wards each from local government areas selected earlier.Consequent on the fact that it is difficult, if not impossible to come up with a sample frame for the study by the researcher or from secondary sources; because of the nature of the population itself, it was imperative that Gari processors who utilize the manual screw press who have been previously identified through the assistance of local resource persons from each ward were selected through a

simple random sampling method. Primary data was collected by the researcher through interviews (individual interview).

In order to avoid ambiguity and a weak evaluation of the phenomenon under study, this study will limit itself to assessment of socioeconomic factors namely: age, household size, level of education, years of processing experience, extension visit(s), and income from gari processing.Inferential statistics namely multiple regression was used for analysis of generated field data. The regression equation is shown below:

$Y = a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+b_6x_6+e.$

Where:

Y=Utilization of the manual screw press for gari processing

a = constant term

$b_1 – b_6$ = Regression Coefficients of $x_1 – x_6$ to be estimated.

x_1 to x_6 = Independent variables as defined in the general equation

X_1= Age

X_2= Household size

X_3= Level of Educational Qualification

X_4 = Level of experience

X_5= Contact with extension agents

X_6= Level of income from gari processing

e= error term

A priori expectation of the explanatory variables

Age is expected to have a negative sign (Omonona et al, 2005), household size is expected to have a positive or negative sign (Omonona et al, 2005), level of education is expected to have a positive sign (Chilot et al, 1996), level of experience is expected to have a positive sign (Chilot et al, 1996), extension contact is expected to have a positive sign (Omonona et al, 2005), and level of income from gari processing is expected to have a positive sign (Unamma, 2014).A positive sign on a parameter would indicate that the higher the value of the variable, the higher the utilization level. Simply put, if the value is positive we can tell that there is a positive relationship between the predicator and manual screw press utilization; whereas a negative coefficient represents a negative relationship.

Results and Discussion

Table 1. Multiple regression showing relationship between utilization and socio-economic variables and their contribution in explaining the variability in utilization of the manual screw press

Variables	Unstandardized Coefficients		Standardized Coefficients	t	sig
	B	Std. Error	Beta		
(Constant)	6.235	.309		20.159	.000
AGE (X_1)	-.126* **	.051	-.106	-2.459	.014
HOUSEHLDSIZE (X_2)	.044 NS	.038	.045	1.148	.252
LEVOFEDU (X_3)	-.031NS	.050	-.024	-.607	.544
YEARSOF EXP (X_4)	.090 ***	.035	.116	2.536	.012
EXT. VISIT (X_5)	-.212 NS	.157	-.051	-1.353	.177
INCOME (X_6)	.627 ***	.038	.699	16.439	.000
R=0.68					
R^2 = 0.46					
Adjusted R^2 = 0.45					

*** Coefficient statistically significant at 1%
NS Not significant
The model is fitted as: Y = 6.235 + -.106(-.126) + .045(0.44) + -.024(-.031) + .116(.090) + -.051(-.212) + .699(.627)+ 0.309

The result of the multiple regression analysis as shown in Table 1 indicates that a correlation (R= 0.68) exists between utilization of the manual screw press for cassava pulp dehydration and the independent variables. The R is the simple correlation between the socioeconomic variables and utilization of the manual screw press. The Table also shows that R^2(coefficient of multiple determination: R^2 measures the proportion of variation in Y explained by X) value is 0.460; indicating that about 46 per cent of the variation in utilization of the manual screw press was explained by variables included in the model. The remaining 54 per cent could be attributed to the variables not included in the regression model. The adjusted R^2 gives some idea of how well the model generalizes, and ideally the value should be close to the value of R^2. The difference in R^2 and adjusted R^2 for the model is a fair bit (0.460 – 0.452= 0.008 or 0.8 per cent). This means that if the model were derived from the population rather than from the sample it will account for approximately 0.8 per cent less variance in the outcome.Furthermore, because, the predictors identified in the study were only able to explain 46 per cent of variation in the utilization of the manual screw press it indicates that there is need to mobilize new factors.

From the result of the regression analysis as shown in Table 1, the regression coefficient of age (-0.126) is statistically significant at 1 per cent level. This implies that age of respondents is significantly related to utilization of screw press for dehydration of cassava mash for gari production in the study area. Or simply put,age composition of respondents for the study is a significant factor in utilization of the screw press; however it was negatively significant. The negative sign of regression coefficient of age (x_1) is in agreement with *a priori* expectation of the explanatory variable as stated earlier. That age was negative signifies an inverse relationship. In other words, increase in age reduces the level of utilization of the manual screw press among respondents. This means that, as a gari processor ages, he/she will use the screw press less in gari processing. That is to say, age has a negative influence on utilization among the respondents. That age of respondents is negatively related with manual screw press utilization confirms the risk aversion component in the diffusion theory; older farmers are more risk averse, and are less likely to experiment with new technology.

A possible explanation for this is that older processors have less need for extra income and do not see the need to try new methods or utilize improved methods that could increase their productivity and income. Again, as processors grow old, there is the tendency to reduce level of adoption as their ability to cope with various processing operations diminishes.

The finding of this study corroborates Wasula (2000) who found that age significantly influences the utilization of contour vegetative strips farming. Suleman (2012) also found out in his study that age of farmers is significantly related to utilization; non-adopters were older than adopters. Kinuthia & Mbaya (2017) study on determinant of technology utilization and how it affects farmers' standard of living in Tanzania and Uganda show that in both Tanzania and Uganda, farmers who plant new seed varieties are relatively younger than those who do not, suggesting that as farmers age they are less open to adopting improved technologies.

From the result of the regression analysis as shown in Table 1, the regression coefficient of household size (0.044) is positive, but not significantly related to utilization of manual screw press for dehydration of cassava mash for gari production in the study area. That is, household size of respondents is not a significant factor in utilization of the screw press. However, that regression coefficient for household size (x2) was positively signed, agrees with the *a priori* expectation of the explanatory variable as earlier stated.

This result fully agrees with Tijjani (2010) who also found household size to be insignificant in the adoption of recommended cowpea production practices.However, our finding contradicts Bonabana- Wabbi (2002) who maintains that household size influences utilization of agricultural technology in that, a larger household has the capacity to relax the labor constraints required during introduction of new agricultural technology.

From the result of the regression analysis as shown in Table 1, the regression coefficient of level of education (-.031) is not significantly related to utilization of screw press for dehydration of cassava mash for gari production. The implication is that level of education of respondents is not a significant factor in

utilization of the screw press; education or lack of education does not affect utilization level of the screw press by gari producers in Kwara state. However, regression coefficient for educational level (x_3) revealed a negative sign which does not agree with the *a priori* expectation of the explanatory variable as stated earlier.

The result corroborates Anaglo et al (2017) study; they found no significant relationship between level of education and farmers level of adoption. The reason for this according to them may be that information on improved livestock production practices disseminated by extension service providers were not done using materials that require high level education, thus all farmers having both low or high education are equally able to apply the improved technologies. This is contrary to findings of Adam &Boateng (2012) who observed that education significantly influences adoption of technological innovation in small ruminant production.

From the result of the regression analysis as shown in Table 1, the regression coefficient of processing experience (0.090) is significantly related to utilization of screw press for dehydration of cassava mash for gari production in the study area. That is, processing experience of respondents is a significant factor in utilization of the screw press.This is possibly because as gari processors acquire more experience, they would have full information and better knowledge hence able to evaluate the advantage of the technology and utilize it. Furthermore, regression coefficient for level of experience(x4) was positively signed in agreement with the *a priori* expectation of the explanatory variable as previously stated.

Our result is in agreement with the study of Mulaudzi & Oyeleke (2015) who found significant relationship between experience of farmers and level of adoption, although negatively related. Mulaudzi & Oyeleke explained that more experienced farmers were unlikely to adopt improved technologies, possibly because they are close to retirement, leaving less time to increase their benefit from proceeds that investment may bring.Again, our finding is in agreement with Ainembabzi & Mugisha (2014) who investigated the relationship between adoption and experience with agricultural technologies and found out that there was a significant relationship between experience of farmers and adoption of agricultural technologies in banana, coffee and maize in Uganda.

From the result of the regression analysis as shown in Table 1, the regression coefficient of extension contacts (-0.212) is not significantly related to utilization of screw press for dehydration of cassava mash for gari production in the study area. That is, extension contacts of respondents are not a significant factor in utilization of the screw press in the study area. What this means is that whether processors are visited by extension agents or not does not determine if they would use the screw press or not use it. Furthermore, regression coefficient for extension contact (x_5) was found to be negatively related which contradicts the *a priori* expectation of the explanatory variable as previously stated.

Our finding is consistent with that of Olaniyan (1998) who found extension contact not to be significantly related to adoption of improved cassava processing technologies. This result also corroborates the finding of the study of Suleman (2012) on factors influencing adoption and utilization of improved cassava

processing technologies in Edo state, Nigeria. In his study Suleman found that extension contact of cassava processors does not have a significant influence on the adoption and utilization of improved technologies.

From the result of the regression analysis as shown in Table 1, the regression coefficient of household income from gari processing (0.627) is significantly related to utilization of screw press for dehydration of cassava mash for gari production in the study area at 1% level. That is, income of respondents from gari processing is a significant factor in utilization of the screw press.Our result shows that for every unit increase in household income from gari processing, a 0.627 point increase in utilization is predicted. This makes income from gari processing the most important predictor for utilization of the screw press for gari processing among the respondents.Furthermore, that regression coefficient of household income from gari processing (x_6) was positively signed agrees with the *a priori* expectation of the explanatory variable as stated earlier.

The result implies that increase in income will lead to increase in utilization of the manual screw press. This result is in consonance with the findings of Unamma (2004) and Chinaka, Ogbuokiri & Chinaka (2007) who found a positive relationship between farm income and adoption; higher incomes enable farmers acquire new or improved technologies that could be financially inaccessible to others. The result also affirms the positions of Mittal, Gandhi, & Tripathi (2010) and Zhang, Fan & Cai (2002) that there is significant and positive relationship between income and utilization of agricultural innovations.

Conclusion

Factors that significantly affect utilization of the manual screw press among respondents are limited to age, years of experience, and level of income. In other words, age, years of experience, and household income from gari processing were important predicators and are factors to consider in the utilization of similar technologies in the study area and comparable regions. To that end, any extension strategy for gari processors aimed at high level improved technology utilization should critically consider the roles of these factors because they have a bearing on utilization decision of the respondents.

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Training Needs Identification of Agricultural Extension Agents in Wadi Zabid of Tihama Region, Yemen

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Abstract

This study explored and described the in-service training needs of agricultural extension agents in Wadi Zabid of Yemen. Using a structured questionnaire, data were collected from forty one (n=41) randomly selected extension agents. Based on the Borich Needs Assessment Model, a survey of 40 competencies from previous research was developed to identify training needs of extension agents (n=41). Mean and standard deviation were calculated to report extension agents' perceived level of performance and ability to practice for each professional competency, while mean weighted discrepancy scores (MWDS) were calculated to indicate in-service training needs.

Findings revealed that the mean age of the respondents was 42.3 years. 31.7 per cent of them have a Bachelor's degree in agriculture and more than half (51.2 %) of the respondents had been working in extension services for 18 years. In addition, 73.2 per cent of the extension agents were male and 26.8 per cent were female. Furthermore, the findings of this study reported that the most important competencies for extension agents were understanding the farming and production system(M=4.78);communicating farmers' problems to researchers (M=4.73); understanding the duties and responsibilities at district and village level (M=4.70); understanding rural culture(M=4.70) and understanding the educational learning process of extension education (M=4.65). However, the findings showed that the highly rated in-service training needs were,producing print-based products (MWDS= 16.38); searching information on the internet(MWDS=15.7); preparing power point slides (MWDS=15.43); using e-mail (MWDS=14.88); using word processing software (MWDS=14.01); using flip chart flash cards(MWDS=12.56); operating film projector (MWDS= 12.25) and evaluating the effectiveness of extension visual-aids respectively(MWDS= 11.95).

Key words: training needs, competencies, agricultural extension agents, Yemen

Introduction

Agricultural extension has an important function worldwide in assisting rural people through informal education and technical procedures in order to increase their production efficiency, income and standard of living. (Roling, 1988; Van den Ban and Hawkins, 1996; Garforth, 1997).

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Furthermore, agricultural extension as an organization established for non-formal educational purposes depends on the extension agents in promoting and implementing its educational programs.

Chizari, Karbasioun and Lindner (1998) stated that well-trained extension agents are the basic resource for a successful extension organization. Without that extension service will be seriously limited in its ability to plan and execute effective extension programs and other technology transfer activities.

In addition, the effectiveness of an extension agent is an important indicator to determine the success or failure of agricultural extension programs (Oakley and Garforth, 1985). However, to be effective, they need competencies in the agricultural extension education process (Gibson and Hillison, 1994). Accordingly, providing regular training for extension agents can be considered as a key tool that effectively helps to keep them qualified and capable to do their duties and responsibilities to meet community and farmers' needs.

Moreover, Gibson and Brown (2003) argued that agricultural extension agents must have competencies comprising knowledge, attitude and skills that are critical to their successful performance. However, the specific competencies needed by extension agents relate to the mission of their organization and the nature of their job. Training is the tool that can help by providing the extension agents with necessary competencies to make them capable of delivering better extension services to farmers.The crucial issue is who will provide the training and in which areas. The training programs in order to be effective, must be conducted based upon training needs identification.

Al-Zahrani et al. (2017) stated that keeping in mind the important role of extension agents in technology transfer, it is important to assess their competencies and training needs to enhance their performance. Therefore, identifying training needs is the first step in the training and educational strategy of an organization and is important to meet the continuing professional development needs of the agricultural extension services.

A study by Lyles and Warmbord (1995) to assess the training needs of the Mississippi Cooperative Extension Service as perceived by 232 extension agents, outlines that four competency areas namely administrative roles, program administration, financial management, and office management were assigned higher mean training need scores.

A study was carried out by Alzahrani and Sorour (1993) to identify the training, knowledge and skills needed by Saudi extension workers in different topics of agricultural technology. The researchers found that there were nine desired competency areas in which respondents wanted to be trained. The priority was given to plant protection competencies with a mean of 4.23. Additionally, the researchers asserted that most of training programs for agricultural extension agents were designed without determining their real training needs scientifically.However, extension agents not only need agricultural technical competencies, but they must also be knowledgeable about the specific culture and social norms of the people with whom they work. They need extension management skills,communication methods that help

them to convey agricultural technical information. In other words, agricultural agents need to possess relevant educational and managerial competencies.

As we have seen, the previous mentioned studies have only focused on technical aspects rather than extension educational competency such as extension principles and philosophy, management, communication and preparation of visual materials and computer operating skills.As Robert S. and Harder A.(2011) stated, a problem with extension services in developing countries is the lack of an adequate balance between the technical and professional competencies of personnel. Moreover, there is a limited number of empirical studies conducted in Yemen regarding training needs identification. This study, therefore, would increase the broad knowledge of the field. Furthermore, this additional information will provide a foundation for fine-tuningthe training programs in the future.

Theoretical Framework of the Study

In agriculture and extension, Roling (1988) argued that there is a considerable emphasis on the use of extension for developing the human being, on forming or enhancing his or her capacities to make decisions to learn, to manage and to communicate with others. This is actually what is called human resource development which focuses on rural people themselves and the social systems in which they function, and deals with such processes as community and leadership development, building institutions and farmer mobilization and organization. He emphasized that:

> *"the objective of HRD is not to develop farms through people but to develop people themselves, so as to make them better leaders, entrepreneurs and decision makers, and to help them organize themselves into effective associations, institutions and, of course, constituencies (Roling, 1988p. 149)".*

Therefore, optimizing Human Resource Development (HRD) must be a priority for agricultural extension services in Yemen and worldwide. Consequently, training is a process of acquiring specific skills, rules, concepts or attitudes to perform tasks better (Goldstein, 1993). It helps the professional to learn and obtain relevant and new information.

Kaufman and English (1979) argued that need assessment is a vital tool to HRD and organizational development for problem identification and justification, a tool that requires the consensus of partners in planning and setting priorities on needs.

Continuous upgrading of extension personnel through in-service training is also necessary to ensure coping with changing in job tasks and the varied needs of the rural community. In order to make the in-service training effective and efficient for extension agents, training needs assessment, is an important step to be implemented because it provides critical information into the development of training programs.This study was guided by a definition of training needs proposed by Borich (1980). According to Borich, a need is described as a discrepancy or gap between what is, or the current situation and what should be. The methodology section provides more details regarding Borich needs assessment model.

Objectives

The general objective of the study was to identify the training needs regarding selected extension education competence as perceived by agricultural extension agents in Wadi Zabid of Yemen. More specifically, the objectives of the study were:

1. To describe the demographic characteristics of extension agents
2. To determine the respondents' perceived importance of the competencies needed
3. To determine the current level of competencies applied by extension agents
4. To identify the training needs of extension agents in specific competencies

Methodology

The design of the study was a descriptive survey. The respondents for the study were 41 agricultural extension agents selected from Wadi Zabid extension department. A questionnaire consisting of two parts was distributed to the respondents. The first part of the questionnaire gathered socio-demographic information on the sample. The second part included a list of competencies which was developed. The list is based on selected 40 competencies identified by the researcher through a literature review and resources such as Baker and Villalobos (1997); Martin and Sajilan (1989); Gamon and Mohammed (1992); Radhakrishna and Smith(2002); Khin Mar Cho (2002). The list consisted of 40 different competencies covering four competency areas namely, principle of extension education, extension administration, preparation /use of audio visual materials and computer application/skills.

A panel of professional and academic extension education experts was asked to review the instrument for content validity. In addition, the reliability test (Cronbach's alpha) was (0.932) and for ability part was (0.853). Each area was measured by restructuring statements of indicators or items to be answered by the respondent according to five point Likert-type scale of measurement. Furthermore, the extension agents were asked to rate the level of importance and ability for the selected competencies as perceived by extension agents.

Descriptive statistics mean and standard deviation were calculated to determine the competencies that extension agents perceived to be important. In addition, mean and standard deviation were employed to determine the competencies in which extension agents perceived themselves to be competent.

The Mean Weighted Discrepancy Score (MWDS) was calculated to describe the overall rankings for each of the competency based on Borich needs assessment model (1980). According to Waters and Haskell (1989) the Borich model weighted discrepancy score is used to determine needs of learners that usually provides results that are different from those that would be obtained by more traditional means of needs assessment or from those identified by using the importance ratings.

Furthermore, the MWDS score was calculated, first by determining the Discrepancy Score (DS) through subtracting the ability score from the importance score, then calculating Weighted Discrepancy Score

(WDS) through multiplying the Discrepancy Score (DS) by the mean importance rating for each competency. Finally the MWDS was calculated for each competency as a sum of WDSs divided by the number of observations for each competency.

Data were collected by distributing the questionnaire among the respondents, and then the statistical data were coded and analyzed using the Statistical Package for Social Sciences (SPSS 22).

Results and Discussion

Socio-demographic Characteristics of the respondents

Table 1 reveals that 73.2 per cent of the extension agents were male and 26.8 per cent were female. The respondents' age ranged from 32 to 55 years with mean of 42.3 years and standard deviation of 5.91 indicating a moderate variation in age among the respondents.

More than half of the extension agents (51.2 %)had more than 18 years of experience. Approximately 31.7 per cent had a bachelor's degree;24.4 per cent of them had a high school certificate; 22 per cent had a high school agriculture technical certificate. In addition, 22 per cent had an elementary school certificate.This level of education, coupled with lack of in-service training would affect the technical knowledge of extension agents.

Table 1. Socio-Demographic Characteristics

(n=41)

Demographic Characteristics	Frequency	%
Gender		
Male	30	73.2
Female	11	26.8
Age (Years)		
less than 32	2	4.9
32-37	8	19.5
38-43	10	24.4
44-48	17	41.5
More than 48	4	9.8
Marital Status		
Single	2	4.9
Married	37	90.2
Divorced	1	2.4
Widow	1	2.4
Educational Qualification		
Elementary School certificate	9	22.0
High School certificate	10	24.4
High School Agriculture Technical	9	22.0
B.Sc., Agriculture	13	31.7

Demographic Characteristics	Frequency	%
Years of experience		
less than 2	1	2.4
3-10	3	7.3
11-18	16	39.0
more than 18	21	51.2

Level of competency

Agricultural extension agents considered all of the competencies needed for realizing the agriculture extension services programs. According to these extension agents, the most important competency was, understanding the farming and production system (*M*= 4.83, *SD*= 0.38), followed by ability to communicate farmers problems to researchers (*M*= 4.80, *SD*= 0.45), understanding the duties and responsibilities of extension workers at the district and village level (*M*= 4.80, *SD*= 0.46), ability to understand rural culture (*M*= 4.78, *SD*=0.41), understanding educational learning process of extension education (*M*= 4.78, *SD*= 0.52) and understanding the objectives of agricultural extension services (*M*=4.73, *SD*=0.59). Table 2 lists extension agents' perceived level of importance for each competency.

Murphy and Bruening (2006) carried out an elaborate study to identify the educational needs of extension agents in Limpopo Province, South Africa. The results of the study showed that the extension administration skills, administrative record-keeping, development of archives, project management, human resource and development skills, and financial management and computer skills are essential to the effectiveness of extension agents.

Table 2. Extension agents' Perceived level of importance on selected competencies

(n=41)

Importance Ranked by Mean Score & Standard Deviation	M	SD
Understanding the farming and production system	4.83	0.38
Ability to communicate farmers problems to researchers	4.80	0.45
Understanding of the duties and responsibilities of extension workers at the district and village level	4.80	0.46
Ability to understand rural cultures (such as customs, dialects etc,) when dealing with rural public	4.78	0.41
Understanding educational learning process of extension education	4.78	0.52
Understanding the objectives of agricultural extension services	4.73	0.59
Ability to keep and maintain necessary department records	4.70	0.51
Understanding contribution of agriculture to community	4.70	0.46
Ability to use e-mail	4.65	0.65
Ability to communicate effectively with extension staff	4.65	0.57

Importance Ranked by Mean Score & Standard Deviation	**M**	**SD**
Ability to use word processing software	4.63	0.66
Ability to participate in forming policy (serves on committees, etc.)	4.63	0.62
Understanding the purpose of extension services	4.63	0.83
Ability to produce print-based products (eg. newsletters, brochures, posters)	4.63	0.79
Ability to search information on the internet	4.63	0.76
Ability to operate a computer	4.63	0.53
Understanding organizational structure, vision, mission, history	4.63	0.53
Ability to manage use of time	4.60	0.62
Ability to produce electronic power point slides	4.58	0.74
Understanding the mechanisms of extension-research linkages	4.58	0.97
Ability to develop cooperative relationship with other agencies at regional level (e.g. farmer's cooperation association, local council, NGOs)	4.56	0.63
Ability to evaluate the effectiveness of Audio Visual Aids	4.53	0.63
Ability to select appropriate audio visual aids for presentation	4.53	0.63
Knowledge of professional improvement opportunities	4.48	0.77
Understanding of basic policies and procedures of extension	4.48	0.59
Ability to operate slide projector	4.46	0.67
Understanding the agricultural extension approaches	4.46	0.74
Ability to use different types of cameras and other photographic equipment	4.44	0.63
A knowledge of existing policies in extension services and other rural development policies	4.44	0.74
Understanding the adult learning theory	4.44	0.80
Ability to use flip chart flash cards	4.36	0.76
Ability to identify the partners and stakeholders with extension organizations	4.31	0.87
Ability to practice the adult learning theory	4.31	0.85
Ability to operate Over Head projector (OHP)	4.29	0.83
Ability to operate film projector	4.29	0.83
Ability to operate video player	4.26	0.77
Understanding the emphasis the interdependence of agriculture with other segments of economy	4.26	0.97
Understanding the importance of democratic principles in extension work	4.24	0.88
Knowing the history of extension in Yemen	4.24	1.06
Understanding the unique partnerships in extension organization (stakeholders, partners volunteers)	4.07	1.10

Level of competency ability

Table 3 indicates that extension agents perceived that they were competent in only five of the 40 competencies listed. These competencies were, understanding the farming and production system (*M*= 4.17, *SD*=0.67), ability to understand rural culture (*M*= 3.95, *SD*=0.89), understanding of the duties and responsibilities of extension workers at the district and village level (*M*= 3.92, *SD*=0.68), understanding the objectives of agricultural extension services (*M*= 3.70, *SD*=0.95) and understanding contribution of agriculture to community (*M*= 3.51, SD=0.96).

Table 3. Extension agents' perceived level of ability on selected competencies (n=41)

Ability Ranked by Mean Score & Standard Deviation	M	SD
Understanding the farming and production system	4.17	0.67
Ability to understand rural cultures (such as customs, dialects etc,) when dealing with rural public	3.95	0.89
Understanding the duties and responsibilities of extension workers at the district and village level.	3.92	0.68
Understanding the objectives of agricultural extension services	3.70	0.95
Understanding contribution of agriculture to community	3.51	0.92
Understanding the purpose of extension services	3.36	0.66
Understanding organizational structure, vision, mission, history	3.34	0.96
Ability to communicate effectively with extension staff	3.34	1.03
Understanding educational learning process of extension education	3.29	1.07
Ability to keep and maintain necessary department records	3.21	0.98
Understanding the importance of democratic principles in extension work	3.07	1.05
Understanding the agricultural extension approaches	2.95	0.86
Ability to manage use of time	2.90	0.96
Ability to develop cooperative relationship with other agencies at regional level (e.g. farmer's cooperation association, local council, NGOs).	2.85	1.19
Understanding the unique partnerships in extension organizations (stakeholders, partners, volunteers)	2.80	1.20
Ability to select appropriate audio visual aids for presentation	2.75	0.94
Knowing the history of extension in Yemen	2.75	0.76
Ability to identify the partners and stakeholders with extension organizations	2.60	1.39
Knowledge of professional improvement opportunities	2.58	1.20
Understanding of basic policies and procedures of extension	2.56	1.04
Understanding the adult learning theory	2.51	0.92
A knowledge of existing policies in extension services and other rural development policies	2.51	0.92

Ability Ranked by Mean Score & Standard Deviation	M	SD
Ability to Participate in forming policy (serves on committees, etc.)	2.46	1.05
Understanding the mechanisms of extension-research linkages	2.46	1.20
Ability to communicate farmers problems to researchers	2.43	1.32
Understanding the emphasis the interdependence of agriculture with other segments of economy	2.43	1.14
Ability to use different types of cameras and other photographic equipment	2.17	1.11
Ability to operate video player	2.14	1.19
Ability to operate a computer	2.12	1.20
Ability to practice adult learning theory	2.07	0.87
Ability to evaluate the effectiveness of AVA	1.90	0.91
Ability to operate slide projector	1.82	1.02
Ability to operate Over Head Projector (OHP)	1.80	1.03
Ability to use word processing software	1.60	1.02
Ability to use e-mail	1.53	0.95
Ability to use flip chart flash cards	1.51	0.89
Ability to operate film projector	1.46	0.83
Ability to search information on the internet	1.31	0.64
Ability to produce electronic power point slides	1.21	0.61
Ability to produce print-based products (eg. newsletters, brochures, posters.)	1.12	0.33

Training Needs as identified by extension agents

Table 4 shows the highest MWDS indicating the highest in-service training need. The findings show that the extension agents need training in the following competencies: ability to produce print-based products (eg. newsletters, brochures, posters) (*MWDS*= 16.38), ability to search information on the internet (*MWDS*= 15.71), ability to prepare electronic power point slides (*MWDS* = 15.43), ability to use e-mail (*MWDS*= 14.88), ability to use word processing software (*MWDS*= 14.01), ability to use flip chart flash cards (*MWDS*= 12.56), ability to operate film projector (*MWDS*= 12.25), ability to evaluate the effectiveness of Extension Visual Aids (MWDS= 11.95), ability to operate slide projector (MWDS= 11.64), ability to operate a computer (MWDS=11.64) and ability to communicate farmers problems to researchers (MWDS=11.48). Table 4 lists thecompetencies in descending order from the most needed to least needed. The findings are in the line with Ovwigho (2011) who reported that the extension agents agreed that they needed training in computer application, preparation and use of audio-visual instructional materials.

Table 4. Training Needs of Agriculture Extension Agents by calculating Mean Weighted Discrepancy Scores (MWDS)

(n=41)

Rank order	In-Service Training Needs Ranked by MWDS	MWDS
1	Ability to produce print-based products (eg. newsletters, brochures, posters)	16.38
2	Ability to search information on the internet	15.71
3	Ability to produce electronic power point slides	15.43
4	Ability to use e-mail	14.88
5	Ability to use word processing software	14.01
6	Ability to use flip chart flash cards	12.56
7	Ability to operate film projector	12.25
8	Ability to evaluate the effectiveness of Extension Visual Aids	11.95
9	Ability to operate slide projector	11.64
9	Ability to operate a computer	11.64
10	Ability to communicate farmers problems to researchers	11.48
11	Ability to operate Over Head projector (OHP)	10.78
12	Understanding the mechanisms of extension-research linkages	10.17
13	Ability to use different types of camera and other photographic equipment	10.06
14	Ability to participate in forming policy	10.05
15	Ability to practice the adult learning theory	9.58
16	Ability to operate video player	9.05
17	Understanding the adult learning theory	8.55
17	A knowledge of existing policies in extension services and other rural development policies	8.55
18	Understanding of basic policies and procedures of extension	8.53
18	Knowledge of professional improvement opportunities	8.53
19	Ability to select appropriate audio visual aids for presentation	8.07
20	Ability to manage use of time	7.87
21	Understanding the emphasis of the interdependence of agriculture with other segments of economy	7.80
22	Ability to develop cooperative relationship with other agencies at regional level	7.78
23	Ability to identify the partners and stakeholders with extension organization	7.37
24	Understanding educational learning process of extension education	7.11
25	Ability to keep and maintain necessary department records	7.00
26	Understanding the agricultural extension approaches	6.74
27	Extension administration Knowing the history of extension in Yemen	6.52

Rank order	In-Service Training Needs Ranked by MWDS	MWDS
28	Understanding organizational structure, vision, mission, history	5.99
29	Understanding the purpose of extension services	5.87
30	Ability to communicate effectively with extension staff	5.79
31	Understanding contribution of agriculture to community	5.62
32	Understanding the importance of democratic principles in extension	4.96
33	Understanding the objectives of agricultural extension services	4.84
34	Understanding the unique partnerships in extension organizations (stakeholders, partners, volunteers)	4.67
35	Ability to understand rural cultures (such as customs, etc.) when dealing with rural public	4.31
36	Understanding the duties and responsibilities of extension workers at the district and village level	4.22
37	Understanding the farming and production system	3.18

Conclusion and Recommendations

Given the important role of agricultural extension services in overall agricultural development, need for competent agricultural professionals in Yemen is ever high.The researcher believes that well-trained extension agents can influence the economic setting within the country. In addition, good extension agents can help farmers to make their decisions and can provide them with information, guidance, encouragement, motivation and skills in making their livelihoods better and sustainable.

The findings of this study will assist the department of agricultural extension of the Tihama Region to strengthen its in-service training programs by taking into account the importance of identifying training needs before conducting in-service training programs.This study also reveals that there is a need for improving the knowledge and abilities of agriculture extension agents in identified areas of extension education. The findings are crucial to extension agents'development in establishing priorities to design and to implement in-service training programs coupled with practical demonstrations on important identified areas.

Based on the findings of the study, the following recommendations could be drawn:

1. Training programs should address the match between an organization's needs and extension agents'available knowledge and skills.

2. Training needs analysis should be carried out periodically to determine the training needs of extension agents.

3. Designing training programs with more focus on strengthening the various competencies that would help the extension agents to perform their duties effectively.

4. Agriculture extension agents' in-service training programs should be planned and designed in extension administration, computer skills and communication skills.

5. There is a need for collaboration between departments of agricultural extension within Ministry of Agriculture and agricultural colleges and institutions in reviewing agricultural extension curriculum that will assist the agricultural extension graduates in facing new challenges so as to perform effectively and efficiently as extension agents.

6. More research needs to be carried out in different regions of Yemen in order to determine the extension educational needs of agriculture extension agents.

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Factors Affecting Work Motivation of Agricultural Extension Officers of Odisha

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Abstract

Well-trained and highly motivated extension functionaries play a critical role in agricultural development as they provide advisories and extension services to the farming community. This study was undertaken to find the factors that influence work motivation of newly-recruited extension functionaries of Odisha state. In the present study, five different aspects of motivation were studied using relevant statements. The statements are sub-grouped as Achievement motivation, Advancement motivation, Work itself is motivation, Recognition motivation and Growth motivation. The study revealed that extension officers are innovative in thinking and ready to take new and non-routine assignments. When the situation demands, they are ready to take decisions and also take responsibility towards their role in agriculture extension related activities. A significant number of extension officers felt proud of their achievements. The functionaries perceived high score in career development than monetary benefits. They are highly motivated when farmers recognize and appreciate their work and services.

Key words: Motivation, Extension officers, Odisha

Introduction

According to Robbins (1989) motivation is the willingness to exert high levels of efforts toward organizational goals, conditioned by the effort's ability to satisfy some individual need.

Motivation refers to the forces either within or external to a person that arouse enthusiasm and persistence to pursue a certain course of action (Daft, 2014). Williams and Tripathy (2016) define Motivation as the set of forces that initiates, directs, and makes people persist in their efforts to accomplish a goal. Initiation of effort is concerned with the choices that people make about how much effort to put forth in their jobs. Direction of effort is concerned with the choices that people make in deciding where to put forth effort in their jobs. Persistence of effort is concerned with the choices that people make about how long they will put forth effort in their jobs before reducing or eliminating those efforts. Initiation, direction and persistence are at the heart of motivation.

Work motivation is a set of energetic forces that originate both within as well as beyond an individual's being, to initiate work-related behaviour, and to determine its form, direction, intensity and duration (Pinder, 1998). Work motivation research focuses on multiple dimensions of behaviour change, including the

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direction, intensity, and persistence of work place actions and job performance within the broader, continuing stream of experiences that characterize the person in relation to his or her work (Kanfer, 1990).Du Toit (1990) added that three groups of variables influence work motivation, viz. individual characteristics such as people's own interests, values and needs; work characteristics, such as task variety and responsibility; and organizational characteristics, such as its policies, procedures and customs.

The present study was conducted to explore factors that motivate the newly-recruited (with one year experience) Agricultural extension functionaries of Department of Agriculture and Farmers' Empowerment, Odisha.

Material and Methods

A structured questionnaire having 16 statements with five point Likert scale (1 strongly disagree to 5 strongly agree) was used to collect the data from 66 newly-recruited agricultural functionaries. The statements are sub grouped as Achievement motivation, Advancement motivation, Work itself is motivation, Recognition motivation and Growth motivation. Factor analysis and descriptive statistical tools were applied using Statistical Package for the Social Sciences (SPSS) software. Factor analysis refers to a set of statistical procedures applied on a data set to reduce a large number of variables into fewer numbers of factors. The fundamental assumption of factor analysis is that some underlying factors which are less in number than the Observed variables are responsible for the co-variation among the observed variables.

Average age of the respondents was 25 years. Regarding gender, the sample consists of 35 male and 31 female officers. Minimum qualification of the respondents was graduation in Agriculture and allied areas. The descriptive analysis of the study is presented in Table 1. It can be observed that the mean and standard deviation range between 3.61 to 4.55, and 0.611 to 0.943 respectively.

Table 1. Descriptive Statistics

S. No.	Statement	Mean	Standard Deviation
1	I am happy with my job as it gives me sense of accomplishment	4.09	0.717
2	I am able to manage both the desk work and field work within the scheduled time	3.97	0.744
3	I feel that I am able to serve the farmers as I achieve the targets given within the stipulated time	4.03	0.841
4	My organization provides opportunities for me to learn and acquire new knowledge and skills for my career advancement	4.29	0.941
5	Career advancement is more important for me than monetary incentives	4.52	0.749

S. No.	Statement	Mean	Standard Deviation
6	My work provides variety of tasks and challenge in terms of resources and time	4.36	0.737
7	I have sufficient authority to carry out my responsibilities of work	3.61	0.943
8	My supervising officers periodically appreciate my work and efforts	3.76	0.878
9	I have a sense of recognition in my organization that acts as an incentive to perform better	3.94	0.875
10	Farmers recognize and appreciate the skills and efforts that I put in my work	3.95	0.793
11	I am ready to take new and non-routine assignments	4.33	0.641
12	I am a team player and all of us in our team viz, seniors, colleagues and junior staff discuss the tasks to be performed and how to go about	4.32	0.768
13	My job provides opportunities to gain experience, skills and improve performance	4.44	0.704
14	I have concern and interest in developing my junior staff in the work place	4.44	0.611
15	When the situation demands, I feel encouraged to take decisions and responsibility at work	4.55	0.612
16	I am proud of my achievements at work	4.33	0.791

Results and Discussion

To analyze the strength of association among variables, the Kaiser-Mayer-Olkin (KMO) measure of sampling adequacy was applied which certifies whether data are suitable to perform Factor Analysis. The value of KMO varies from 0 to 1 and high values generally indicate that the data are suitable for conducting factor analysis test. KMO score should be .60 to be adequate for testing. As per Table 2, it is clear that KMO score was 0.794, indicating adequacy for testing.

The table below indicates that, the Kaiser-Meyer-Olkin measure of sampling adequacy is a statistic that indicates the proportion of variance in variables that might be caused by underlying factors. High value closer to 1 generally indicates that a factor analysis may be useful with the data. Bartlett's test of Sphericity is the ratio of squared value of simple correlation to sum of squared values of simple correlation and squared values of partial correlation. If the value of the index is closer to "1", it indicates that partial

correlation is very low compared to simple correlation. In the present case, the KMO index is 0.794 which implies that there is presence of moderate level of partial correlation. Small value (<0.05) of the significance level indicates that a factor analysis may be useful with the data (https://www.ibm.com/support/knowledgecenter/en/SSLVMB_24.0.0/spss/tutorials/fac_telco_kmo_01.html).

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling	0.794
AdequacyApprox. chi-Square	458.490
Bartlett's Test of Sphericity df	120
Sig.	0.000

Eigen value reflects the number of extracted factors whose sum should be equal to number of Items which are subjected to factor analysis. The next item shows all the factors extractable from the analysis along with their Eigen values. It can be observed that the first factor accounts for 39.3 the second factor accounts for 9.4 and the third is 7.9 per cent (Table 3).

Table 3. Total Variance Explained

Compo nent	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumula tive %	Total	% of Variance	Cumul ative %	Total	% of Variance	Cumulative %
1	6.290	39.310	39.310	6.290	39.310	39.310	2.575	16.095	16.095
2	1.505	9.404	48.714	1.505	9.404	48.714	2.297	14.354	30.448
3	1.278	7.986	56.700	1.278	7.986	56.700	2.181	13.634	44.082
4	1.081	6.756	63.455	1.081	6.756	63.455	1.780	11.123	55.205
5	.918	5.739	69.194	.918	5.739	69.194	1.607	10.045	65.250
6	.834	5.209	74.404	.834	5.209	74.404	1.465	9.154	74.404

In order to produce theoretical results, fixed number of components has been specified, instead of extracting the factors based on Eigen value creation. Principal component analysis (PCA) was carried out to explore the underlying factors associated with 16 items. Table 4 shows that 74.40 per cent of variation in work motivation of the employees was explained by six components.

Table 4. Component Matrix, Rotated Component Matrix

		Component			
		1	**2**	**3**	**4**
1	I am happy with my job as it gives me sense of accomplishment	.496	.509		
2	I am able to manage both the desk work and field work within the scheduled time	.730			
3	I feel that I am able to serve the farmers as I achieve the targets given within the stipulated time	.530			.536
4	My organization provides opportunities for me to learn and acquire new knowledge and skills for my career advancement	.440			
5	Career advancement is more important for me than monetary incentives				.670
6	My work provides variety of tasks and challenge in terms of resources and time				.720
7	I have sufficient authority to carry out my responsibilities of work			.650	
8	My supervising officers periodically appreciate my work and efforts	.405		.589	
9	I have a sense of recognition in my organization that acts as an incentive to perform better	.453	.679		
10	Farmers recognize and appreciate the skills and efforts that I put in my work	.778			
11	I am ready to take new and non-routine assignments		.776		
12	I am a team player and all of us in our team viz, seniors, colleagues and junior staff discuss the tasks to be performed and how to go about			.671	
13	My job provides opportunities to gain experience, skills and improve performance		.459		.665
14	I have concern and interest in developing my junior staff in the work place			.772	
15	When the situation demands, I feel encouraged to take decisions and responsibility at work		.792		
16	I am proud of my achievements at work	.761			

Extraction Method: Principal Component Analysis

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 7 iterations.

Component one is labeled as Achievement motivation (F1) and it is represented through four items (Table 5). They are item 1, 2, 3, and 16. In F1 the factor loadings range from 0.509 to 0.761, which implies that employees had better achievement motivation. Component two is labeled as Advancement Motivation (F2). It is represented through items 4 and 5. The factor loadings are 0.404 and 0.670 respectively for these two items which indicate that the loadings are moderate. Component 3 is labeled as "Work itself is motivation". It is represented through items, 6, 7 and 11, and their factor loadings are 0.720, 0.650 and 0.776 respectively. From the factor loadings, it can be inferred that employees had better perception about 'work itself is motivation". Component 4 is labeled as "Recognition motivation". It is represented through 8, 9, 10, 12 and 14 and their factor loadings are 0.589, 0.679, 0.778, 0.671 and 0.772 respectively. From the factor loadings it can be inferred that employees had better Recognition motivation. Component 5 is labeled as "Growth Motivation" and is represented through items 13 and 15 whose loadings are 0.665 and 0.792 respectively. From the factor loadings, it can be inferred that employees had better growth motivation.

Naming of the factors is represented in Table 5.

Table 5. Naming of Factors

Factor No.	Name of the Dimension	Item No	Variables	Factor loading
F1	Achievement Motivation	1	I am happy with my job as it gives me sense of accomplishment	0.509
		2	I am able to manage both the desk work and field work within the scheduled time	0.730
		3	I feel that I am able to serve the farmers as I achieve the targets given within the stipulated time	0.536
		16	I am proud of my achievements at work	0.761
F2	Advancement Motivation	4	My organization provides opportunities for me to learn and acquire new knowledge and skills for my career advancement	0.440
		5	Career advancement is more important for me than monetary incentives	0.670
F3	Work itself is motivation	6	My work provides variety of tasks and challenge in terms of resources and time	0.720
		7	I have sufficient authority to carry out my responsibilities of work	0.650
		11	I am ready to take new and non routine assignments	0.776
F4	Recognition Motivation	8	My supervising officers periodically appreciate my work and efforts	0.589
		9	I have a sense of recognition in my or ganization that acts as an incentive to perform better	0.679
		10	Farmers recognize and appreciate the skills and efforts that I put in my work	0.778

Factor No.	Name of the Dimension	Item No	Variables	Factor loading
		12	I am a team player and all of us in our team viz, seniors, colleagues and junior staff discuss the tasks to be performed and how to go about	0.671
		14	I have concern and interest in developing my junior staff in the work place	0.772
F5	Growth Motivation	13	My job provides opportunities to gain experience, skills and improve performance	0.665
		15	When the situation demands, I feel encouraged to take decisions and responsibility at work	0.792

Table 6. Main factors responsible for work motivation of Agricultural Officers

Factor Number	Name of the Dimension	Item No	Variable	Factor Loading
F1	Achievement Motivation	16	I am proud of my achievements at work	0.761
F2	Advance Motivation	5	Career advancement is more important than monetary benefits	0.670
F3	W ork itself is motivation	11	Extension functionaries are ready to take the new a nd non -routine assignments	0.776
F4	Recognition motivation	10	Extension functionaries are highly motivated when farmers recognize and appreciate the work or services done by the extension functionaries	0.778
F5	Growth Motivation	15	When the situation dem ands, I feel encouraged to take decisions and responsibility at work	0.792

Conclusion

It can be concluded from the above analysis that the perceived motivation factors of the extension functionaries are item number 15 of Growth motivation i.e. "When the situation demands, I feel encouraged to take decisions and responsibility at work" stands first with 0.792. In Achievement motivation, item number 16 namely "I am proud of my achievements at work" ranks first with factor loading 0.761. In Advancement motivation item no.5 i.e. "Career advancement is more important than monetary benefits" ranks first with 0.670. In "work itself is motivation", item no. 11 i.e. "Extension functionaries are ready to take the new and non-routine assignments" ranks first with factor loading of 0.776. In Recognition motivation, item no.10 i.e. the extension functionaries are highly motivated when farmers recognize and appreciate the work or services with factor loading of 0.778 (Table 6). Although each factor contributes to the work motivation of extension functionaries, the above specified factors from the five categories play a vital role in work motivation of Agricultural extension functionaries from the study area.

It can be inferred from the study that Assistant Agricultural Officers are motivated as they are newly appointed and looking forward for challenging and non-routine work and are proud of their achievements. Career advancement is more important than monetary benefits and when farmers recognize and appreciate their work/services, the motivation level is significant.

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Factors affecting the Perception of Farmers about Climate Change in Agriculture

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Abstract

Climate is a critical factor in the livelihoods of people and socioeconomic development as a whole, however the recent developments have adversely affected climate and its effect is seen in all the sectors. Among these different sectors, agriculture is highly sensitive to climate change where a large number of small and marginal farmers depend on agriculture and allied activities for their livelihood. In view of this, a study was undertaken in two states having different vulnerabilities to climate change with an objective of assessing the perception of farmers about climate change in agriculture and factors associated with their perception. The study reveals that a majority of the respondents perceived that the summer temperature is increasing during daytime (84.44% and night time (68.89%), water requirement for the crops has increased (80.00%). The variables such asage, education, extension contact and mass media had a positive and significant relationship at one percent level of probability. Hence, timely access to extension services and weather information are crucial in shaping the perception of farmers about climate change.

Key words: Climate change, Perception, Farmers, Uttarakhand, Karnataka

Introduction

India is considered one of the most vulnerable countries in the world to climate change because of its geographical location, economic dependence on agriculture, and the recurrence of natural hazards (IPCC, 2007). Agricultural production is severely affected by climate change in India where a large portion of the poverty-stricken population depends on agriculture and allied activities for their livelihood. Sudden natural disasters such as storm surges, floods, droughts, and cyclones are associated with long-term changes in salinity due to the rising sea level, landslides which alter the landscape and lead to the emergence of new pests and diseases. These are a few of the challenges of climate change in India. In order to address the emerging threats of climate change a number of efforts are being undertaken by public and private organizations to enhance the resilience of India's agricultural sectors in the face of climate change. Among different sectors, agriculture is one of the most sensitive sectors therefore, concentrated efforts are required for adaptation and to reduce the vulnerability of Indian agriculture to the adverse impacts of climate change and making Indian agriculture more resilient.

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The perceptual understanding of farmers about climate change can shape the preparedness of these actors to adapt and change their practices. The adoption and successful implementation of new technology by farmers in their ecosystems depend on their tendency to perceive and react accordingly to the changes in climate and the environment. Perception strongly affects how farmers deal with climate-induced risks and opportunities; the precise nature of their behavioural responses to this perception will shape adaptation options and outcomes (Adger*et al*. 2009; Pauw 2013).The misconception about climate change and its associated risks may result in no adaptation or maladaptation thus increasing the negative impact of climate change (Grothmann and Patt 2005).Hence, there is a desperate need to increase the ability of the farmers to tackle the ill effects of climate change. The present research study was undertaken to find out the perception level of farmers towards climate change in agriculture with the following specific objectives;

i. To understand the perception of the farmers about Climate Change in agriculture.

ii. To find out the factors affecting the perception of farmers about climate change in agriculture

Research Methodology

The study was conducted in two States of India namely, Uttarakhand and Karnataka as these two States were most frequently exposed to climate vagaries such as floods and drought, respectively. These two states were adopted under the National Innovations on Climate Resilient Agriculture(NICRA)project of Government of India based on the vulnerability index. In this context, Dunda village of Uttarkashi district in Uttarakhand State and Nagenahalli village of Tumkur district in Karnataka State were purposively selected. A total of forty-five farmers who were the beneficiaries of the NICRA project were selected randomly as respondents. The primary data were collected using both structured and semi-structured interview schedule and focus group discussion was also conducted to collect qualitative data from the farmers. The quantitative data were analyzed using statistical tools like percentage, frequency, multiple regression and descriptive statistics were used to analyze the farmers' responses to interpret and draw meaningful results.

Results and Discussion

Table 1. Distribution of respondents based on their perception about climate change (n=45)

S.N	Statements	Increased	Decreased	No change
1	Changes in environmental temperature			
	a) Summer Temperature (day time)	38(84.44)	0(0.00)	7(15.56)
	b) Summer Temperature (night time)	31(68.89)	2(4.44)	12(26.67)
	c) Winter temperature (day time)	19(42.22)	20(44.44)	6(17.78)
	d) Winter temperature (night time)	15(33.33)	22(48.89)	8(4.00)
	e) Extended summer period	30(66.67)	6(13.33)	9(20.00)

2	Changes in rainfall			
	a) Total quantity of rain fall	7(15.56)	36(80.00)	2(4.44)
	b) No. of rainy days in a year	1(2.22)	39(86.67)	5(11.11)
3	Heat wave in summer	22(48.89)	23(51.11)	0(0.00)
4	Cold wave in winter	16(35.56)	29(64.44)	0(0.00)
5	Water table in the reservoirs	7(15.56)	34(75.56)	4(8.89)
6	Water requirement of crops	36(80.00)	9(20.00)	0
7	Changes in pest and disease incidence	31(68.89)	14(31.11)	0(0.00)
8	Changes in the cost of production			
	a) Expenditure on seeds	29(82.86)	5(14.29)	1(2.86)
	b) Expenditure on fertilizers	23(51.11)	16(35.56)	6(13.33)
	c) Expenditure on pesticide	23(51.11)	11(24.44)	11(24.44)
	d) Expenditure on weeding	15(33.33)	21(46.67)	9(20.00)
	e) Expenditure on harvesting	14(31.11)	19(42.22)	12(26.67)
9	Feeding behaviour of dairy animals	32(71.11)	13(28.89)	0(0.00)
10	Occurrence of disease in animals due to climate change	27(60.00)	18(40.00)	0(0.00)
11	Distress sale of animals due to the effect of climate change	23(51.11)	22(48.89)	0(0.00)
12	Investment in agriculture due to climate change	35(77.78)	10(22.22)	0(0.00)

The above table clearly indicates that the majority of the respondents have perceived that the summer temperature is increasing during daytime (84.44 per cent) as well as in the night time (68.89 per cent). Rathore *et al* (2013) also indicated in their study report that the increasing trends were significant over Karnataka, and Uttarakhand. This finding is similar to studies conducted by Nhemachen and Hassan (2007) and they concluded that 84.40 per cent and 100 per cent of the respondents have perceived that there is a significant change in the atmospheric temperature. A vast majority of the respondents (84.44 per cent) perceived that the winter temperature has decreased both during day and night time and summer period was extended. The majority (70.00 per cent) of the respondents also perceived that the heat wave in the summer increased.Further, 80 per cent of the respondents perceived that total quantity of rainfall has decreased.

Water table in the reservoirs like canals, bore wells and open wells has decreased (75.56 per cent) and on the other hand water requirement for the crops has increased (80.00 per cent) in major crops like paddy and wheat due to increased temperature. More than half (55.00 per cent) of the respondents have perceived the increase in the occurrence of pests and diseases due to the change in climate. The respondents

have also noticed new pest and diseases in the field which they felt are very difficult to control. The effect of climate change also changed the cost of production. A vast majority of the respondents (80.00 per cent) perceived that there was an increase in expenditure on seeds. This might be due to delayed/ abrupt rain in the study area which has resulted in poor germination of some crops hence respondents have purchased seed material more than once for re-sowing or gap-filling. Nearly half of the respondents (42.22 per cent) have perceived that the expenditure on harvesting operation was reduced; it might be due to the usage of machinery of custom hiring centers established as part of NICRA project.

Three-fourths of the respondents (71.11 per cent) perceived that there were changes in feeding behavior of animals in the study area; animals feeding pattern changed from open grazing to feeding of the mineral mixture and concentrated feed mixture to get higher milk yield. Feeding behavior of animals changed from dry fodder to mineral mixture and concentrated feed mixture.Farmers felt that desi cows require less fodder and they give an average yield even when fed with dry fodder. But in case of crossbred they have to be fed with a lot of green fodder with extra mineral mixture;then only the farmer will be able to get high milk yield. About 60.00 per cent of the respondents perceived that there was an increase in the occurrence of diseases in animals due to climate change. Intensive training/demonstration and other educational activities on breed improvement, feed management, health and shelter management of KVK in the adopted village helped the respondents to cope up with changes in animal husbandry in the study area.

Due to change in the climate, 77.78 per cent of the respondents perceived that there was an increase in investment in agriculture. More investment has to be made in purchase of quality seeds, fertilizers and plant protection measures and other management practices have to be taken to protect the crops from the vagaries of climate change and to obtain good yield. Similar cases have been reported earlier by Parameswaranaik *et al*. (2015), Simelton *et al*. (2013), Deressa *et al*. (2011), Bryan *et al*. (2009) and Mertz *et al*. (2009).

Association and contribution of profile characteristics of the respondents towards climate change in agriculture

Table 2. Association and contribution of profile characteristics with their perception towards climate change(n=45)

S.No	Profile characteristics	'r' Value	PRC	SE	't'Value
1	**(X_1)** Age	0.618	1.312	0.533	2.462**
2	**(X_2)** Gender	0.272	0.809	0.744	1.085^{NS}
3	**(X_3)** Education	0.588	1.408	1.402	3.001**
4	**(X_4)** Experience in farming	0.286	1.602	0.876	0.910*
5	**(X_5)** Family Size	-0.342	0.708	0.748	1.807^{NS}
6	**(X_6)** Occupation	0.285	0.126	0.221	0.571^{NS}

S.N	Profile characteristics	'r' Value	PRC	SE	't'Value
7	**(X_7)** Annual Income	0.507	0.564	0.239	1.714^{NS}
8	**(X_8)** Extension Contact	0.468	2.365	1.425	2.188**
9	**(X_9)** Social Participation	0.364	0.759	0.344	0.205*
10	**(X_{10})** Mass Media	0.588	0.529	0.249	3.216**
	R2		0.546		
	F value		6.642**		
	Constant		12.185		

PRC=Partial Regression Co-efficient NS =Non-Significant
SE= Standard Error **= Significant at 0.01 level *= Significant at 0.05 level

The association and contribution of profile characteristics of respondents with their perception towards climate change have been presented in this section. The results revealed that the variables age, education, extension contact and mass media had a positive and significant relationship at one per cent level of probability; whereas experience in farming and social participation had significant relationship at five percent level of probability. However, variables, such as gender, family size, occupation and annual income depicted a non-significant relationship with the dependent variable. The extent of contribution of independent variables with the dependent variable was worked out, while using multiple regression analysis and the results have been presented in table 2. The result indicated that the R_2 value was 0.546, which revealed that 54.60 percent variation in the perception of respondents towards climate changewas explained by ten independent variables selected for the study. The 'F' value (6.642) was significant at one percent level of probability. The prediction equation was fitted in as below:

Y1= 12.185 + 1.132(X1) +0.809(X2) +1.408(X3) + 1.602(X4) + 0.708(X5) + 0.126(X6) + 0.564(X7) +2.365(X8) + 0.759(X9) + 0.529(X10)

The profile characteristics namely, age, education, extension contact and mass media had maximum level of association with the perception level of respondents towards climate change in agriculture. This may be due to the fact that as a person gets older he feels and observes the changes in his surrounding environment and his education level also opens a mental horizon of the individual into the ongoing phenomena of his surroundings. Extension contact and mass media exposure enables the cosmopoliteness of the respondents. When the respondents have contact with different extension functionaries and mass media he/shewill have more opportunities to learn about climate change and its effect on agriculture.Hence, age, education, extension contact and mass media exposure had significantly contributed towards the perception level of respondents towards climate change in agriculture. While experience in farming and social participation also contributed towards the perception level of respondents towards climate change, it may be due to the longer years of experience in farming that they may realize the changes in climate

which affects crop production. Similarly, due to social participation of respondents in different public meetings or discussions with other members, he might have gained knowledge about climate change and its effect on agriculture. Hence these two factors i.e., experience in farming and social participation also associated and contributed in the perception level of respondents towards climate change in agriculture.

Conclusion

Climate change is likely to affect all the natural ecosystems as well as socio-economic conditions of Indian farmers. Farmers have rightly perceived about climate change and its effect on agriculture and they have identified the increase in environmental temperature, changes in rainfall, emergence of new pests and diseases in their field and also depletion of the water table. Hence, timely access to extension services and weather information are crucial in shaping the perception of farmers about climate change which could be incorporated into site-specific adaption strategies. It is therefore important that all the factors influencing farmer's perception be taken into consideration to improve their perception as these factors further influence the field level adaptation strategies to combat vagaries of climate change in agriculture.

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Insights into Implementation of National Agricultural Market scheme in Telangana

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Abstract

A common market for agricultural produce in India is an idea at a time when agricultural marketing is faced with many challenges. An ICT based common market has the potential to address such limitations. Accordingly, the concept of electronic National Agricultural Market (eNAM) has been introduced by the Union Government. An attempt has been made, in the present paper, to understand the implementation of eNAM and assess its ability to live up to its potential. The observations made in selected markets in Telangana in terms of capturing arrivals, electronic price discovery and shortening of trade cycle hours triggers the hope for development of an agricultural market operating at the national level. The concept has the potential to catalyse the overall development of the sector, if over time, it is able to move beyond application of information technology by having a holistic development of the marketing system covering its different aspects. It is required to be pursued as a means and not as an end in itself and must be made to evolve accordingly.

Key words: Agricultural Marketing, National Agricultural Market, eNAM, Telangana

Introduction

A common market for agricultural produce in India is a concept which is timely and appropriate to the present complexities. Indian agricultural marketing is fraught with several challenges like fragmented supply chains, long chain of middlemen, high transaction costs, limited availability of infrastructure, poor market information system and absence of economies of scale, etc. An ICT-based common market for agricultural produce has the potential to address majority of the limitations faced by the sector, thereby ensuring a better price-discovery mechanism for the farmers.

Accordingly, a Central Sector Scheme for promotion of National Agricultural Market (NAM)was introduced by the Government on 14th April 2016 covering 585 markets in18 States/UTs. The national market facilitating barrier-free, inter-state trade would help in realizing favourable prices for both the farmers and consumers as the entire supply chain would be reasonably streamlined.

With this background, an attempt has been made in the present paper to analyse different aspects of the Scheme based on the lessons learned from its implementation in Telangana State, a leading state in terms of the number of markets covered.

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Objective

The paper mainly aims at understanding the implementation of e-NAM in terms of trade process flow in an eNAM market, bidding process on the electronic platform, benefits from the initiative as perceived by different stakeholders and an assessment of influence of eNAM on different aspects of agricultural marketing. An attempt has also been made to present a model to facilitate inter-Mandi trade. The paper also suggests a way forward based on the insights obtained to make the scheme inclusive and farmer-friendly.

Methodology

The study is mainly based on the qualitative information collected through interaction with relevant stakeholders covering farmers, traders, commission agents, market staff and officials at the selected markets namely Nizamabad, Suryapet and Mahbubnagar in the State of Telangana. The sample markets were identified with the help of the Department of Agricultural Marketing, Govt of Telangana (Table 1). The secondary information made available by the selected markets has also been used.

Table 1. Sample Markets and Respondents

Sr No	Market	e-NAM Linkage	Distinction	Traders	CAs	Farmers
1	Nizamabad	14.04.16	Tendering from Open Auction	5	4	5
2	Suryapet	01.07.16	Comprehensive Coverage	4	6	8
3	Mahbubnagar	09.09.16	Weight Integration	2	4	2

Importance of a Common Market

E-NAM being an enabler of a common market for agricultural produce in India, a brief description of the importance of a common market will put the discussion in the right perspective. There is a need to remove different restrictions on the movement and storage of agricultural produce. The trade barriers and entry barriers have to be done away with to move towards perfect competition in the sector. Thus, there is a need for trade liberalisation in agriculture to help evolve a common market operating across states.

As restrictions on domestic trade are relaxed, prices stabilise across states and there are welfare gains to producers, consumers and the wholesale traders at the national level (Jha and Srnivasan, 2001). The removal of inter-state barriers would impact the realisation of better prices by the Indian farmers as supply chains between the producers and consumers would be reasonably streamlined (FAO, 2005).

In order to create an enabling environment for e-NAM, requisite reforms in agricultural marketing have accordingly been suggested by the Government through a Model APMC Act in 2003 and recently through

the Model APLM Act, 2017. The Act suggests various provisions required to facilitate inter-Mandi trade like single license, single point levy and electronic trade. However, there are aspects going beyond legal reforms for a common market operating across different states, like economic, technological and development of requisite infrastructure. The evolution of a national market calls for a comprehensive policy addressing different dimensions of a common market.

The FAO report for National Commission for Farmers also finds inter-state trade to be complex, being affected by restrictions imposed by different Acts, fiscal aspects, transport and agriculture trade (regulations) related issues. The evaluation of a free trade area has to deal with issues like heterogeneity in the rules of origin, non-tariff barriers, trade facilitation, technical regulations, infrastructural shortfalls, financing, standards and conformity with assessment procedures (EPRC, 2011).

Implementation of e-NAM in Sample Markets

Profile of Markets

E – NAM is being implemented in 585 markets covering 16 States and 2 UTs. Uttar Pradesh tops the states with 100 such e-NAM connected mandis of Agricultural Produce Marketing Committees (APMCs). In Telangana there are 180 APMCs, 270 market yards/ mandis. The state has 47 of the mandis covered under e- NAM. The profile of the selected Agricultural Produce Market Committee (APMC) markets in terms of year of establishment, major commodities being traded and strength of different functionaries is presented in Table 2. These markets are old and have sufficient market functionaries to handle volumes arriving in the market. These markets have come forward to implement e-NAM proactively. The staff and officials of all the markets were found to be enthusiastic to adopt the changes and mould their functioning as per the needs of e-NAM. The case of e-NAM was well supported by other stakeholders as well, like traders, commission agents and various market functionaries.

Table 2. Profile of Sample APMC Markets

Sr No.	Items	Unit	Suryapet Market	Mahabubnagar Market	Nizamabad Market
1	Established	Date	21.02.40	16.04.65	29.01.38
2	e-NAM Introduced	Date	01.07.16	09.09.16	14.04.16
3	Notified Area (Mandals)	No.	05	05	06
4	Major commodities	Name	Paddy, Pulses, Groundnut, Castor and Maize	Paddy, Groundnut, Maize, Castor and Ragi	Paddy, Maize, Turmeric, Soybean, Onion, Pulses and Oilseeds

Sr No.	Items	Unit	Suryapet Market	Mahabubnagar Market	Nizamabad Market
5	Market Functionaries	No.	873	326	710
6	Godowns	No.	02	05	06
7	Godowns Capacity	MTs	12400	5300	26000
8	Officers/ staff	No.	17	07	36
9	Staff (Outsourced)	No.	17	15	17

Trade Processes followed in e-NAM Market

The process flow at the sample markets after their integration with the e-NAM platform is depicted in the Figure 1. After a farmer arrives at the market with his/ her agri-produce, an electronic gate pass is generated at the market entry gate with a unique lot number to facilitate rest of the trade process. A gate pass contains information like name and address of the farmer and details about the commodity along with its approximate weight. Commission agents are allotted as per the preference of the farmer, as most of the farmers have prior relations with them. In case they are visiting for the first time, they are provided with the list of commission agents active in the market to choose one from the list. The commodities upon their arrival in the Mandi are unloaded in the sheds for the purpose of display. The lot ID Slip (lot number/ Gate Pass Slip) is displayed on the heap. The sample is collected at this stage for grading and assaying and assessment report is provided against the lot number on e-platform to facilitate the traders in taking trade decision.

Since the grading facility which was operational for some time is not functioning, the quality of the produce is assessed on the basis of physical examination by traders or their representatives. These heaps are visited by the licensed traders/ purchasers for physical assessment of the quality and quantity of each heap before quoting prices through online bidding. The traders quote their bids electronically for the lot they are interested in. Since, the facility is internet-based, the quotation by the registered traders may be made from anywhere by accessing their account using internet within the time prescribed for e-bidding by the Committee for that particular commodity. However, the traders are placing their bids using the facilities created by the Committee for the purpose except for the Nizamabad market. In Nizamabad market, traders are placing quotes through their own arrangements. In this way, the rates quoted by different traders for different commodities are collected. At the prescribed time, the system brings out the successful quotations i.e. highest prices quoted for different lots of commodities will appear on the monitor. The information about successful bids can be accessed from anywhere with the help of internet by the registered user. However, the same is also being disseminated by the APMC using different means like printouts and display board.

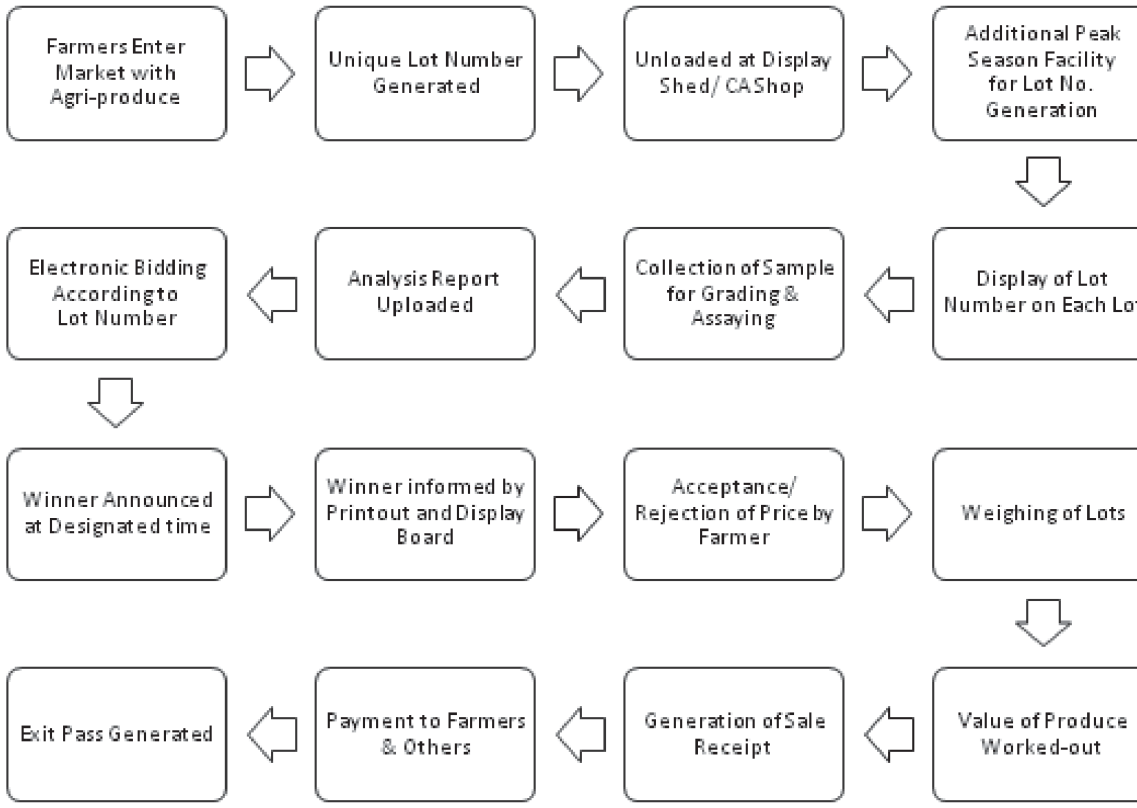

Figure 1 Flowchart depicting the Process Flow in the e-NAM Market

Source: *Field survey*

The consent of the farmers is obtained for the quoted price with the help of the concerned commission agent. If a farmer doesn't accept the quoted price of his produce, the same lot will be placed for next day's bidding. The affirmative reply of the farmer leads to recording of actual weight of the commodity. On getting the final weight, the primary sale bill is generated. The value of produce on the basis of price and weight is worked out and payment is made to the respective stakeholders like price to the farmers, fee to the APMC and charges to different functionaries. This completes the transaction at APMC with generation of exit passes.

Electronic Bidding Process

Competitive, transparent and scientific discovery of prices is an important objective behind introduction of regulations in marketing of agri-produce. Introduction of NAM will further enhance the degree of competition and transparency by shifting manual tendering process to the electronic platform at intra-market level and by encouraging participation from other markets for inter-Mandi trade.

The tender process for all the lots in case of each commodity in all the three sample markets is being performed electronically utilizing e-NAM portal. Around 40-60 active buyers participate, on an average, in the online bidding process every day.

The method of price discovery followed in the Nizamabad market before introduction of e-NAM was open auction. The market shifted to closed tender process considering its convenience in operation on e-NAM Platform. The market has successfully shifted to the new system on e-NAM platform.

The trade, though confined to the local market, has been able to bring in efficiency in terms of time as revealed by the number of lots managed by the markets even during peak days of arrivals. The maximum number of lots handled on e-NAM portal in a day varies from 1164 lots in Suryapet market to 11200 lots in Nizamabad market (Table 3). The timely completion of the trade cycle, generally by evening, also suggests the time efficiency in completion of different processes. The average number of bids per lots (worked out on sample dates) also suggest competitive and transparent discovery of prices though trade at present is confined to the local Mandi only. Each lot in selected markets on the sample date has received an average of 6.55 bids (Table 4).

Table 3. A Snapshot of Bidding Performance in Selected Markets

Sr No	Particulars	Maximum Lot Arrived on e-NAM in a Single Day	Highest Number of Bids for a single lot
1	Suryapet	1164	18
2	Mahabubnagar	1294	14
3	Nizamabad	11200	18

Table 4. Degree of Competition as Reflected by Average Number of Bids Received per Lot

Sl.No	Market	Date	No of Lots	No of Bids	Average No. of Bids per Lot	Max No. of Bids per Lot	Min No. of Bids per Lot
1	Suryapet	30.05.18	0201	00772	3.84	8	1
2	Mahabubnagar	27.02.18	1240	10260	8.27	12	3
3	Nizamabad	02.05.18	1634	09094	5.57	18	3
4	Average	—	3075	20126	6.55	18	1

Stakeholders' Response

The concept of e-NAM has been introduced not only to make the marketing system efficient but also to facilitate ease of doing business for different stakeholders. Accordingly, the perception of different stakeholders in the sample e-NAM markets has also been recorded.

All the stakeholders including traders, commission agents and farmers have expressed their satisfaction about the initiative. The biggest advantage was observed in terms of saving of time to perform the complete cycle of trade inside the market. Earlier, the complete cycle of trade from farmers' entry to dispatch used to take more than 12 hours and even used to go up to mid-night on a day of heavy arrival. However, after the introduction of e-NAM, on an average, the cycle gets completed by evening. The respondents were not able to speak clearly about the impact of NAM on parameters like arrivals and lowering of transaction costs. Some of the farmers felt better price realisation in the new system. The traders also observed fewer mistakes in the declaration of bids in the new system (Table 5). The grading and assaying facility was made available by the Mandi through a private player for about six months but was not effectively used by traders due to their reliance and trust on the age-old practice of physical examination. They also felt the information provided through assessment report was not fully useful for them, and they trust personal physical evaluation as most of the trade is taking place locally and no inter-Mandi trade is taking place. The traders not only expressed their convenience with their old practice of physically examining the agri-commodity but also expressed their limitation on the reliability of the assessment report.

Table 5. Response of Different Stakeholders on e-NAM Initiative (n=50)

Sr No	Items	APMC	Traders	Commission Agents	Farmers
1	Time Saving	√	√	√	√
2	Convenience	√	√	√	√
3	Transparent	√	√	√	√
4	Better Price	√	√	√	√
5	Bank Payment*	*X*	*X*	*X*	*X*
6	Grading & Assaying**	√	*X*	*X*	*X*

*Provision is available but restricted to limited number of payments

**The service was provided on pilot basis for six months under PPP arrangement

The market committees also feel that formal grading and assaying is quite challenging to integrate with the system as it is multi-faceted and time consuming. The arrangements made in the Mandi during pilot testing for grading and assessing were not sufficient even to cover 10 percent of the lots arriving on an average day. The market committees also found it highly challenging to integrate the bank for online payments due to the reluctance of both commission agents and farmers. It needs a comprehensive strategy including incentive for users and bringing bank on board to make them understand the complete requirements of the Mandi trade.

The market committee staff is of the opinion that e-NAM is a step in the right direction but will need a lot more to be done to make the system more efficient and vibrant. The present software under e-NAM provides for operations related to Mandi-trade though there are so many operations beyond trade by stakeholders like *Mandi*, traders and commission agents which need to be covered to enhance its acceptability. The software has to offer a complete solution covering both internal and external management.

Assessment of influence of implementation of e-NAM in Telangana

The e-NAM scheme (model)was introduced in the state in the first phase during 2016. Though it has to go a long way before implementing the same in a holistic framework, there are still quite some learnings that trigger the hope for developing an agricultural market operating at the national level. Though e-NAM in the sample markets is limited to intra-Mandi transactions only, the little achievements it has made so far, give hopes for a greater and efficient e-NAM platform facilitating inter-Mandi transactions. For example, it has now been able to capture 100 percent arrivals along with price being discovered completely on the electronic platform (e-tendering) leading to a better price discovery. The increase in average number of bids per lots suggests that markets are competitive. E-tendering has also brought about efficiencies in the form of shortening of trade cycle hours in the Mandi and the Mandi is also in a position to handle large number of lots in a day (Table 6).

It also provides scope for public private partnership as has been experimented by introducing the facility for grading and assaying in sample markets in partnership with a private player. Weighment has also been integrated on a pilot basis though it is challenging for various factors like arrivals of a large number of small lots, limited level of understanding of licensed weighment of technology, etc.

Table 6. Influence of e-NAM on Mandi Processes and Performance

Sr No	Areas	Influence	Basis
1	Arrivals	▪ 100 Gate Passes to capture arrivals	▪ Mandi
2	Price Discovery	▪ 100 percent e-tendering	▪ Mandi
3	Competition	▪ Improved	▪ Transparent e-tendering process ▪ Average number of bids received per lot on sample day
4	Mandi Efficiency	▪ Ability to handle large number of lots	▪ Maximum number of lots handled in a single day
5	Time Efficiency	▪ Ability to complete trade cycle quickly	▪ Trade cycle getting completed by evening ▪ Suggested by all stakeholders
6	Weighing	▪ Weighing integration	▪ Challenging but being pilot tested

Inter-Mandi trade in e-NAM

The study reveals that operations within the sample Mandis have, by and large, been successfully shifted to the electronic platform as defined under e-NAM. However, effecting inter-Mandi trade is still a challenge. The linkages envisaged in the e-NAM model for enabling inter-Mandi trade have been delineated in the following paragraph along with a diagrammatic presentation.

The role of physical markets is very crucial for successful implementation of e-NAM. These markets should be operated by technically qualified professionals. The markets should have access to IT infrastructure such as computers and *wifi* with uninterrupted internet connectivity. If the aim of the market is to get good price realization by the farmers, they must enrol good number of traders from across the country online. Every market can project their important arrivals, e.g. commercial crops like turmeric in Nizamabad market, by uploading the photographs of such commodities along with the broad quality parameters. In order to facilitate proper matching between demand and supply, the suppliers should have knowledge about the demand for the commodity at the other end of a channel. Market

studies of the commodities being traded in a market will go a long way towards realizing this objective. The market can also facilitate in transportation and other logistic services by empanelling good service agencies. Traders can obtain online quotes from the empanelled service agencies for availing different services at best possible prices. A diagramatic presentation for inter-mandi trade is depicted in the Figure 2.

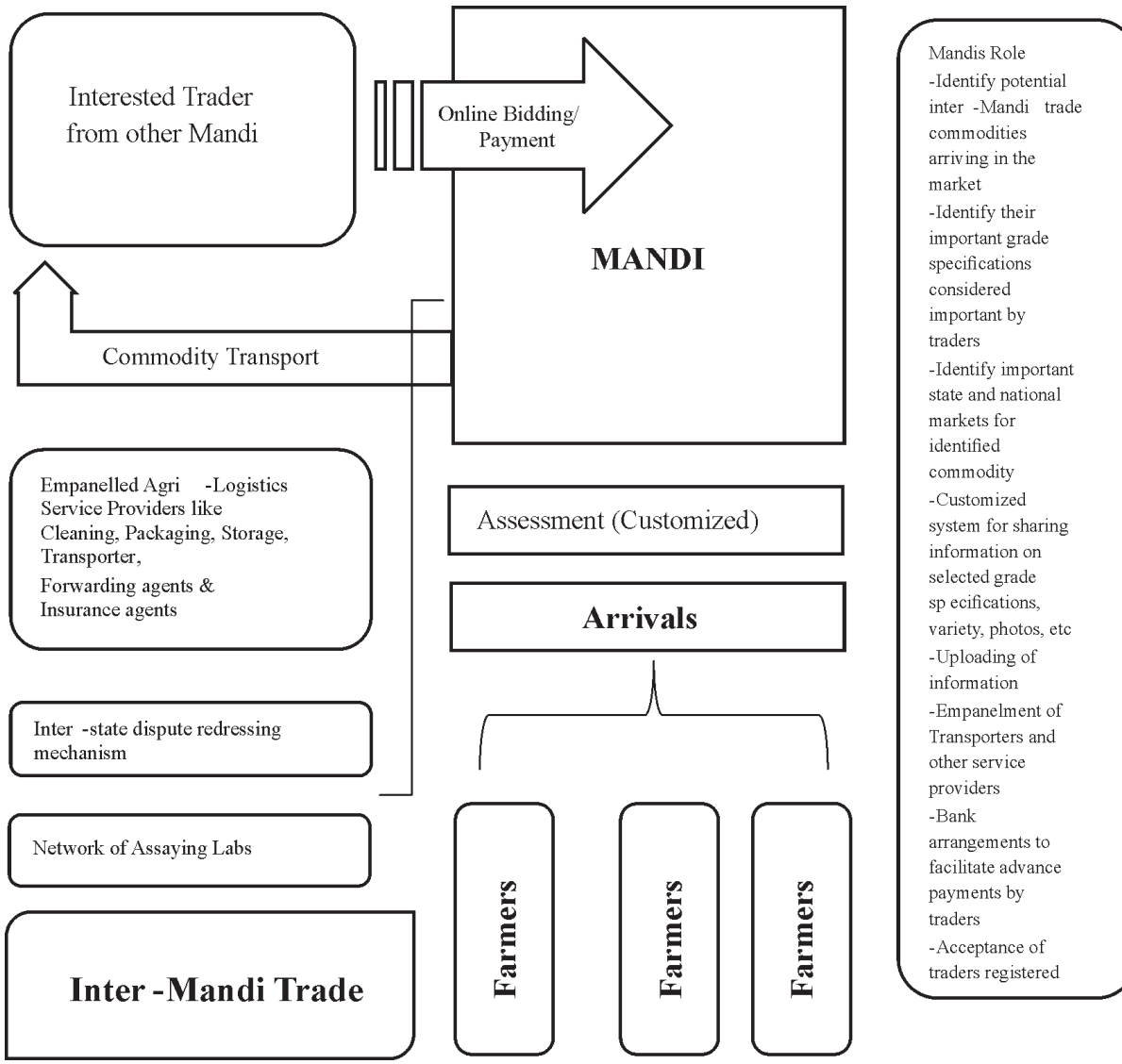

Fig.2. Inter Mandi Trade in e-NAM

A comprehensive online payment system addressing concerns of different stakeholders, mainly farmers, is the need of the hour to encourage online payment. Thus, e-NAM will facilitate ease of doing business in the sector and help the farmers fully harness the benefit of technology to their advantage and make the market competitive enough for better price discovery. In the long-run, the demand at various places will be integrated to help evolve a common market for agricultural produce in India.

The Mandis under e-NAM framework will have a revised role covering aspects like identification of trade in important commodities, identification of state and national level markets for identified commodities and developing a mechanism to share information about different commodities as per the requirement of the buyers.

Way Forward

The concept of e-NAM has the potential to overcome the challenges faced by the system, if it is, over time, able to move beyond application of information technology by having a holistic development of the marketing system covering aspects such as reforms, concerns of stakeholders, grading and assaying facilities, integration of banking, warehousing and logistics and, institutional support to address any possible dispute arising in the entire supply chain. A proper policy also needs to be put in place to offer solutions and incentives to different stakeholders, to make the concept truly inclusive.

There is a need to develop appropriate technologies and comprehensive strategy to integrate services like banking, grading and assaying, warehouses and weighment to help evolve a true national market for agricultural produce. There would be requirement to define role, responsibilities and norms for participation of different service providers and development of a mechanism to take care of any possible inter-Mandi disputes. The present software has also to go beyond tapping trade transaction to make the market completely automated from individual market level to unification of markets to enable inter-Mandi trade to happen. The software has to offer complete and integrated solution covering both internal and external management.

To conclude it may be mentioned that the e-National Agricultural Market has the potential to catalyse the overall development of the sector, if it is pursued as a means and not as an end in itself and is made to evolve accordingly.

Acknowledgement

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Temporal Analysis of Onion Prices in major Markets in India

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Abstract

In the last two decades, area and production of onion has increased,extending into non-traditional areas.However, there is a marginal increase in productivity. Price analysis of onion revealed that instability of the prices are high in domestic markets as observed in the last two decades period. On the contrary, in a few markets, a positive correlation between arrivals and prices of onion is witnessed indicating the existence of exogenous factors such as more number of traders operating during harvesting season for hoarding of the stock for onward sale in other markets. Price analysis of onion also revealed that there is a cyclic trend of sudden hike in the price of onion. Thus there is a need to curb the exorbitant price rise of onions by intervention of the government based on supply demand dynamics. There is also a need for strengthening the marketing information system and increasing of post-harvest management infrastructure for onion to resolve the issues related to onion supply chain in India, being the world's second largest producer of onion.

Key words: Onion, wholesale prices, crop dynamics, seasonal arrivals and price index, domestic markets.

Introduction

In the last two decades, among the food commodities, onion is one of the commodities which experienced high volatility in price movement. In general, this commodity is less elastic to price and income and inherently unstable due to weather and institutional risks (Chengappa et al., 2012). In the recent times, onion wholesale prices have exorbitantly increased and touched the historical highs of Rs. 5000-6000 per quintal in domestic markets. The sudden spurt in the price levels of onion has caught wide spread attention of the consumers, middle men, exporters and policy makers in India. Onion being a household vegetable for daily consumption, its price rise has significant impact on trade, exports and household budget allocation (Sohan, Premi and Premi B R, 2017). The glaring volatility in the price of onion is noticed in the years 1998, 2010, 2013, 2015 and 2017, and the concerning fact is that, skyrocketing of price is recurring frequently than previous years (alternate years in the recent times). The price fluctuations were pretty high in consumer markets like Delhi, Kolkata, Mumbai, Pune and Chennai than the markets located in onion production centers. Despite increase in the area and production of onion in India, periodical volatility of prices of onion is noticed due to several factors including vagaries in area allocation and production. Against this backdrop,an attempt has been made in this paper to analyse the factors responsible for price

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volatility such as supply and demand, area, production, rainfall pattern, export demand, Minimum Export Price (MEP) etc.

Accordingly, in this study, emphasis has been given to analyse the price behavior in major markets in India. Besides, the major determinants of this price behavior of onion in major wholesale markets in India is analyzed. Hence this study will throw light on understanding the price trends and seasonality effect on price movement and identifying the major determinants of price volatility. The outcome of the study will help in addressing existing concerns of price rise by formulating suitable policy measures to stabilize the supply and in turn to arrest volatility in prices of onion in domestic markets. The underlying principle is that, based on the outcome of the study, policy suggestions would be recommended to bring in stability in the prices of onion, which will benefit all the stakeholders in the chain including farmers and consumers. Keeping all these factors in view, the present study is taken up with the following specified objectives.

Objectives

· To analyze the wholesale price volatility of onion in major domestic markets in India.

· To analyze determinants of price volatility of onion (such as area, production, yield, exports, trade limits, rainfall, and policy framework of onion crop).

Methodology

Study area

In this study, major onion producing states and marketing centers located in Maharashtra, Karnataka, Madhya Pradesh, Rajasthan, Tamil Nadu, West Bengal and Bihar in India were selected for analyzing the price trend and its volatility in major markets and influence of changing crop dynamics, export performance on price movement for the time period of 2002 to 2017.

Sources of data

Secondary data on area, production and yield in major producing states in India were collected from Directorate of Economics and Statistics (DES) and State's Season Crop Reports. Information on Indian onion exports was collected from Directorate General of Commercial Intelligence and Statistics (DGCIS) and National Agricultural Co-operative Marketing Federation of India Ltd. (NAFED).For understanding the trends in prices of onion, the wholesale prices and arrivals in major markets in India were collected from the National Horticultural Research & Development Foundation (NHRDF) official website. The data collected from different sources were analyzed by using suitable quantitative statistical methods.

Data analysis

For understanding of the instability in prices, arrivals and prices seasonal trends of onion in domestic markets, coefficient of variance, correlation coefficient, and seasonal indices were calculated using

secondary data on wholesale prices and arrivals in 12 major markets in India. The data pertains to the year 2002-2017. For better interpretation and understanding of the results, graphical analysis is also carried out.

For understanding of instability or variability in the price movement Coefficient of variance was calculated.

Coefficient of variance of prices = Standard deviation/ Mean*100

To analyze the relation, association and strength in arrivals pattern and price movement of onion calculated correlation coefficient in the study.

$$r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\sqrt{n\sum y_i^2 - (\sum y_i)^2}}$$

r = Coefficient of correlation,

n number of observations

x_i= prices of onion

y_i= arrivals of onion

Seasonal index of prices and arrivals was calculated by

$$SI\ for\ Prices = \frac{\text{Average price of the commodity in particular month over a period of time}}{\text{Average prices in the year overa period of time}} * 100$$

$$SI\ for\ Arrivals = \frac{\text{Average arrivals of the commodity in particular month over a period of time}}{\text{Average arrivals of the commodity in the year overa period of time}} * 100$$

About onion crop

India is the second largest producer of onion in the world. Total area under onion has increased from 0.25 million ha to 1.23 million ha during the period of 1980-2015 with the annual average growth rate of 5.15 per cent. Production also increased during the same period from 2.5 million tonnes to 20.99 million tonnes with annual average growth rate of 7.39 per cent. The average yield of onion in India is 16.45 t /ha, which is far below the average global yield level of 22.06t/ha. In India, onion is mainly cultivated in Maharashtra with lion's share of 37.28 per cent in total onion acreage, followed by Karnataka (14.73 per cent), Madhya Pradesh (9.81 per cent), and Gujarat (4.73 per cent), Rajasthan (4.97 per cent), Bihar (4.48 per cent) and Andhra Pradesh (3.84 per cent). In the case of production, Maharashtra holds the top position by contributing around 29.9 per cent of total onion production in the country followed by, Karnataka

(14.87 per cent), Madhya Pradesh (14.36 per cent), Gujarat (7.31 per cent), Bihar (6.4 per cent), Andhra Pradesh (4.14 per cent) and Rajasthan (3.88 per cent). The highest average productivity of 23-25 MT/ha onion was registered in Gujarat followed by Madhya Pradesh (24.10 MT/ha) and Bihar (23.30 MT/ha), while in the case of other states, it ranged between 12-16 MT /ha during the study period.The growth rate of area and production and yield of onion was calculated for the period 1980-2015, mainly to ascertain the impact of rise in prices on acreage under onion and the results are presented in (Table 1). The data revealed that, at all India level, onion registered positive growth rates of 4.89 per cent, 6.42 per cent and 1.46 per cent in area, production and productivity respectively during 1980-2015. State level analysis reveals that, all the selected states have registered positive growth rates in, area, production and productivity. In India, onion is grown both in rabi and kharif seasons. So the supply is available throughout the year with varying volumes. Onion is an inevitable vegetable ingredient used in recipes to enhance the flavor of the wide varieties of culinary around the world.

Table 1. TE of Area, production and yield of Onion in major cultivating states in India (2013-15)

States	Area (m.ha)	Production (m.t)	Yield (t/ha)	Percentage share in total area	Percentage share in total production	Growth rate (1980-2015) in %		
						Area	Production	yield
Maharashtra	0.45	5.91	13.22	37.28	29.90	6.82	7.01	0.18
Karnataka	0.18	2.94	16.47	14.73	14.87	5.49	8.21	2.58
Madhya Pradesh	0.12	2.84	24.10	9.81	14.36	6.45	8.79	2.0
Gujarat	0.06	1.44	25.44	4.73	7.31	5.06	5.18	0.12
Rajasthan	0.06	0.77	12.83	4.97	3.88	6.32	10.04	3.5
Bihar	0.05	1.27	23.35	4.48	6.40	3.89	7.02	3.02
Andhra Pradesh	0.05	0.82	17.62	3.84	4.14	3.82	6.85	2.92
Others	0.24	3.78	13.50	19.98	19.12	-	-	-
All India	1.20	19.77	16.45	100.00	100.00	4.89	6.42	1.46

Source: *Directorate of Economics and Statistics, GOI, 2017 data base.*

Price trend in major wholesale markets in India

In this section the trends in onion wholesale prices and arrivals movement and their seasonal indices, volatility of the wholesale prices of onion have been discussed for major markets in selected states of Maharashtra, Karnataka, Rajasthan, Tamil Nadu, and Bihar in India. In general, prices of agricultural commodities follow a typical seasonal pattern of movement during the crop year. The general pattern of the price movement is lower prices during the post-harvest months and higher prices during the off season and pre-harvest months in a year. In general, the major factors that influence the price movement

are arrivals of the crop, area and production estimates, perishability of the commodity, the cost of storage, availability of storage facilities, trader's stock limits and minimum export price(P.G.Chengappa, 2012). Onion is one of the illustrious commodities which has the typical pattern of the price movement and has experienced significant price rise in the recent times. So, to identify the underlying seasonal pattern of onion, price movement and the instability of the price in selected major markets in India, seasonal index of arrivals and prices of onion and coefficient of variations (C.V) of prices were calculated respectively for the period 2002 to 2017.

In India, in the case of onion, the total arrivals in the top 50 markets account for around 95 per cent of the total arrivals in all the 107 markets (Gummagolmath, 2012). For this study, 12 major wholesale markets namely (Jaipur, Kolkata, Chennai, Mumbai, Pimpalgaon, Lasalgaon, Mahua, Hubli, Pune and Ahmedabad Delhi, Bangalore) which accounted for 60 per cent of the total arrivals in the country were selected for analyzing the seasonality pattern in arrivals and prices of onion for the period of 2002-2017. The main purpose of calculating the seasonal Indices of arrivals and prices of onion is to identify the typical underlying pattern of the arrivals and its influence on the price movement.

Instability in wholesale prices of Onion

The estimates of coefficient of variation (C.V) of wholesale prices of onion in the major markets of India from 2002 to 2017 period are presented in Table -2. These estimated values of coefficient of variation give the deviation of the prices from the mean value of the prices in a particular year. The estimated values from (Table 2) reveal that, onion wholesale prices have registered higher instability particularly in the years 2005, 2010 and 2013 compared to other years, while during 2016 and 2017, the fluctuations in the prices were lower compared to the previous period. It was also observed that, since 2009, volatility in wholesale prices of onion is comparatively high in a majority of the markets than the previous years and almost all the selected markets witnessed a high volatility in the wholesale prices. Among them,the intensity of volatility is high among Pimpalgaon, Delhi, Lasalgaon Ahmedabad, Mumbai and Pune markets compared to the other markets. The common feature noticed among all the markets was that, the intensity of volatility in prices was high during October- January months.

Table 2. Coefficient of Variation (C.V) of wholesale prices of Onion in major markets in India

Market Centre	Jaipur	Delhi	Bangalore	Chennai	Mumbai	Lasalgaon	Pimpalgaon	Hubli	Mahua	Pune	Kolkata	Ahmedabad
2002	32.34	38.65	27.28	23.66	37.72	40.41	41.5	36.22	29.87	42.79	32.16	29.68
2003	41.65	35.87	40.22	30.83	39.87	45.73	47.74	35.18	41.42	46.12	38.13	38.78
2004	42.12	31.38	30.66	23.07	27.05	37.42	35.64	20.39	42.36	26.59	28.54	39.05
2005	60.45	43.53	38.03	39.06	62.21	71.35	67.49	40.55	53.74	56.66	52.55	62.19
2006	25.72	19.95	15.68	23.79	38.49	46.36	43.63	15.93	48.21	41.52	26.17	43.64
2007	35.87	37.63	21.36	20.7	34.65	40.27	39.72	20.57	36.45	34.61	29.35	29.81
2008	41.25	38.58	34.69	33.47	40.19	54.32	54.77	38.4	43.92	54.66	44.21	47.47
2009	34.58	32.4	36.72	40.49	42.43	40.43	39.62	27.48	36.69	44.65	50.16	35.39
2010	55.98	48.55	69.83	49.97	62.29	46.21	44.59	39.98	49.64	65.66	53.66	54.33
2011	68.25	58.63	52.56	57.43	52.93	57.79	52.48	35.9	62.46	62.78	58.28	62.54

Market Centre	Jaipur	Delhi	Bangalore	Chennai	Mumbai	Lasalgaon	Pimpalgaon	Hubli	Mahua	Pune	Kolkata	Ahmedabad
2012	31.92	31.01	42.25	35.55	37.96	49.73	43.93	23.49	38.84	44.02	39.95	42.09
2013	66.79	59.98	44.94	50.6	60.00	62.54	65.97	46.24	48.74	61.34	50.18	58.39
2014	33.36	31.69	40.15	29.39	32.51	28.42	25.11	28.73	24.17	34.4	28.2	26.82
2015	48.64	44.5	31.25	39.44	51.47	55.08	59.24	32.76	40.41	62.35	44.29	48.87
2016	16.81	22.45	22.47	15.61	20.83	23.83	20.61	21.35	24.39	26.77	13.14	17.39
2017	48.47	42.16	43.75	31.13	52.51	57.77	57.25	45.26	42.47	54.88	46.14	47.28

The calculated values of correlation coefficient between the monthly wholesale prices and arrivals of onion in major markets in India are presented in Table 3. In general, in the case of agricultural commodities, prices will have a negative relationship with the arrivals of the commodity. The correlation analysis across the selected markets (2002-2017) reveals that,Bangalore, Chennai Mumbai, Ahmedabad and Hubli markets mostly have a positive correlation coefficient i.e., with the increased arrivals, the prices also were at higher levels in these markets, whereas, in the other selected markets, arrivals and prices were negatively correlated. The year wise analysis of the correlation coefficient between prices and arrivals in selected onion markets explains that, every year about three to four markets in the selected market list are showing a positive correlation among the arrivals and prices. During 2002- 2004 period, Jaipur, Chennai, Delhi, Bangalore Pune and Kolkata registered positive correlation. In 2009, Delhi, Bangalore, Mumbai, Pune, Ahmedabad and Hubli showcased positive correlation. However, in the year 2010, except Lasalgaon, Hubli, and Bangalore markets, in all other selected markets negative correlation between arrivals and prices was noticed. Again in the year 2013, Jaipur, Hubli and Bangalore markets registered a positive correlation. In the years 2016 except Jaipur, Delhi, Bangalore and Hubli markets all other markets showed a positive correlation between arrivals and prices of onion.

On the whole, a few markets namely Bangalore, Chennai, Hubli and Ahmedabad markets have witnessed majorly a positive correlation between arrivals and prices in onion over a period of time.The instances of positive correlation in other markets are very limited .This indicates the paradoxical situation that as the arrivals increase the prices also increased. From this analysis it is evident that, exogenous factors (such as cartels holding the stock in speculation of higher prices on crop failure estimates and traders reluctance to reduce the prices despite increased arrivals in the market) were interfering in the market functioning and kept the prices on higher side in onion despite increased arrivals. Besides, as per the opinion of the traders in those markets more number of traders operated for purchase of onion for onward trade in other parts of the country thus resulting in increase in prices. (Purushottam and Gummagolmath, 2012).

Table 3. Year wise correlation coefficient of wholesale prices of onion in major markets in India

Year	Jaipur	Delhi	Bangalore	Chennai	Mumbai	Pune	Kolkata	Ahmedabad	Lasalgaon	Pimpalgaon	Hubli	Mahua
2002	-0.08	0.19	0.33	0.11	-0.01	-0.89	-0.17	-0.08	-0.50	-0.44	0.48	-0.54
2003	0.63	0.40	0.84	0.22	0.08	-0.71	0.09	0.81	-0.55	-0.03	0.36	-0.54
2004	-0.43	-0.58	-0.31	-0.24	0.59	0.70	0.71	0.49	0.46	-0.10	-0.47	0.29
2005	-0.67	-0.08	0.74	-0.28	-0.82	-0.93	-0.42	-0.40	-0.79	-0.79	0.69	-0.53
2006	-0.50	-0.45	-0.01	0.22	-0.54	-0.72	-0.65	-0.21	-0.07	-0.29	0.42	-0.41
2007	-0.38	-0.65	0.02	0.16	-0.69	-0.39	0.25	0.34	-0.52	-0.77	-0.39	0.00
2008	-0.64	-0.67	-0.67	-0.24	-0.62	-0.60	-0.48	0.20	-0.55	-0.42	0.62	-0.44
2009	-0.52	0.11	0.53	-0.14	0.50	0.06	-0.52	0.55	-0.08	-0.07	0.78	0.26
2010	-0.82	-0.22	0.59	-0.63	-0.09	-0.21	-0.61	-0.46	0.05	-0.54	0.80	0.26
2011	-0.48	-0.56	-0.10	-0.40	0.19	0.01	-0.13	-0.48	-0.24	-0.29	-0.15	-0.58
2012	-0.69	0.40	0.54	-0.80	-0.39	-0.81	-0.13	-0.53	0.33	-0.19	0.43	-0.61
2013	0.45	-0.93	0.74	-0.71	-0.84	-0.69	-0.82	-0.80	-0.77	-0.76	0.13	-0.49
2014	-0.09	0.01	-0.11	-0.17	-0.34	-0.78	-0.29	-0.44	-0.35	0.12	-0.17	-0.80
2015	-0.31	-0.39	0.41	0.04	-0.37	-0.73	-0.37	-0.70	-0.90	-0.92	0.11	-0.64
2016	-0.53	-0.30	-0.27	0.23	0.72	0.21	0.56	0.52	0.37	0.30	-0.35	0.47
2017	0.18	-0.38	-0.90	-0.61	-0.65	-0.74	-0.62	-0.85	-0.50	-0.85	-0.62	-0.72

Table 4.Correlation coefficient between monthly onion arrivals and prices in major markets in India (2002-2017)

Market center	Correlation coefficient
Jaipur	0.01
Delhi	-0.11
Bangalore	0.39
Chennai	0.28
Mumbai	0.06
Lasalgaon	-0.30
Pimpalgaon	-0.34

Market center	Correlation coefficient
Hubli	0.26
Mahua	-0.03
Pune	-0.25
Kolkata	-0.25
Ahmedabad	0.24

Seasonality in Arrivals and Prices of Onion in major Domestic Markets in India

The results presented in the (Tables 5 & 6) illustrate the monthly trends in prices and arrivals in the selected major onion markets in India. Onion supply is persistent around the year as the crop is cultivated in both the seasons. Despite this phenomenon, higher volatility in the prices of onion is observed in the recent times. In almost all the selected markets, the lowest prices were seen during the months of April and May,and from there prices increased steadily. From the month of September onwards, onion prices increased at a higher pace and reached peak level by December. Then,from January onwards, prices took the declining trend and slowly moved down side due to commencement of arrivals from the rabi crop. This typical price movement pattern is witnessed in all the selected years in the case of onion during the study period (2002-2017). Further, the analysis of onion arrivals in the major markets indicated that, markets were flooded with arrivals in the peak season during the months of May to August from rabi crop and early kharif crop. From this period onwards, slowly the arrivals started declining in the markets. These declining arrivals make the prices move higher. Seasonal indices of market wise arrivals and price are discussed in detail as under.

Table 5. Seasonal Indices of prices of onion in major consuming markets in India (2002-2017)

Months	Jaipur	Delhi	Bangalore	Chennai	Mumbai	Lasalgaon	Pimpalgaon	Hubli	Mahua	Pune	Kolkata	Ahmedabad
January	104	101	105	106	95	97	97	97	106	98	99	101
February	89	86	87	86	76	77	78	82	89	70	83	85
March	75	74	67	70	63	60	60	73	74	57	60	68
April	65	67	62	68	59	58	58	68	64	53	62	59
May	56	61	67	67	62	58	61	72	64	58	64	57
June	61	72	87	83	79	78	72	91	72	81	78	75

Months	Jaipur	Delhi	Bangalore	Chennai	Mumbai	Lasalgaon	Pimpalgaon	Hubli	Mahua	Pune	Kolkata	Ahmedabad
July	84	93	105	95	94	98	94	110	91	95	96	94
August	124	127	127	122	130	139	140	139	121	136	126	132
September	150	140	121	124	138	145	150	125	130	140	133	138
October	154	145	125	125	144	148	149	116	137	141	139	132
November	129	125	128	134	140	131	132	116	138	145	135	133
December	111	109	118	121	120	110	110	110	113	127	126	126

Table 6. Seasonal Indices of arrivals of Onion in major consuming markets in India (2002-2017)

Months	Jaipur	Delhi	Bangalore	Chennai	Mumbai	Lasalgaon	Pimpalgaon	Hubli	Mahua	Pune	Kolkata	Ahmedabad
January	86	88	81	103	118	164	141	60	164	129	126	108
February	78	86	63	105	104	140	116	45	251	168	134	105
March	88	108	71	107	118	105	84	52	246	156	93	109
April	88	101	70	90	102	98	106	46	232	113	71	118
May	146	107	73	103	94	116	157	50	165	103	108	98
June	123	111	66	105	95	91	111	46	23	83	96	99
July	122	104	66	108	96	88	100	43	11	78	113	96
August	113	90	77	92	83	79	69	40	12	72	100	83
September	94	83	133	100	87	67	81	87	10	64	91	80
October	89	90	215	91	90	61	60	255	11	69	89	88
November	85	124	172	98	101	67	79	296	17	73	79	107
December	88	109	113	98	112	124	130	180	58	91	99	109

Source: *National Horticultural Research and Development Foundation (NHRDF)*

From the above analysis of prices and arrivals pattern in all the selected markets, it is clear that, in Bangalore, Kolkata, Hubli and Chennai markets, prices are increasing with the increasing arrivals of onion in a few months, whereas in other selected markets, increased arrivals has led to decline in the prices. The positive correlation of the prices and arrivals in Hubli, Bangalore Chennai and Kolkata indicates the operation of more number of traders to purchase the onion for onward trade in other markets of the country. This may be attributed to the fact that in these places, onion is grown in kharif as well as rabi season. In other parts of the country it is grown only during rabi season.

Onion prices performance in last two decades

In the recent past, onion is one of the agricultural commodites which is subject to high price fluctuations in major markets in India. In general onion prices follow a typical seasonal pattern in price movement. In addition to that, prices skyrocketed to historical highs in a few years. An in-depth analysis of price movement in onion is discussed below, giving extra emphasis to the years in which prices touched a historical high in the last two decades.

During 1998, the upward movement of the prices of onion commenced and touched a historical high price of Rs.2000 per quintal. In the month of August, the prices started increasing and the trend continued up to December across the major markets in the country. This upward movement of the prices was attributed mainly to estimates of lower onion production and low volumes of produce coupled with delayed and reduced arrivals of fresh kharif crop harvest due to excessive rains. However, prices started declining from December due to improved arrivals and interventions by the government and different agencies through the procurement operations at domestic levels, coupled with regulating the exports to international markets. The exports were curtailed by minimum export price of onion to curb the rising domestic prices. As a result, of these interventions, the prices were moving in the reasonable price range of Rs 300 to Rs.800 per quintal. Again the same pattern of 1998 i.e., surge in the onion prices was repeated during October, 2005 due to the same factors and the prices crossed Rs.1000 per quintal mark in almost all the markets in the country. The main reason for this increase in the prices is delayed sowing of the kharif crop in major producing states (ICAR reports on crop performance). However, the government policy decision of the onion imports changed the upward trend sentiment in the markets and prices started declining. In the year 2005, onion wholesale prices were traded in the range of Rs. 1000 to Rs.1500 per quintal and thereafter on increased arrivals in the major markets and government intervention, prices dropped straight way to Rs. 300 to 500 per quintal during April –May in 2006. However, during this period, the retail prices hovered in the range of Rs. 60-70 per kg in major consuming markets such as Delhi, Bangalore, Jaipur and other markets.

Further analysis revealed that, during the period 2006-10 , onion prices were moving in the range of Rs. 500 to Rs. 1500 per quintal. The phenomenon of skyrocketing of prices observed during 1998 and 2005 was again repeated during 2010 and the magnitude of increase in prices was higher than the previous situation. The prices touched a historical high of Rs. 2500-3000 per quintal in the year 2010.

The main cause of this unconditional rise in prices is attributed to the reports of 10-20 per cent crop damage due to excess rainfall in Maharashtra and Karnataka states and poor market intelligence on crop performance information, which resulted in the limited arrivals in the markets and stock hoarding by the traders in anticipation of the rise in price(CCI Report). This situation created an artificial supply crunch in the market leading to exorbitant spike in the prices of onion in the wholesale and retail markets. But the rise in price was not for a long period of time and within a short period, the prices took a reverse trend and declined to Rs. 500 levels per quintal in April and May. The price trend remained normal in the next two years in the range of Rs, 500-1500 per quintal based on the seasonality factors in 2011 and 2012.

However, in the year 2013, wholesale prices have increased considerably from the lowest point of Rs. 650 to Rs. 4500-5000 per quintal in major markets across the country. The rise in prices was noticed from the month of July and the bullish upward trend continued till November 2013. In 2013, the onion prices have increased uncontrollably to touch the all-time record level of Rs. 5000 per quintal. The same upward and down ward seasonal price movement in the onion prices repeated in the years 2015 and 2017. The reoccurrence of this trend is in regular intervals with a relatively short interval than the previous situation of 1998 and 2006. In both consumer and producer markets the prices of onion rose to new historical heights with marginal difference, during 2010 to 2017(Figure -1). The main reasons attributed for this rise in prices are excess rainfall in onion growing states, which resulted in crop damage to some extent. In addition, stock hoarding by the traders, short supply of the produce and lower arrivals in the markets and rising export demand were the other major factors contributing to the rise in the prices of onion in recent times in domestic markets. As per the reports of the Competition Commission of India (CCI), another major reason for exorbitant increase in the prices of onion is that, the onion trade in the country is controlled by a few traders leading to monopsony situation. There is also a speculation that, farmers in Maharashtra have resorted to storage of onion in the low cost storage devised by NHRDF. Moreover, the cultivation of onion has expanded to non-traditional states, the acreage of which is highly fluctuating and thus leading to uncertainties in arrivals.

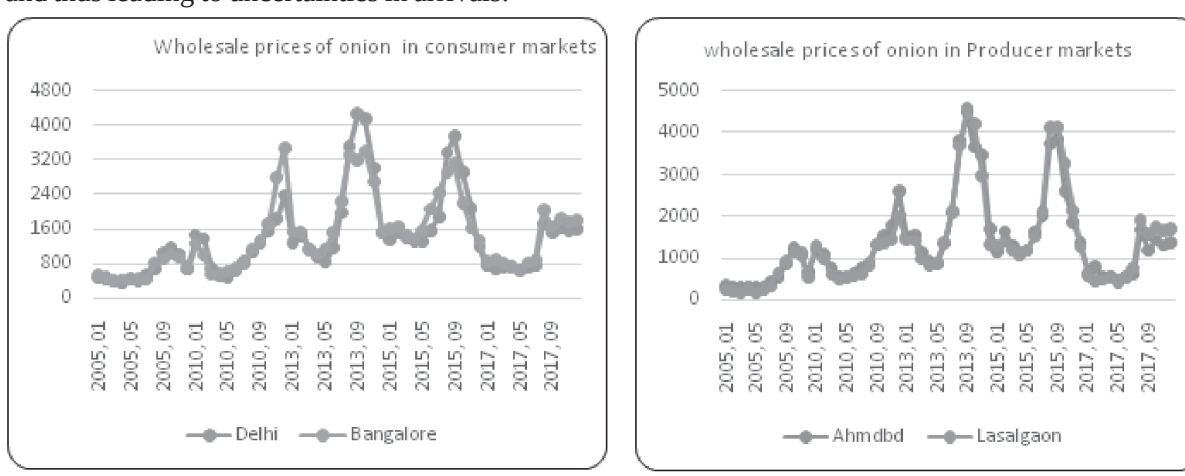

Figure 1. Wholesale prices of onion in producer and consumer markets

From the above analysis it is clear that onion prices moved to some extent in tandem with the arrival pattern in the market but also got influenced by exogenous factors such as stock holding by traders and reluctance to reduce the prices on increased arrivals in expectation of earning higher profits. In addition to these factors, however, there is a need to study the other determining fundamental factors as the factors greatly influence the trends in agricultural prices such as area, production and productivity performance,rainfall pattern, commodity exports (MEP and export ban, procurement etc. (Kretschmer, Bowyer and Buckwell 2012). With this discussion an attempt is made to analyze the influence of fundamental factors on the price movement of onion in the country and detail in the following paragraphs.

Determinants of price volatility in onion

i) APY crop performance in major producing states and in India

In India, area and production of onion has continuously increased with the positive CAGR growth rate of 4.89 per cent and 6.42 per cent respectively during the period 1980-2015. However, the productivity increased with a lower magnitude of growth rate compared to area and production with increase of 1.46 per cent year on year for the same period. Hence it can be attributed that, increase in production is mainly due to increase in area and marginally supported by growth in productivity. The phenomenal increase in production and area is mainly due to price incentive offered by onion trade. It has also resulted in expansion of area in non- onion production states. But in the years 2009 and 2012 area and production marginally declined at all India level due to the crop damage on excess rainfall. This decline in production estimates supported the bullish sentiment with the decline in arrivals and prices skyrocketed in domestic markets. For the remaining period, despite bumper crop production, the prices increased to higher levels due to speculative holding by the traders in lean period and ever increasing export demand. At the state level also, area, production and productivity of onion has increased significantly in all the selected major onion producing states in India. Despite positive growth trend in area, production and yield, the prices have significantly increased in the recent times which clearly state the presence of the other exogenous factors in the markets which may have been controlling the prices.

ii) Rainfall pattern

The analysis of the rainfall pattern impact on crop performance of onion clearly explains that, in the years (2005, 2010, and 2015) excess rainfall received in major onion producing states on standing crop in the months of June-September resulted in lower arrivals during these months. This situation resulted in crop damage to the extent of 20-40 per cent in various states. (ICAR reports). This situation coupled with manipulation in trade practices resulted in price rise to peak levels and touched historical highs in anticipation of the shortage of the produce in the markets. This opportunity was leveraged by the traders to their advantage and they hoarded the stock to create anartificial crunch in the supply for making extra profits.

iii) Export of onion

India is the second largest onion producer in the world, so it exports around 7-10 per cent of its onion to the countries across the world. The exports from India significantly increased manifold from 0.056 million tons in 1950's to 2.46 million tons in the year 2016-17. Correspondingly the export price also increased from Rs.187 per ton to Rs.21,183 per ton during the same period. From the annual export data of onion from India, it is revealed thatonion export prices are increasing year on year with increasing export demand and export price of onion sharply increased by 50 per cent in 2013 as compared to the previous year. So here we can conclude that, the rising international demand and price movement have influence on domestic prices of onion. However, by the intervention of the government in terms of setting the Minimum Export Price (MEP) for onion and export trade limits and imports of onion from Pakistan are the few measures that assisted in bringing down the onion prices under control in the domestic markets in India in the recent times.

The increase in MEP has a negative relationship with the price of onion i.e., as the MEP increases, the priceof onion declines on increased supply of the produce in domestic markets. The higher Minimum Export Price (MEP) is not a compatible price in the international market as onion export prices of the other major producing countries like China and Egypt are far below the Indian export prices. MEP was fixed at a higher level during 2010 (around $ 280) and gradually increased to $ 850 by 2017 to curb the exports and in turn to ensure rising domestic prices and to increase the domestic supply.

Conclusion

In the last two decades, area and production of onion has increased considerably in non-traditional areas under onion cultivation coupled with marginal increase in productivity in Madhya Pradesh, Maharashtra, Punjab, Karnataka, Haryana and Rajasthan taking cues from rising wholesale prices in domestic markets. Time series analysis of prices revealed that wholesale prices have exorbitantly increased and touched a historical high of Rs. 5000-6000 per quintal. This has become a regular phenomenon since 1998. The instability or volatility of the prices are high but sustained only for a short period. Among them the intensity of volatility is high in the case of Pimpalgaon, Delhi, Lasalgaon Ahmedabad, Mumbai and Pune markets as compared to the other markets. In addition to that, in a few markets, positive correlation between arrivals and prices of onion witnessed, clearly indicates the existence of exogenous factors such as more number of traders operating during the harvesting season for hoarding of the stock for onward sale in other markets.Important observation of the price analysis is that, there is a cyclic trend of sudden hike in the prices of onion.Thus there is pressing need not only to curb the exorbitant price rise of onions but by also volatility prescribing the stock holding limit to the traders and by intervention of the government on regulating the export trade by fixing the minimum export price based on supply demand dynamics. There is also a need for strengthening the marketing information system and increasing post-harvest management infrastructure for onion to resolve the issues related to onion supply chain. India, being the world's second largest producer of onion,exports around 7-10 per cent of its total production to various countries across the world. Analysing the direction of the Indian onion trade in the global market, will facilitate further understanding of the impact of export demand on price movement in domestic markets.

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Extension Approaches Adopted by the Agri-allied Sector Departments of Karnataka State

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Abstract

The extension approaches followed by different extension organizations have resulted into wider spread of modern technologies and increase in agricultural production. However, in the agri-allied sector these extension approaches are not fully adopted due to several reasons.It has been seen that majority (85%) of the animal husbandry officers in Karnataka visited the farmers field daily, followed by sericulture officers (60%) and 50 per cent of horticulture officers and fisheries officers. Nearly 45 per cent of the horticulture officers, 40 per cent of the sericulture and fisheries officers and 10 per cent of the animal husbandry officers were involved in formation of farmer groups. General Extension Approach was the most popular among the agri-allied sector officers. It has been noticed that 90 per cent of horticulture officers, 85 per cent of animal husbandry officers and 70 per cent of the sericulture and fisheries officers were aware of the Agricultural Technology Management Agency (ATMA). However most of them; viz., 70 per cent of the sericulture officers, 50 per cent of the fisheries officers, 65 per cent of both animal husbandry and horticulture officers had no knowledge about the key functions of ATMA. Cent per cent of all the department officers in Karnataka stated that extension services were not system based and not converged with the other line departments. None of the officers recommended any farming systems to the farmers. Participatory approach and ICT approach were not much practiced by the allied sector officers as only 25 per cent were affirmative about the details of the participatory approach. Commodity approach and project approach of extension were least popular with the agri-allied officers of Karnataka State. Thus, it can be concluded that to promote adoption of other extension approaches among the agri-allied department officers, capacity building through induction training and refresher training programs on extension management aspects and well defined job chart inclusive of frequent field visits is the need of the hour for Karnataka State.

Keywords: Agricultural Technology Management Agency (ATMA), Commodity Approach, Extension Reforms Approach, Farming System, General Extension Approach, Information and Communication Technology (ICT), Participatory Approach, Project Approach

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Introduction

Indian agriculture sector is the backbone of the rural economy but in the past few years it is showing a declining trend in contribution to the national Gross Domestic Product (GDP). On the contrary, agri-allied sectors like Animal husbandry, Fishery, Horticulture and Sericulture are emerging in a commercial way and enriching the food basket of consumers.

Animal Husbandry is the major player among the allied sectors and plays an important role in the Indian economy. About 20.5 million people depend upon livestock for their livelihood. The Livestock sector contributes 4.11 per cent to national GDP and 25.6 per cent to Agriculture GDP. Animal Husbandry sector has always played a significant role in the State's economy through supplementing assured family incomes and generating gainful employment in the rural areas. The major problems being faced by the sector include shortage of fodder, inadequate and inaccessible credit, shortage of technical labour force for veterinary services and lack of infrastructure such as buildings, equipment, veterinary institutions, abattoirs, milk collection centres etc.

The area under the horticulture production in 2016-17 was 249 lakh hectares, which resulted in 93 million tonnes fruit production and 175 million tonnes vegetable production. (Times of India, May 2017). Karnataka is a predominant player in the horticulture sector in India. Although the sector accounts for only 15 per cent of total net area sown in the State, its contribution to gross value of output of agricultural sector is over 40 per cent. The area under various fruit crops in the state during 2016-17 was 20.7 lakh ha, and the production output was 21.29 MMT (National Horticulture Board). Karnataka is the largest producer of spices, aromatic and medicinal crops. Since the past decade, India has witnessed a huge demand for horticultural produce from domestic and international markets due to increase in per capita income and shift in consumption pattern of the population. This phenomenon has provided a big opportunity to the farmers for fetching higher income through high value horticultural crops. The sector also provides excellent opportunities to farmers in rainfed areas, where a significant shift in horticultural area and production is evident. The major constraints of horticulture production in India are; inadequate post-harvest infrastructure and processing facilities, poor marketing infrastructure, and weak extension support.

India is the second largest producer of raw silk after China and the biggest consumer of raw silk and silk fabric. An analysis of trends in international silk production suggests that sericulture has better prospects for growth in the developing countries rather than in the advanced countries. Indian silk industry, contributes nearly 28,700 tonnes (16.12 per cent) of silk to the total world output. At present, India imports 6,000 to 8,000 tonnes/year of raw silk and silk fabric from China to meet the growing domestic demand. (The Hindu, 2015). Karnataka is a pioneer State in production of raw silk. The sector not only shares almost 50 per cent of the total raw silk production in the country, but also provides employment to 13 lakh work force in the State. Even though silk production in the State is rising in terms of quantity, its share in the

country's total output has declined by 15 per cent over a decade, consequent upon Andhra Pradesh and Tamil Nadu increasing their respective shares. Historically, the cultivation of mulberry has remained confined to 8 traditional districts in the southern region of the State. However, recently northern region as well as some other non-traditional districts of southern region have also witnessed some expansion in the area under mulberry. The districts of Dharwad and Tumkur are the most popular silk producing regions as they possess the perfect sub-humid to dry semi-arid climate most suitable for silk production. (Govt. of Karnataka).

India is the second largest producer of fish in the world. Fisheries provide livelihood opportunities to millions of people directly and through a number of subsidiary industries. The total fish production in 2016-17 was 11.4 million metric tonnes (3.6 million metric tonnes from marine fisheries and 7.8 million metric tonnes from inland fisheries). The per capita availability of fish is 9 kg per person per year, which is quite low as compared to other developing nations. (GoI, DAHD&F, 2017-18). The fishery sector also plays an important role in the socio-economic development of Karnataka state. The sector contributes around 2-3 per cent in agricultural GDP and provides employment to nearly 7.49 lakh fisherman. Besides, the State also earns a large amount of foreign exchange through exports of fish particularly marine. Historically, marine sector dominates the State fishery sector and only three districts viz. Dakshina Kannada, Udupi and Uttara Kannada have a coastal line. Inland fishery has witnessed an increase in its share from 30 to 42 per cent and is spread in all the districts of the State, according to Karnataka Agriculture & Rural Development Vision 2020 document.

The extension approaches followed by service providers mainly State Departments have resulted into a wider spread of modern technologies and increase in agricultural production worldwide. However, it has been repeatedly observed by the researchers that, the extension components in allied sector are generally weak. In this context an in-depth study was taken up by the Center for Extension in Agri-Allied Sector (EAAS), MANAGE, Hyderabad on "Analysis of Extension Approaches adopted by Agri-allied sector departments**"** to explore the reasons for weakness of the extension component in the allied sector.

Methodology

Locale of the study

The study was conducted in four major Indian states viz., Maharashtra, Uttar Pradesh, Odisha and Karnataka. The states were selected purposively wherein; all the allied sectors viz., Animal Husbandry, Horticulture, Sericulture and Fisheries department were present and operational. A total of 480 respondents (240 Government Officers and 240 Farmers) were selected randomly from two districts of each state. The details of the sampling procedure is as follows;

Table 1. State -wise distribution of respondents

State	Uttar Pradesh				Odisha				Maharashtra				**Karnataka**			
Districts	**Basti**		Faizabad		Sonepur		Bargarh		Ahmednagar		Aurangabad		**Kolar**		**Chikkaballapur**	
	O	**F**	**O**	**F**	**O**	**F**	**O**	**F**	**O**	**F**	**O**	**F**	**O**	**F**	**O**	**F**
Animal Husbandry	10	10	10	10	10	10	10	10	10	10	10	10	**10**	10	**10**	10
Horticulture	5	5	5	5	5	5	5	5	5	5	5	5	**10**	5	**10**	5
Sericulture	5	5	5	5	5	5	5	5	5	5	5	5	**5**	5	**5**	5
Fisheries	10	10	10	10	10	10	10	10	10	10	10	10	**5**	10	**5**	10
Total	30	30	30	30	30	30	30	30	30	30	30	30	**30**	30	**30**	30
Gross Total	480								**(30+30=60) sample size for present paper**							

*(O: Officers, F: Farmers)

In view of the enormousness of the research, it is difficult to discuss all the research findings comprehensively, in a single research paper. As such one of the objectives of the research study was to explore the "Extension approaches adopted by the officers of allied sector departments in providing extension services to farmers". The following extension approaches were considered for the study viz. General Extension Approach or Public Extension Approach**,** Extension Reforms Approach, Farming Systems Approach (FSA), Participatory Approach, ICT Approach, Commodity Approach and Project Approach. The scope of this paper is limited to discussing the above objective i.e., Extension approaches adopted by the agri-allied department officers in Karnataka state and the total sample size for the present paper is 60 agri-allied department officers.

Data collection tool

Taking into consideration, the scope and objectives of the study, a draft interview schedule was prepared after perusal of available literature and through consultation with experts in the field of agri-allied extension and other related fields. After incorporating their suggestions, a well-structured interview schedule was finalized and pre-tested on agri- allied department officers of Ranga Reddy district of Telangana. The observations made in the pre-test of the schedule were incorporated and a final version of the interview schedule was prepared to be used for data collection, which was carried out through personal interview.

Statistical analysis

The data collected from the respondents were scored, tabulated and in relevance to the objective of the study the data was subjected to different statistical tools like frequency, percentage and correlation coefficient.

Findings of the study

Socio-economic and personal profile

In social research socio-economic and personal profile of the respondents is generally important to establish relationship between the dependent and independent variables.

Table 2. Socio-economic and personal profile characteristics of officers in the state of Karnataka

Sl	Socio-personal variables	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n= 20)	
		f	%	*f*	%	*f*	%	*f*	%
A	**Age**								
1	Young (up to 35 years)	2	20	3	30	7	35	12	60
2	Middle (36 -45 years)	4	40	4	40	5	25	5	25
3	Old (> 45 years)	4	40	3	30	8	40	3	15
B	**Education**								
1	Metric	0	0	0	0	0	0	0	0
2	12^{th}	0	0	0	0	0	0	2	10
3	Degree	3	30	4	40	14	70	17	85
4	Masters Degree	6	60	3	30	5	25	1	5
5	PhD	1	10	3	30	1	5	0	0
C	**Experience**								
1	0-10 years	4	40	5	50	10	50	16	80
2	11-20 years	6	60	2	20	3	15	3	15
3	> 20 years	0	0	3	30	7	35	1	5

Sl	Socio -personal variables	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n= 20)	
		f	%	*f*	%	*f*	%	*f*	%
D	**Frequency of visit**								
1	Daily	6	60	0	0	17	85	3	15
2	Once in a week	1	10	4	40	0	0	4	20
3	Once in a fortnight	0	0	0	0	1	5	1	5
4	Once in a month	0	0	1	10	1	5	1	5
5	Irregular	2	20	5	50	0	0	10	50
6	Never	1	10	0	0	1	5	1	5
E	**Formation of groups**								
1	No	6	60	6	60	18	90	11	55
2	Yes	4	40	4	40	2	10	9	45
	Linking of group/s to a financial institute								
3	Yes	0	0	0	0	0	0	1	5

From table 2, it is evident that 40 per cent of the sericulture officers belong to middle and old age group. Similarly, 40 per cent of the fisheries officers belong to middle age group. Likewise 40 per cent of the animal husbandry officers belong to old age group. Majority (60 %) of the horticulture officers belong to young age group.

Majority (60 %) of the sericulture officers had a postgraduate degree. Nearly, 40 per cent of the fisheries officers in the state of Karnataka had completed undergraduate degree. Majority (70 %) of the animal husbandry officers had finished undergraduate degree and 85 per cent of the horticulture officers had undergraduate degree.

As much as 60 per cent of the sericulture officers had 11 to 20 years of experience. Likewise, half of the respondents (50%) in fisheries and animal husbandry had less than 10 years of experience. Majority (80 %) of the respondents in horticulture had less than 10 years of experience.

Majority (60 %) of the sericulture officers visited the farm field on daily basis. Nearly, 50 per cent of the fisheries officers had irregular visits to the farm field. As much as 85 per cent of the animal husbandry officers visited the farm field daily and nearly 50 per cent of the horticulture officers visited the farm field at irregular time intervals.

Nearly 40 per cent of the sericulture and fisheries officers, 10 per cent of the animal husbandry officers and 45 per cent of the horticulture officers were involved in formation of farmer groups. It was further

noted that, only 5 per cent of the horticulture officers were involved in linking of farmers groups to financial institutes.

Knowledge level of officers of agri-allied departments of Karnataka about various extension approaches

The knowledge level of officers working in agri-allied departments has been studied with respect to different extension approaches and the results are presented below;

A. General Extension Approach: The approach is centralized and government-controlled. Success is measured in the adoption rate of recommendations and increase in national production. (Axinn, 1988).

Table 3. General Extension Approach followed by the agri-allied department officers in Karnataka

Sl	General extension approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (N=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Central and State level schemes being implemented by the respective departments	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	0 (0)	**60 (100)**	**0 (0)**
2	Knowledge about different schemes	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	0 (0)	**60 (100)**	**0 (0)**
3	Farmers adopt a new technology without subsidiary component	10 (100)	0 (0)	6 (60)	4 (40)	20 (100)	0 (0)	19 (95)	1 (5)	**55 (92)**	**5 (8)**
4	Farmers participate in implementation of the schemes without their participation in planning	8 (80)	2 (20)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	0 (0)	**58 (97)**	**2 (3)**

Sl	General extension approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (N=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
5	Beneficiary selection is a difficult task in the prevailing political situations in the villages	3 (30)	7 (70)	1 (10)	9 (90)	4 (20)	16 (80)	7 (35)	13 (65)	**15 (25)**	**45 (75)**
	Total average of agri -allied department (%)									**82.8**	**17.2**

*Figures in parenthesis indicate percentage to the total

It is clear from table 3, that cent per cent of all the four agri-allied department officers were implementing different central and state level schemes and had knowledge about schemes. Simillarly100 per cent of the sericulture and animal husbandry officers, 95 per cent of the horticulture and 60 per cent of the fisheries officers stated that farmers adopt a new technology without subsidiary component. Cent per cent of the fisheries, animal husbandry and horticulture officers and 80 per cent of the sericulture officers stated that farmers participate in implementation of the schemes without their participation in planning. As much as 90 per cent of the fisheries, 80 per cent of animal husbandry, 70 per cent of sericulture and 65 per cent of and horticulture officers stated that selection of beneficiaries was a difficult task in the prevailing political situation of the villages.As all the officers in the study area knew and were implementing different Government sponsored schemes related to the allied sector, it can be concluded that this approach was adopted by the allied sector departments.

B. Extension Reforms Approach: This approach based on ATMA model launched in May, 2005 in all the States/UTs, by the Department of Agriculture & Farmers Welfare, Ministry of Agriculture, Government of India, was a major intervention in addressing the constraints as observed in T &V and post T & V system by making the extension system farmer driven and farmer accountable through process and institutional reforms mechanism in the form of Agricultural Technology Management Agency (ATMA) at district level.

ATMA is a multi – agency platform designed for addressing all the shortcomings of agricultural extension including convergence of agriculture and allied sector services, gender equity, linking farmers to markets, bottom-up planning process, farmers' participation in planning and implementation, farming system based extension, public –private partnership, demand driven, strengthening Research-Extension-Farmer linkages and increasing the use of ICT etc.

Table 4. Extension Reforms Approach i.e. ATMA followed by the agri-allied department officers in Karnataka

Sl	Extension reforms approach	Sericulture officers(n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (N=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Awareness about ATMA	7 (70)	3 (30)	7 (70)	3 (30)	17 (85)	3 (15)	18 (90)	2 (10)	**49 (82)**	**11 (18)**
2	Key functions of ATMA	3 (30)	7 (70)	5 (50)	5 (50)	7 (35)	13 (65)	7 (35)	13 (65)	**22 (37)**	**38 (63)**
3	Attending ATMA meetings	3 (30)	7 (70)	6 (60)	4 (40)	7 (35)	13 (65)	4 (20)	16 (80)	**20 (33.3)**	**40 (67)**
3a	Other line department officers attend the ATMA meetings	3 (30)	7 (70)	6 (60)	4 (40)	7 (35)	13 (65)	4 (20)	16 (80)	**20 (33)**	**40 (67)**
3b	Convergence with other line departments helps in carrying out your own department works	3 (30)	7 (70)	6 (60)	4 (40)	1 (5)	19 (95)	7 (35)	13 (65)	**17 (28)**	**43 (78)**
3c	Involved in preparation of block action plan	2 (20)	8 (80)	2 (20)	8 (80)	0 (0)	20 (100)	1 (5)	19 (95)	**5 (8)**	**55 (92)**
3d.	Involved in preparation of district action plan	0 (0)	10 (100)	1 (10)	9(90)	1(5)	19 (95)	0(0)	20 (100)	**2 (3)**	**58 (97)**

Sl	Extension reforms approach	Sericulture officers(n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (N=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
3e	Prepared the action plan, by taking the Farmer's advice	1 (10)	9 (90)	3 (30)	7 (70)	1 (5)	19 (95)	1 (5)	19 (95)	**6 (10)**	**54 (90)**
3f	Refer the Strategic Research Extension Plan (SREP) prepared for the district to prepare the action plans	1 (10)	9 (90)	2 (20)	8 (80)	1 (5)	19 (95)	0 (0)	20 (100)	**4 (7)**	**56 (93)**
3g.	Feel extra burden working in ATMA or convergent mode	0 (0)	10 (100)	2 (20)	8 (80)	0 (0)	20 (100)	1 (5)	19 (95)	**3 (5)**	**57 (95)**
3h.	Get the funds as proposed in the BAP/DAP from ATMA	3 (30)	7 (70)	1 (10)	9 (90)	0 (0)	20 (100)	0 (0)	20 (100)	**4 (7)**	**56 (93)**
3i	Face problem in adjustment of the expenditure bills with BTT convener/ P.D. ATMA	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	Total average of agri-allied department (%)									**21**	**79**

*Figures in parenthesis indicate percentage to the total

From table 4, it is revealed that 30 per cent of the sericulture and fisheries officers, 15 per cent of animal husbandry officers and 10 per cent of horticulture officers were not aware of ATMA. As much as 70 per cent of the sericulture officers, 50 per cent of the fisheries, 65 per cent of both animal husbandry and horticulture officers had no knowledge about the key functions of ATMA.Around 70 per cent of the sericulture officers, 40 per cent of the fisheries, 65 per cent of the animal husbandry and 80 per cent of the horticulture officers had not attended ATMA meetings. Those who attended ATMA meetings stated that other line department officers also take part in the meetings.Only 20 per cent of the sericulture and fisheries officers and 5 per cent of the horticulture officers were involved in preparation of block action plan. Similarly, only 5 per cent of the animal husbandry and 10 per cent of the fisheries officers were involved in the preparation of district action plan.Around 20 per cent of the fisheries and only 5 per cent of the horticulture officers stated that there exists an extra burden working in convergent mode with 30 per cent of the sericulture and 10 per cent of the fisheries officers stating that they received less funds compared to the proposed and not even a single officer had faced problems in adjusting the expenditure bills. It can be concluded that not even half of the department staff knew about the functions of ATMA and only a few officers were involved in preparation of action plans. This approach mainly involves allocation of funds from the Government to the allied sectors to carry out trainings, exposure visits and other extension activities in allied sector. In the State of Karnataka, no fund was allotted to the allied sectors for the year 2014-2015 and no convergence meeting was conducted for the said year. Hence, this approach mainly works when separate fund was granted for the allied sector, therefore this particular approach was not fully adopted by the allied sector departments.

C. Farming Systems Approach (FSA): This approach is a holistic approach, complex in nature, with interrelated components, matrix of soils, plants, animals, power, implements, labour, capital and other inputs, influenced by political, economic, institutional and social forces. The approach requires the integration of extension activities across the different line departments.

Table 5. Farming systems approach (FSA) followed by the agri-allied department officers in Karnataka

Sl No	Farming systems approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (n=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Aware of Farming Systems Approach or Broad Based Extension	5 (50)	5 (50)	8 (80)	2 (20)	13 (65)	7 (35)	16 (80)	4 (20)	**42 (70)**	**18 (30)**
2	Key features of FSA	4 (40)	6 (60)	8 (80)	2 (20)	12 (60)	8 (40)	14 (70)	6 (30)	**38 (63)**	**22 (37)**
3	Recommended to the farmers to take combination of two/three enterprises	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
4	Work out the economic viability of the individual enterprises and total system	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
5	Recommended intensification or diversification of enterprises	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
6	Extension services are system based, converged with the other line departments	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
7	Recommended farming systems	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	Total average of agri-allied department (%)									**19**	**81**

*Figures in parenthesis indicate percentage to the total

Results from the above Table 5 indicate that 50 per cent of the sericulture, 20 per cent of the fisheries, 35 per cent of the animal husbandry and 20 per cent of the horticulture officers were not aware of farming systems approach.Around 60 per cent of the sericulture, 20 per cent of the fisheries, 40 per cent of the animal husbandry and 30 per cent of the horticulture officers had no knowledge about farming systems.Cent per cent of the allied department officers had not recommended the farmers to take up a combination of enterprises, had no idea of economic viability and had not recommended intensification or diversification of the enterprises.Cent per cent of all the department officers stated that extension services were not system based and not converged with the other line departments. Similarly, none of the officers recommended any farming systems to the farmers.It clearly indicates that though some of the officers knew about the FSA, they didn't recommend any farming systems. It indicates that the department staff were not adopting this approach.

D. Participatory Approach: This extension approach is designed to strengthen the delivery of more responsive and relevant services to farmers and rural communities. It is a process that fully engages farmers and communities in partnership with external extension service providers. The fundamental principle in participatory approaches is to listen and learn from farmers and to promote sustainable development based on the priorities of farmers as determined by them. It is a process that enhances community capacity to help them and to utilize their resources and those of external providers more effectively to improve their livelihood.

Table 6. Participatory approach followed by the agri-allied department officers in Karnataka

Sl No	Participatory approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (n=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Awareness about PRA	3 (30)	7 (70)	0 (0)	10 (100)	20 (100)	0 (0)	3 (15)	17 (85)	**26 (43)**	**34 (57)**
2	Knowledge about PRA tools	2 (20)	8 (80)	0 (0)	10 (100)	20 (100)	0 (0)	3 (15)	17 (85)	**25 (42)**	**35 (58)**
3	Use of participatory tools	0 (0)	10 (100)	0 (0)	10 (100)	20 (100)	0 (0)	0 (0)	20 (100)	**20 (33)**	**40 (67)**
4	Participatory tools useful for micro level planning	0 (0)	10 (100)	0 (0)	10 (100)	20 (100)	0 (0)	2 (10)	18 (90)	**22 (37)**	**38 (63)**

Sl No	Participatory approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (n=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
5	Conducted focused group discussion with the farmers	2 (20)	8 (80)	0 (0)	10 (100)	2 (10)	18 (90)	2 (10)	18 (90)	**6 (10)**	**54 (90)**
6	Merit in use of PRA tools	1 (10)	9 (90)	0 (0)	10 (100)	20 (100)	0 (0)	2 (10)	18 (90)	**23 (38)**	**37 (61)**
7	Awareness about Village map	5 (50)	5 (50)	2 (20)	8 (80)	20 (100)	0 (0)	6 (30)	14 (70)	**33 (55)**	**27 (45)**
8	Awareness about social map	3 (30)	7 (70)	0 (0)	10 (100)	7 (35)	13 (65)	2 (10)	18 (90)	**12 (20)**	**48 (80)**
9	Awareness about resource map	4 (40)	6 (60)	2 (20)	8 (80)	11 (55)	9 (45)	5 (25)	15 (75)	**22 (37)**	**38 (63)**
10	Involved in the preparation of above maps	0 (0)	10 (100)	0 (0)	10 (100)	20 (100)	0 (0)	0 (0)	20 (100)	**20 (33)**	**40 (67)**
11	Awareness about Transect Walk	0 (0)	10 (100)	1 (10)	9 (90)	17 (85)	3 (15)	2 (10)	18 (90)	**20 (33)**	**40 (67)**
12	Performed Transect walk	0 (0)	10 (100)	0 (0)	10 (100)	16 (20)	4 (20)	0 (0)	20 (100)	**16 (27)**	**44 (73)**
13	Awareness about Seasonality ranking	0 (0)	10 (100)	0 (0)	10 (100)	2 (10)	18 (90)	0 (0)	20 (100)	**2 (3)**	**58 (97)**
14	Awareness about Matrix ranking	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**

Sl No	Participatory approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (n=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
15	Awareness about Venn diagram	0 (0)	10 (100)	0 (0)	10 (100)	1 (5)	19 (95)	0 (0)	20 (100)	**1 (2)**	**59 (98)**
16	Developed a village plan based on participatory tools	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	Total average of agri-allied department (%)									**25.8**	**74.2**

*Figures in parenthesis indicate percentage to the total

Cent per cent of the fisheries officers, 70 per cent of sericulture and 85 per cent of horticulture officers were not aware of PRA technique. Similarly, cent per cent of the fisheries, 80 per cent of sericulture and 85 per cent of horticulture officers had no knowledge of PRA techniques. Around 20 per cent of sericulture officers, 10 per cent of both animal husbandry and horticulture officers were involved in conducting focused group discussion.Around 50 per cent of the sericulture, 80 per cent of the fisheries and 70 per cent of the horticulture officers were not aware of village map. Though few of the officers in the department of sericulture, fisheries and horticulture were aware of social and resource maps, they were not involved in the preparation of the above maps.It is clear from the above table that cent per cent of the animal husbandry officers were involved in the preparation of village maps. This is because of the fact that the State Government of Animal Husbandry has notified in the official memorandum that the veterinary officers working at the village level must and should prepare village maps in order to better tackle the vaccination of livestock, thereby veterinary officers were involved in the preparation of these maps. Using these maps the department is planning to prepare village plans in the near future.From the above table it is clear that the allied department officers were not adopting PRA approach. Though the officers in animal husbandry knew about PRA techniques and its usage they are yet to prepare village plans.

E. ICT Approach: This extension approach encourages the use of Information and Communication Technology in extension services.(Axinn, 1988).

Table 7. ICT approach followed by the agri-allied department officers in Karnataka

Sl No	Extension approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (n=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Awareness about ICT tools	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	0 (0)	**60 (100)**	**0 (0)**
2	ICT tools used:										
	a. Telephonic/ mobile calls	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	0 (0)	**60 (100)**	**0 (0)**
	b. Mobile messages	0 (0)	10 (100)	10 (100)	0 (0)	0 (0)	20 (100)	0 (0)	20 (100)	**10 (17)**	**50 (83)**
	c. Internet (Email)/use of tablets	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	4 (20)	16 (80)	**4 (7)**	**56 (93)**
	d. Video calling	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	e. Radio	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	f. Television shows	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	g. Kisan call center	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	h. Community Radio										
	a. Awareness about community radio	1 (10)	9 (90)	3 (30)	7 (70)	4 (20)	16 (80)	6 (30)	14 (70)	**14 (23)**	**46 (77)**
	b. Participated in community radio talk shows	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	Total average of agri-allied department (%)									**23**	**50**

*Figures in parenthesis indicate percentage to the total

Results from the above Table 7 revealed that all the four allied department officers were aware of ICT tools and used telephone calls to contact the farmers. Cent per cent of the animal husbandry officers used telephonic calls on a daily basis. Around 50 per cent of horticulture officers used telephone calls on a weekly basis, 40 per cent of the fisheries officers used it at irregular intervals and sericulture officers used it on weekly (30 %) and fortnightly (30 %) basis.As much as 90 per cent of the sericulture officers, 80 per cent of animal husbandry, 70 per cent of the horticulture and fisheries officers were not aware of community radio and none of the officers from the above four departments had participated in community radio talks.Except telephone calls none of the officers used any other mode of ICT viz., mobile message service (except fisheries department, wherein the State Government of Karnataka provides mobile based advisory services to the registered fisherman regarding new schemes in fish farming and fish related activities), use of internet/tablets (only 20 per cent of horticulture officers use tablets to diagnose the pest infestation and provide suitable solutions using the power of internet. This initiative of providing tablets to the horticulture officers was undertaken recently by the Karnataka State department of horticulture on a trial basis) in horticulture crops etc. Hence, more importance must be given to usage of these tools by the officers as these tools will not only ensure timely availability of information to the farmers but also provide quality messages to the end users.It can be concluded that the usage of ICT tools is restricted to mobile calls only, therefore the department staff should be provided with necessary ICT knowledge along with the technology components.

F. Commodity Specialized Approach: This approach tends to focus on one export crop, such as coffee, sugar, tobacco, cotton, or rubber.The commodity specialized approach groups all the functions for increased production, such as extension services, research, input supply, marketing and prices - under one administration. Extension is fairly centralized and is oriented towards one commodity or crop and the agent has many functions.(Axinn,1988).

It is revealed from Table 8 that cent per cent of the animal husbandry officers, 95 per cent of the horticulture officers, 90 per cent of the fisheries officers and 80 per cent of the sericulture officers were not aware of the commodity approach as well as they had no knowledge of commodity approach.All officers of the four departments stated that there was no commodity based departmental programme and that they had not linked any commodity groups to markets. Hence, it can be concluded that this approach was not adopted by the allied sector departments in the state of Karnataka.

Table 8. Commodity Specialized Approach followed by the agri-allied department officers in Karnataka

Sl No.	Commodity approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry Officers (n=20)		Horticulture officers (n=20)		Total (n=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Awareness about commodity approach	2 (20)	8 (80)	1 (10)	9 (90)	0 (0)	20 (100)	1 (5)	19 (95)	**4 (7)**	**56 (93)**
2	Knowledge about commodity approach	2 (20)	8 (80)	1 (10)	9 (90)	0 (0)	20 (100)	1 (5)	19 (95)	**4 (7)**	**56 (93)**
3	Commodity based programmes	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
4	Link of commodity groups to markets	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	Total average of agri-allied department (%)									**3**	**97**

*Figures in parenthesis indicate percentage to the total

G. Project Approach: This approach assumes that the large government bureaucracy featured in some other approaches is not likely to have a significant impact upon either agricultural production or rural people, and that better results can be achieved in a particular location, during a specified time period, with large infusions of outside resources. The approach focuses on concentrated efforts on a particular location, for a specific time period, often with outside resources and sustained after the project period. Change in the short term is often a measure of success. (Axinn,1988).

Results from Table 9 revealed that cent per cent of the fisheries, animal husbandry and horticulture officers were not aware of the project approach and had no knowledge about it, whereas in case of sericulture it was 80 per cent. Not even a single officer in the study area had undertaken project approach in the allied sector. Hence, it can be concluded that this approach was not adopted by the allied sector department in the state of Karnataka.

Table 9.Project approach followed by the agri-allied department officers in Karnataka

Sl No.	Project approach	Sericulture officers (n=10)		Fisheries officers (n=10)		Animal Husbandry officers (n=20)		Horticulture officers (n=20)		Total (n=60)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Awareness about project approach	2 (20)	8 (80)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**2 (3)**	**58 (97)**
2	Knowledge about project approach	2 (20)	8 (80)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**2 (3)**	**58 (97)**
3	Undertaken project approach	0 (0)	10 (100)	0 (0)	10 (100)	0 (0)	20 (100)	0 (0)	20 (100)	**0 (0)**	**60 (100)**
	Total average of agri-allied department (%)									**2**	**98**

*Figures in parenthesis indicate percentage to the total

Conclusion

The extension approaches followed by different extension departments have resulted into wider spread of modern technologies and increase in agricultural production, but with time, rate of agricultural production has slowed down due to several reasons. Moreover, there is increasing inability of line departments in carrying out extension activities (Sulaiman and Van den Ban, 2003). The present study was conducted to explore extension approaches adopted by the agri-allied sector departments of Karnataka State. The study focused on the General Extension Approach, Extension Reforms Approach, Farming System Approach, Participatory Approach, Commodity Specialised Approach and Project Approach. It was observed that, except General Extension Approach all other extension approaches are almost unknown to the officers of agri-allied sector in Karnataka. General Extension Approach is being used by the agri-allied department since its establishment in order to stimulate development of sectors and this particular approach is the most popular extension approach because it involves subsidy to the beneficiary under various central and state level schemes. It can be concluded from the present research that, to promote adoption of other approaches among the officers of agri-allied departments - recruitment of the officers having specialization in the relevant subject i.e. post-graduation, capacity building through induction training and refresher training program on extension management aspects and a well-defined job chart inclusive of frequent field visits is the need of the hour for development of agri-allied sector in Karnataka.

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