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Study on socio economic profile, economic potential of paddy seed, potentiality of selected verities and constraints for adaptation of high-end quality rice in Siddharth Nagar district of Uttar Pradesh

Shailendra Pratap Singh, Dr. Ameesh J Stephen, Dr. Ashish S Noel and Paras Nath Jhariya

Abstract
The Siddharthnagar district is divided into 5 tehsils and 14 blocks, where for Kalanamak production and constraints study the blocks were purposively selected whereas for estimation of seed replacement rate and for other objective estimations, the blocks were randomly selected. Barhni, Itwa, Shohratgarh, and Dumariyaganj, these four blocks are taken for further study about paddy seed distribution, utility and assessment of seed replacement rate for last 20 years. The primary data were certainly collected from the seed growers, distributers and farmers. The socio-economic details and various aspect of production and marketing of paddy seed were collected through various personal interview sessions with the help of pre-structured interview schedule. The secondary data were derived from state seed development and distribution bodies, Siddharthnagar Kirshi Bhawan, Vikas Bhawan (Naugadh) Sidharthnagar, from state economic survey 2019 and seed dacnet sites along with various e-sources. The percentage distribution to various variety grower and paddy growers at various sectors were selected block and villages in Siddharthnagar. Cluster analysis done to integrate the seed utilizing community according to their primary and secondary income and their educational as well occupational segregation. Trend analysis with indexing number assignments for measuring the difference of magnitude of a group of related variables with different units estimated. The sequence of related business deals (activates) from special input for specific product to primary production, grading, marketing certification etc, to final selling till consumers. The first cluster is of semi medium and medium farmers where the cluster contained (45) 65.2 percent of semi-medium of the total cluster population of (69) 100 percent farmers, in this group all farmers were following IFS as their occupation. Cluster 2 had mostly the medium farmers which counted to 48.9 percent out of those 74.5 percent (47) had occupational follow up of IFS+business firm. The third cluster formed had a total of 38 members in which most of them were small farm holders, having 76 percent of their population following only IFS as their occupation. income from secondary sources for cluster 1 were less than mean i.e., ₹ 25,753.62 out of the mean value of ₹30266.45, cluster 2 had mean secondary income of ₹ 65,328.98 and the cluster 3 had a mean income from secondary sources of ₹16684.21. The mean agricultural income was ₹ 34,958.09, where the cluster 1 had incremented income of ₹35942.03, cluster 2 had much higher income than mean income which was accounted as ₹50723.40 and lastly the cluster 3 had a mean income from primary sources of ₹17,642.11.

Keywords: Paddy, cluster analysis, trend analysis, KMO Barlett test, cuddy Della Valle instability index

Introduction
The seed industry in India has undergone significant changes during the last decade. Many of these changes were either induced by policies or were necessitated by changing technological considerations. This research work begins with an outline of the technological characteristics of existing seed profiles of the area and seed production and processing activities. This is supplemented by a brief description of the recent changes in seed policy and in the structure of the seed industry.

Seed being the fundamental input in crop production; its high-quality forms the basis of high productivity. Although seed accounts for a minor portion of the total costs in a majority of crops, on this vital input depends the returns one obtains from land using other costly inputs like farm machinery, irrigation, chemical fertilizers, pesticides, labour, etc. Much of the efforts and investment would be anfractuous if one does not use quality seeds. The quality seed production is a specialized activity. The general farm produce retained for seed cannot be substituted for quality seed as it generally lacks genetic vigor and has poor germination.

These characteristics are relevant for our purposes in so far as these may influence the participation of the private sector (and of different sized firms within the sector) in the production and processing of seeds. These activities can be broadly grouped into three categories: (a) varietal development; (b) seed production; and (c) seed processing. Varietal development includes germplasm collection, its manipulation for applied plant breeding and varietal testing. This activity culminates in the production and release of breeder seed which is the basic input for the subsequent seed multiplication process. Breeder seed, therefore, is the seed of a newly developed variety that is produced under the supervision of the plant breeder or the owner of the variety. Seed production or multiplication involves the production of foundation and commercial seeds. Foundation (or basic) seed is the progeny of the breeder seed and it consists of the generations of seed between breeder and commercial seed. Commercial seed, which is sometimes called the certified seed, is the seed that is produced to be sold to farmers. Seed processing involves drying, shelling, sizing, removal of inert material and alien seed, and various types of treatment (e.g., fumigation or chemical dressing) to protect seed health and combat against fungi, viruses, and

Research methodology

Study was conducted conveniently in Siddharthnagar district, it borders with Nepal and is well known tourist place and holds GI tag for Kalanamak variety of paddy being tarai district have very intensive cereal production belt. Districts in Eastern Uttar Pradesh, India have been considered for identifying major yield determinants in rice. Adoption of traditional varieties is higher in Siddharthnagar. Therefore, any development of rice varieties suitable for these fragile ecologies will make a positive impact on the millions of poor people in eastern Uttar Pradesh thus the area is chosen at priority list.

The Siddharthnagar district is divided into 5 tehsils and 14 blocks, where for Kalanamak production and constraints study the blocks were purposively selected whereas for estimation of seed replacement rate and for other objective estimations, the blocks were randomly selected.

a) Trend analysis with indexing number assignments for measuring the difference of magnitude of a group of related variables with different units.

$I_t = (V_t/V_0)* 100$

Here,

I_t = Index Number for the Time T

V_t = Value of Current Year Variable.

V_0 = Value of Base Year Variable.

b) Forecasting models

1. **ARIMA model (0,0,0):** autoregressive, integrated and moving average model implied on the time series data of production, are and productivity of paddy at state, district level and on block level only production taken under consideration. As errors were found to be uncorrelated to the changing time, this is a non seasonal ARIMA forecast and this was formulated as:

$$y't=c+\phi 1y't-1+\cdots+\phi py't-p+\theta 1\varepsilon t-1+\cdots+\theta q\varepsilon t-q+\varepsilon t,$$

It is called ARIMA (p,d,q) model where

y′t is series that has differenced more than once (response variable at time t)

c is constant

ϕ1y′t−1+⋯+ϕpy′t is auto-regressive portion

θ1εt−1+⋯+θqεt−q are a moving average portion.

2. **Brown model:** Double Exponential Smoothing (Brown) Method:

This method is commonly used for data containing linear trend. This method is often called also a one parameter linear method from Brown. The formula is used in this method are:

Sn" = αSn' + (1-α) Sn-1

as there was a trend pattern that has to be evaluated and found that the data were non-stationary and no seasonality was found, a double exponential smoothing formula were inherited in the documentation with little data. Using MSE (Mean Square Error) and MAPE (Mean Absolute Percentage Errors are estimates and compared for smaller error in both ARIMA and Browns model methods.

3. **Holt model:** A time series with trend has to be dealt with Holt linear trend smoothing equations where three separate equations work simultaneously. In first equation the last smoothed value for last period's trend undergo smoothing and adjustments. In second equation trend formulated as the difference between last two smoothened values of the time series data and the third equation used to produce final forecasting values.

Forecast equation$\hat{}yt+h|t=\ell t+hbt$

Level equation$\ell t=\alpha yt+(1-\alpha)(\ell t-1+bt-1)$

Trend equation$bt=\beta*(\ell t-\ell t-1)+(1-\beta*)bt-1$

Where

ℓtℓt = an estimate of the level of the series at time tt,

btbt = an estimate of the trend of the series at time tt,

αα = the smoothing coefficient

c) Cuddy Della Valle Instability index

Cuddy-Della Valle index was used to estimate the Siddharthnagar district level instability in total area, production and productivity in paddy.

$V_I = CV (1-R2) 0.5$

OR

$V_I = CV*\sqrt{1-AdR^2}$

Where

V_I = Instability index (per cent)

CV = Coefficient of variation (per cent)

R2 = Coefficient of determination from a time trend regression adjusted by the number of degrees of freedom.

AdR = adjusted R squared

Particular State	Value of instability
Low Instability	0-15
Medium Instability	15-30
High Instability	>30

d) Decomposition analysis: To estimate the relative

contribution of area, yield, and their interactive relationship with the production the technique of decomposition analysis is applied, component analysis methods which was formulated to serve the purpose to study relative contributive relationship between various attributes was estimated and were used in this thesis. The output growth was figured out by the change in output of current year over base period which were taken as an average of three consecutive years.

Let P_0 and P_n be the production in the base year and nth year respectively,
They are given by,

$P_0 = A_0 \times Y_0$ and $P_n = A_n \times Y_n$

Where, A_0 and A_n represent the area
Y_0 and Y_n represent the yield in the base year and nth year respectively

$P_n\text{-}P_0 = ÄP$, $A_n\text{-}A_0 = ÄA$, $Y_n - Y_0 = ÄY$

From the above equations we can write,

$ÄP = A_o\, ÄY + Y_n\, ÄA + ÄAÄY$

i.e., Production= Yield Effect + Area Effect + Interaction Effect
Thus, the total change in production can be decomposed in to three effects, *viz*., yield effect, area effect and the interaction effect due to the change in yield and area.

Result and Discussion
Study was conducted conveniently in Siddharthnagar district, it borders with Nepal and is well known tourist place and holds GI tag for Kalanamak variety of paddy being tarai district have very intensive cereal production belt. Districts in Eastern Uttar Pradesh, India have been considered for identifying major yield determinants in rice. The chapter is arranged in different sub-section according to objectives of the study.

- Socio-economic profiling of the paddy growers in the selected blocks.
- Intensive assessment of various potentially economic paddy seed profile existing amongst the different paddy growers.
- Explore potentiality of the selected varieties in the study area and extract constraints for adoption of this high-end quality rice.

Socio-Economic Features of Sample Households

Table 1: Tabulation for farmers' distribution in the selected area based on their land holding

	Large	Marginal	Medium	Semi medium	Small	Grand Total
Count of count number	10	15	48	59	24	156
Percentage	6.41	9.62	30.77	37.82	15.38	100.00

The sample of 156 farmers were taken out of 4 blocks of the district of Sidharth nagar of Uttar Pradesh, here the national average of the farming community followed different distribution, where the marginal farmer community were found to be prominent but, in this study, the marginal farmers were found to be 9.62 percent of the total farming community which has less than 1 hectare land holding, followed by 6.41 percent of large farming community holding more than 10 hectares of land. Maximum farmers had landholding between 2 and 4 hectares, followed 37.82 percentage of the total community, the next were medium farmers having 30.77 percent out of the total community and had landholding of more than 4 hectares ad less than 10 hectares. Lastly small farming community had been accounted to be 15.38 percent out of the total farming community.

Table 2: Tabulation of types of holding and educational qualification in between different groups of farmers

Particulars		Types of land holding * education Cross-tabulation					
		Education					Total
		Graduate	Intermediate	Matric	Non-matric	Others	
Types of land holding	Marginal	0(0.00)	0(0.00)	0(0.00)	3(1.92)	11(7.05)	14(8.97)
	Small	1(0.64)	6(3.85)	7(4.49)	10(6.41)	0(0.00)	24(15.38)
	Medium	2(1.28)	5(3.21)	16(10.26)	23(14.74)	3(1.92)	49(31.41)
	Semi-medium	1(0.64)	15(9.62)	24(15.38)	19(12.18)	0(0.00)	59(37.82)
	Large	1(0.64)	1(0.64)	2(1.28)	6(3.85)	0(0.00)	10(6.41)
Total		5(3.21)	27(17.31)	49(31.41)	61(39.10)	14(8.97)	156(100.00)

The table 2 stated the educational qualifications amongst the farming community was found to be distributed: as only 3.21 percent of the sample were found to be graduate, which was maximum amongst medium farmers, 17.31 percent were found to be educated till intermediate and was found mostly amongst semi-medium farming community. Matric education was found to be done by 31.41 percent of the farming community and semi-medium group was found to have highest count for matric educated whereas most of the farming community was found to be least educated that 39.10 percent were under matric educated, 8.97 percent had been absolutely illiterate which was counted in others.

Table 3: Tabulation for types of farmers/landholdings and their age group distribution

Types of land holding * age group Cross tabulation							
Count							
		Age group					Total
		<25	26-35	36-45	46-55	>55	
Types of land holding	Marginal	1 (0.64)	6 (3.85)	3 (1.92)	4 (2.56)	1 (0.64)	15(9.62)
	Small	2 (1.28)	5 (3.21)	8 (5.13)	5 (3.21)	4 (2.56)	24(15.38)
	Medium	0 (0.00)	3 (1.92)	20 (12.82)	17 (10.9)	8 (5.13)	48(30.77)
	Semi medium	1 (0.64)	16 (10.2)	26 (16.67)	9 (5.77)	7 (4.49)	59(37.82)
	Large	0 (0.00)	1 (0.64)	2 (1.28)	3 (1.92)	4 (2.56)	10(6.41)
Total		4 (2.56)	31 (19.9)	59 (37.82)	38 (24.7)	24 (15.4)	156(100.00)

the table 3 states the average age of the farming community in selected area were found to have that below 25 years of age were found to be 2.56 percent, the millennial i.e. age group between 26-35 were found to be 19.87 percent and the age group between 36-45 were found to be in majority as the composition was found to be 37.82 percent of whole community, 24.36 percent of the farmers were found to fall in age bracket of 46 to 55 and the above 55 were found to be 15.38 percent.

Table 4: Tabulation for types of farmers/landholdings and their market distances from farm

Types of land holding * market distance Cross tabulation					
Count					
		Market-distance			Total
		<5km	5-10km	>10km	
Types of land holding	Marginal	2(1.29)	6(3.87)	6(3.87)	14(9.03)
	Small	1(0.65)	7(4.52)	16(10.32)	24(15.48)
	Medium	8(5.16)	19(12.26)	21(13.55)	48(30.97)
	Semi medium	5(3.23)	23(14.84)	31(20.00)	59(38.06)
	Large	1(0.65)	2(1.29)	7(4.52)	10(6.45)
Total		17(10.97)	57(36.77)	81(52.26)	155(100.00)

Table 4 interprets the average market distance which changes the profit margin amongst the different community, 10.97 percent of the community were near the marketing spot which was found to be <5 km, 36.77 percent of the farmers were found to reside between 5 to 10 km distance from market and rest 52.26 percent of the farming community were found to reside far away from the market spot which was found to be more than 10 km, this hindered with their accession of the inputs and well selling point and conveyance availability.

Table 5: tabulation for types of land holding and primary income of respective households

Types of land holding *primary_income Cross-tabulation						
		<20000	20-40000	40-80000	>80000	
Types of land holding	Marginal	14(9.03)	0(0.00)	0(0.00)	0(0.00)	14(9.03)
	Small	11(7.10)	13(8.39)	0(0.00)	0(0.00)	24(15.48)
	Medium	9(5.81)	18(11.61)	11(7.10)	10(6.45)	48(30.97)
	Semi medium	4(2.58)	33(21.29)	16(10.32)	6(3.87)	59(38.06)
	Large	0(0.00)	3(1.94)	2(1.29)	5(3.23)	10(6.45)
Total		38(24.52)	67(43.23)	29(18.71)	21(13.55)	155(100.00)

The table 5 is a cross tabulation for different types of farming community based on their land holding and their primary income from their agricultural and allied sources, 24.52 percent of the farming community had been earning less than ₹ 20,000, 43.23 percent of the farming population was striving on income between ₹20,000 to ₹40,000. 18.71 percent of the farming population fell under ₹ 40,000 to ₹ 80,000 and the last group which was in > ₹ 80,000 income section was 13.55 percent of the whole sample selected.

Table 6: Tabulation for different farmers/land holding and secondary income sources from respective household

Types of land holding * Secondary_income_source Cross-tabulation							
		Secondary_Income_Source					Total
		<20000	20-40000	40-60000	60-80000	>80000	
Types of land holding	Marginal	14(9.55)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	14(9.55)
	Small	15(9.55)	6(3.82)	3(1.91)	0(0.00)	0(0.00)	24(15.29)
	Medium	6(3.82)	19(12.10)	11(7.01)	6(3.82)	7(4.46)	49(31.21)
	Semi medium	19(12.10)	32(20.38)	4(2.55)	2(1.27)	2(1.27)	59(37.58)
	Large	0(0.00)	2(1.27)	3(1.91)	2(1.27)	3(1.91)	10(6.37)
Total		54(35.03)	59(37.58)	21(13.38)	10(6.37)	12(7.64)	156(100.00)

Table 6 explains different farming section and their income resources from secondary or tertiary sectors which might be business or services, 35.03 percent of the farming community has < ₹20000 income from sources other than agriculture, and next 37.58 percent of the farming community had fallen in ₹ 20000 to ₹ 40000 groups. Rest of 6.37 percent and 7.64 percent had clustered into group of ₹ 60-80000 and > ₹ 80000 secondary income group. These segregations helped onto selecting the proper section of the farming community where they can be targeted with better campaigning to increase the utility and penetration of researched or hybrid seeds. As expected all the marginal farmers fell on group of least earning and fall into in-economies to scale, maximum farmers *viz*. 20.38 percent were under semi-medium scoring under 20-40000 group.

Table 7: Tabulation for the types of land holding and occupational segregation amongst various group of the farming community

Types of land holding *occupation segregation Cross-tabulation					
		Occupation segregation			Total
		IFS	IFS+ business	IFS+ service	
Types of land holding	Marginal	12(7.69)	2(1.28)	0(0.00)	14(8.97)
	Small	19(12.18)	2(1.28)	3(1.92)	24(15.38)
	Medium	25(16.03)	17(10.90)	7(4.49)	49(31.41)
	Semi medium	45(28.85)	11(7.05)	3(1.92)	59(37.82)
	Large	1(0.64)	7(4.49)	2(1.28)	10(6.41)
Total		102(65.38)	39(25.00)	15(9.62)	156(100.00)

Table 7 explains the occupational segregation and respective farming community, here the occupation differentiation based on their IFS (Integrated Farming System)/ Ifs plus business ventures other than agricultural and allied business/ IFS plus any service (private/public), here 65.38 percent that majority of the farming community is dependent only on agricultural system for employment, but here it can be accessed that the semi-medium were involved up to 28.85 percent of the total agricultural dependency in the selected area. IFS plus business is done by 25.00 percent of the selected sample, the rest 9.62 percent fall under IFS plus service group.

Table 8: Tabulation for cluster development of the selected sample and their sequestration in probably most homogenous blocks

Cluster Distribution				
		N	% of Combined	% of Total
Cluster	1	38	24.7%	24.4%
	2	47	30.5%	30.1%
	3	69	44.8%	44.2%
	Combined	154	100.0%	98.7%
Excluded Cases		2		1.3%
Total		156		100.0%

Two categorical variables/inputs which are land holding types and occupational segregation, and three continuous variables/inputs which ae value of researched seeds, primary income from agriculture and secondary income from other sources were included for assessments of cluster and three different types of clusters were developed. The continuous variables/inputs had been assumed to follow normal distribution; the desirable features are differentiated under clustering techniques. The developed clusters were compared by Schwarzs' Bayesian Criterion (BIC) under clustering criterion.

The silhouette measure of cohesion and separation details about the quality of cluster obtained by two step cluster analysis, where when the cluster cohesion must fall between 0-0.5 and the cluster is found to be fair and considerable. The clusters can be seen fairly cohesive within and separated from other clusters in this two step cluster analysis, with a total of 5 inputs there were 3 clusters formulated.

Table 9: Auto-clustering of the three distinctive groups out of five selected variable

Auto-Clustering				
Number of Clusters	Schwarz's Bayesian Criterion (BIC)	BIC Change[a]	Ratio of BIC Changes[b]	Ratio of Distance Measures[c]
1	1090.734			
2	873.058	-217.676	1.000	1.331
3	725.828	-147.230	.676	2.293
4	698.540	-27.288	.125	1.464
5	700.636	2.096	-.010	1.024
6	704.203	3.568	-.016	1.346
7	708.679	4.494	-.090	1.140
8	748.855	40.158	-.116	1.439
9	786.310	37.456	-.172	1.812
10	836.323	50.012	-.230	1.055
11	887.136	50.813	-.233	1.027
12	938.338	51.202	-.235	1.027
13	989.911	51.573	-.237	1.280
14	1044.531	54.620	-.251	1.216

15	1101.079	56.548	-.260	1.002
a. The changes are from the previous number of clusters in the table.				
b. The ratios of changes are relative to the change for the two cluster solution.				
c. The ratios of distance measures are based on the current number of clusters against the previous number of clusters.				

The least BIC valued cluster is supposed to be more stable and homogenous, cluster with BIC 698.540 which is the third cluster had majorly the smaller landholders but the other clusters with 725.828 and 873.058 BIC count had more of heterogeneous grouping (comparatively) which might hinder in better marketing positioning of hybrid/researched seed distribution campaigning. The most negative BIC changes were selected as most stable group in the cluster segregations. The tendency of BIC change penalized the complexity of the model where complexity refers to the number of parameters in the model. cluster 5 has BIC change 2.096, cluster 6 and cluster 7 has most appropriate ranking as the BIC change in these clusters were found to be 3.568 and 4.494 respectively and according to Beyasian Information Criterion table the most appropriate range falls between 2 to 6 to fit the model following only IFS as their occupation. income from secondary sources for cluster 1 were less than mean i.e. ₹ 25,753.62 out of the mean value of ₹30266.45, cluster 2 had mean secondary income of ₹ 65,328.98 and the cluster 3 had a mean income from secondary sources of ₹16684.21. The mean agricultural income were ₹ 34,958.09, where the cluster 1 had incremented income of ₹35942.03, cluster 2 had much higher income than mean income which was accounted as ₹50723.40 and lastly the cluster 3 had a mean income from primary sources of ₹17,642.11.

Objective 2: Estimations of area, production and productivity of paddy at state and district level.

Table 10: Model description of the factors i.e. area production and productivity of paddy in Uttar Pradesh state

Model Description			
			Model Type
Model ID	Paddt_area	Model_1	ARIMA(0,0,0)
	Rice production in Uttar Pradesh	Model_2	Brown
	Paddy_Productivity	Model_3	Brown

Table 10 included the models suggested under expert modeler in SPSS, where the paddy area had allotted ARIMA (0, 0, 0) model whereas the other two variables which were production of paddy and productivity had taken up the brown model (double exponential smoothing model) for future forecasts in Uttar Pradesh. The double exponential smoothing model is useful for the patterns showing linear trend in the data set during time series analysis (Noreha Mohamed Yusofa, 2020). The ARIMA (0, 0,0) model is used where zero order of Auto-correlation, Integration and Moving average and there are no use of constant since no p,d,q are specified.

Table 11: Descriptive statistics for the factors i.e. area, production and productivity of paddy in Uttar Pradesh state

Particulars	Area (Hectare)	Production (Qt)	Yield (qt/ha)
Mean	5801238	126440597.3	21.81818
Standard Error	51143.56	3496996.635	0.5191
Median	5885068	124554880	21.35
Standard Deviation	239884.6	16402368.13	2.434795
Sample Variance	5.75E+10	2.69038E+14	5.928225
Kurtosis	2.72471	-0.476911689	-0.36564
Skewness	-1.66522	0.281024906	0.499101
Range	931776	63454940	8.9
Minimum	5148046	95869350	18.1
Maximum	6079822	159324290	27
Sum	1.28E+08	2781693140	480
Count	22	22	22
Jarque-bera	0.169729	0.498066021	1.035926
p value	0.000206	0.077955424	0.0595733

The table 11 explain the descriptive statistics of the area in hectares, production in Quintals and productivity in Qt/ ha where the mean for the three variables are 5801238 ha, 126440597.3 Qt and 21.81Qt/ha respectively. As the sample value is small (between 20-30) the Jarque-bera estimates fall for Markov simulation table for smaller values were conducted and found that values congregate to the p value for area being 0.000206, for production 0.0779 and productivity it was 0.059. Skewness for area showed that the average is skewed to left in normal distribution curve, but other two variables which were found skewed to right and less than 0.05 whereas the kurtosis is less than 3 which meant most of them are platykurtic in shape and the distribution of the data is flatter tailed on normal distribution curve.

Table 12: summary for model fit of the factors i.e. area, production and productivity of paddy in Uttar Pradesh state

Fit Statistic	Mean	SE	Minimum	Maximum
Stationary R-squared	.508	.440	8.460E-14	.763
R-squared	.280	.253	8.460E-14	.491
RMSE	4487250.209	7565348.547	1.737	13221864.316
MAPE	6.265	2.926	3.085	8.843
Max APE	19.295	9.597	12.688	30.304
MAE	3739385.90	6326948.46	1.484	11044428.145
Max AE	9901709.60	16587796.22	3.172	29051933.972
Normalized BIC	19.69	16.47	1.245	32.935

In this fit statistics table the stationary r square for all values are positive that estimated that the model under consideration is better than the baseline model on prediction base. The estimates of the total variance of the series are being predicted by the r squared in this model. The estimated value ranges from negative infinite to one. Here all the values are positive which indicated a better fitted model for forecast estimation. the mean absolute percentage error was estimated in order to predict the variation in dependent series, here < 7 percent error in prediction were calculated in the mean and the percentage in standard error were calculated to be 2.92, thus this being one of the most fitted model running for least BIC value normalized for mean being 19.69 and for standard error it had been estimated to be 16.47 in the forecast. Here the MAPE are <= 15 i.e. for mean and standard error the MAPE had been estimated to be 6.265 and 2.926 respectively, the predicting models were very good at had better accuracy for forecasting the area, production and productivity of paddy in Uttar Pradesh state.

Table 13: Model statistics for the factors i.e. area production and productivity of paddy in Uttar Pradesh state

Model Statistics						
Model	Number of Predictors	Model Fit statistics		Ljung-Box Q(18)		
		Stationary R-squared	R-squared	Statistics	DF	Sig.
Paddy_area-Model_1	0	8.460E-14	8.460E-14	10.290	18	.922
Paddy production in Uttar Pradesh -Model_2	0	.763	.650	7.864	17	.969
Paddy_productivity-Model_3	0	.761	.691	11.728	17	.816

In the table 13 the Ljung-Box Q statistics test that had been performed on SPSS 25 expert modeler exempted the assessments that the model is statistically different from zero as the p value for area was 0.922, for production the p value was 0.969 and for productivity the p value was estimated to be 0.816. here the R squatted for paddy area was near to zero 8.460E-14 thus the model for prediction might not give a better fit but for production and productivity the R squared had been >0.5 i.e. .763 and .761 that meant tending towards 1, thus this would be a better fit for prediction.

Table 14: Forecasting the factors i.e. area production and productivity of paddy in Uttar Pradesh state under different models

Forecast						
Model		2020	2021	2022	2023	2024
paddy_area-Model_1	Forecast	5801238	5801238	5801238	5801238	5801238
	UCL	6300105	6300105	6300105	6300105	6300105
	LCL	5302370	5302370	5302370	5302370	5302370
Paddy production-Model_2	Forecast	154897784	157668141	160438498	163208855	165979212
	UCL	182394156	187527919	192955887	198654746	204602215
	LCL	127401412	127808363	127921110	127762964	127356209
Paddy_productivity-Model_3	Forecast	26.40	26.86	27.32	27.78	28.24
	UCL	30.01	30.85	31.73	32.65	33.61
	LCL	22.79	22.88	22.97	22.91	22.86

For each model, forecasts start after the last non-missing in the range of the requested estimation period, and end at the last period for which non-missing values of all the predictors are available or at the end date of the requested forecast period, whichever is earlier

Table 14 indicated the forecast of next 5 years on the basis of the ARIMA (0,0,0) and brown that is exponential smoothing techniques and it was deciphered that in area, there will be consistency as there had already been a saturation in the land acquisition for farming. There was constant increase in the production in quintals in Uttar Pradesh with an average of 182394156 qt in 2020 to 165979212 qt in 2025. Whereas the lower limit for production in 2020 estimated to be 127401412 qt which would decreased to 127356209 qt and on the other hand the upper limit forecast had been 182394156 qt in 2020 which had been estimated to increase to 204602215 qt till 2025. the productivity can be seen increasing from 2020 to 2025 from 26.40 qt/ha to 28.24 qt/ha.

Table 15: Model description of the factors i.e. area, production and productivity of paddy in Sidharthnagar district

Model Description			
			Model Type
Model ID	Area (Hectare)	Model_1	ARIMA(0,0,0)
	Production (Qt)	Model_2	Holt
	Yield (qt/ha)	Model_3	ARIMA(1,1,0)

The above table 15 deciphered area, production and productivity model for forecast in Sidhhatrh Nagar district of Uttar Pradesh, here the area had taken ARIMA (0,0,0) model whereas the yield had chosen ARIMA (1,1,0) model which means order of one year had been implemented to dampen the seasonality and production had been chosen to be calculated under Holt model by expert modeler in SPSS. When the data is exhibiting a trend, the time series generally introduced to Holts exponential smoothening, resulting in evaporating the trend in data to get better forecasting results thus existence of linear trend and absence of seasonality is considered while dealing with linear trend. The ARIMA (0,0,0) model is used where zero order of Auto-correlation, Integration and Moving average and there are no use of constant since no p,d,q are specified. A Hold exponential smoothening equated to the ARIMA model of (0, 2,2) which meant zero order of p i.e. auto-regression, second order of d i.e. differentials, and second order of q i.e. moving average. The third model for yield is ARIMA (1,1,0) which explained there had been single order of auto-regression and single order of integration but there was zero order of moving average.

Table 16: Descriptive statistics for the factors i.e. area production and productivity of paddy in Sidharthnagar District

	Area (Hectare)	**Production(Qt)**	**Yeild (qt/ha)**
Mean	170723.31	3493408.18	20.36
Standard Error	1872.34	232190.09	1.29
Median	172385	3776650	20.99
Mode	173147	#N/A	#N/A
Standard Deviation	8782.05	1089068.073	6.05
Sample Variance	77124496.13	1.18607E+12	36.71
Kurtosis	1.56	-0.15	-0.05
Skewness	-0.72	-0.50	-0.50
Range	38425	4131860	23.40
Minimum	149112	1378590	8.13
Maximum	187537	5510450	31.54
Sum	3755913	76854980	448.02
Count	22	22	22
Confidence Level (95.0%)	3893.74	482865.73	2.68
Jarqa-bera	0.416	0.1140	0.112
p-value	0.12	0.56	0.56

Table 16 explained the mean for area to be 170723.31 ha, production being 3493408.18 Qt and productivity being 20.36 Qt/ha. The jarqa bera value according to Markov simulation table for smaller sample size was estimated to be 0. 416 for which estimated that the area is not normally distributed whereas the production and productivity were less than 0.414 which was calculated for sample size of (20-30) and were 0.114 and 0.112 respectively which indicate their normal distribution. the p value for area were less than 0.5 whereas the production and productivity it was estimated to be equal that was 0.56 which was near to 0.5 and can be accepted that there were existence of normal distribution. The sample for area had shown a leptokurtic peak whereas the production and productivity had shown platykurtic peak. All the three variables had skewed tailed towards left as the variables have had Skewness of -0.72, -0.5 and -0.5 for area, production and productivity.

Table 17: Model summary for model fit of the factors i.e. area production and productivity of paddy in Sidharthnagar district

Model Fit				
Fit Statistic	**Mean**	**SE**	**Minimum**	**Maximum**
Stationary R-squared	.483	.446	-5.330E-11	.879
R-squared	.324	.285	-2.650E-6	.535
RMSE	256542.79	436757.68	4.644	760841.66
MAPE	14.608	11.291	3.573	23.354
MaxAPE	82.27	58.69	14.50	116.64
MAE	192268.26	327860.67	3.63	570833.49
MaxAE	556695.08	945549.68	9.48	1648450.49
Normalized BIC	16.29	12.19	3.21	27.36

Table 17 described the model fitting for trend and seasonality in the time series data along with existence of white noise if present. The normalized BIC for the proposed models were least for the chosen models thus mean had 16.29, for standard error it was 12.19 for minimum and maximum model fit it were 3.21 and 27.36 respectively. the suggested model had been shown root mean squared error which was the root of the actual forecast and estimated forecast, as the sample size is

small the mean had an RMSE of 256542.79 whereas the minimum error was found to be 4.644 and maximum error was found to be 760841.66. The next parameter was MAPE i.e. Mean Absolute Percentage error, if the MAPE is estimated <= 10-15 percent then the model is acceptable and reliable. Thus in this suggested model MAPE had mean percentage error to be 14.608 and for standard error the MAPE had been 11.29 percent, the minimum MAPE had been 3.573 and maximum MAPE had been 23.354.

Table 18: Model statistics for the factors i.e. area production and productivity of paddy in Sidharthnagar district

Model Statistics							
Model	**Number of Predictors**	**Model Fit statistics**		**Ljung-Box Q(18)**			**Number of Outliers**
		Stationary R-squared	**R-squared**	**Statistics**	**DF**	**Sig.**	
Area (Hectare)-Model_1	0	-5.330E-11	-2.650E-6	18.162	18	.445	0
Production (Qt)-Model_2	0	.879	.535	19.319	16	.252	0
Yeild (qt/ha) -Model_3	0	.671	.536	8.008	17	.966	0

As the above table 18 indicates that the R squared for area had taken value of -5.330E-11 that is tending to zero and thus this model is not quite efficient in forecasting but for production and productivity the value that had been taken for R squared are 0.879 and 0.671 respectively. Thus the forecasting for production and productivity would be more accurate.

Table 19: Forecasting the factors i.e. area production and productivity of paddy Sidharthnagar district under different models

Forecast						
Model		**2020**	**2021**	**2022**	**2023**	**2024**
Area (Hectare)-Model_1	Forecast	170737	170737	170737	170737	170737
	UCL	190185	190185	190185	190185	190185
	LCL	152856	152856	152856	152856	152856
production (Qt)-Model_2	Forecast	4978837	5105791	5232744	5359698	5486651
	UCL	6565925	6699950	6833943	6967906	7101838
	LCL	3391749	3511632	3631545	3751490	3871465
yield (qt/ha) -Model_3	Forecast	28.029	31.69	29.55	31.981	30.7552
	UCL	47.4869	54.31	58.31	64.45	67.35
	LCL	15.3733	17.130	13.19	13.853	11.79

For each model, forecasts start after the last non-missing in the range of the requested estimation period, and end at the last period for which non-missing values of all the predictors are available or at the end date of the requested forecast period, whichever is earlier

Above table 19 showed the forecast of upper and lower limits against 5 years of time leap from 2020 to 2025. for area since it was estimated that the model was not quite predicting any reliable forecasting thus the trend in area in hectares had been shown no increment in area from year 2020 till 2025 as it was stated to be 170737 hectares the upper limits for area forecast were same as 190185 ha throughout 5 years whereas the lower limits were equal though out the five years to be 152856 ha. The production had shown better fitting model thus there can be seen increasing trend in production in Qt, from year 202 the production being 4978837 qt to 5486651 qt till year 2025. The productivity had also shown a fitting model and promising increment in productivity in the area from 28.029 qt/ha in 2020 to 30.75 till 2025. The maximum upper limit could be expected with better extension approach from 47.48 qt/ha during 2020 to 67.35 qt/ha during 2025. The lower limits were expected to be 15.37 qt/ha during 2020 to 11.79 qt/ha till 2025 which had shown a decreasing trend.

Table 20: Model description of the area (hectares) of paddy in Sidharthnagar district block wise

Model Description			
			Model Type
Model I	Khuniyav	Model_1	Simple
	Itwa	Model_2	ARIMA(0,0,0)
	Bhanbapur	Model_3	ARIMA(0,0,0)
	Barhni	Model_4	Simple
	Shohratgarh	Model_5	Simple
	Birdpur	Model_6	Holt
	Naugarh	Model_7	Holt
	Jogia	Model_8	Holt
	Uska Bazaar	Model_9	Simple
	Dumaria Ganj	Model_10	ARIMA(0,0,0)
	Banshee	Model_11	Simple
	Sweetwal	Model_12	ARIMA(0,0,0)
	Khesraha	Model_13	Simple
	District total	Model_14	ARIMA(0,0,0)

In above table 20 the models suggested by expert modeller of SPSS had been selected various kind of forecasting model where simple trend in area under paddy cultivation for last 20 years were shown in blocks like Khesraha, Uska Bazaar, Barhni, Shohratgarh, Khuniyav and Banshee. the other kind of models which were developed by expert modeler were

ARIMA(0,0,0), here there had been zero order of auto-regression, zero order of integration and zero order of moving average lags. The blocks under ARIMA model were Sweetwal, Dumaria Ganj, Itwa and Bhanbapur. others were forecasted on the basis of exponential smoothing by Holt double exponential smoothing implemented in situations where there exist a trend in the time series data sample, thus it was expected that area under blocks such as Jogia, Naugarh and Birdpur had shown a trend and possibly seasonality, thus the weighted average of previous area value of respective blocks which were decaying exponentially from recent to oldest value had been considered.

Table 21: Model fit table for area (hectares) under paddy cultivation of all the blocks of district Siddharthnagar

Model Fit				
Fit Statistic	**Mean**	**SE**	**Minimum**	**Maximum**
Stationary R-squared	.187	.332	-.034	.826
R-squared	.638	.608	-1.821E-14	.816
RMSE	1385.858	1678.645	392.230	7037.278
MAPE	4.616	1.462	2.515	8.512
Max APE	21.080	12.285	9.247	53.687
MAE	976.825	1401.330	278.360	5764.062
Max AE	3567.887	3401.958	1019.229	14206.059
Normalized BIC	14.025	1.403	12.277	17.885

Table 21 depicted that the models were fitting to the forecasting the least normalized BIC were recorded to be 14.025 for mean, 1.403 for standard error and for minimum and maximum it was recorded to be 12.277 and 17.885. Whereas R squared calculated for mean was .638 and for error .608 which were more than 0.5 and leaning towards 1. In MAPE, mean absolute percentage error was the rate of error was averaged and absolute values were taken, if the MAPE were <10-15 percentage then the forecasting models are considered to be best fit and most accurate once. In the above table MAPE for mean had been calculated to be 4.616, for SE the MAPE was 1.462 and for maximum and minimum fitting chances, the MAPE had been 2.515 and 8.512. Maximum mean absolute errors were depicted for mean, SE, maximum and minimum being 21.080, 12.285, 9.247 and 53.687 respectively.

Table 22: model statistics for various district model developed by expert modeller

Model	**Number of Predictors**	**Model Fit statistics**	
		Stationary R-squared	**R-squared**
Khuniyav-Model_1	0	.591	.594
Itwa-Model_2	0	-4.885E-15	-4.885E-15
Bhanbapur-Model_3	0	-2.220E-16	-2.220E-16
Barhni-Model_4	0	.034	.748
Shohratgarh-Model_5	0	.002	.477
Birdpur-Model_6	0	.826	.428
Naugarh-Model_7	0	.783	.658
Jogia-Model_8	0	.738	.816
Uska Bazaar-Model_9	0	-.016	.637
Dumaria Ganj-Model_10	0	1.943E-14	1.943E-14
Banshee-Model_11	0	.685	.672
Sweetwal-Model_12	0	-1.776E-15	-1.776E-15
Khesraha-Model_13	0	-.01	.533

Above table 22 describes the model statistics of various blocks' model that were developed by modeller expert in SPSS, here some of the models have good fit to the predictive values, all those values which were > 0.5 were predicted to be better fits, thus Khuniyav had R squared .594, Barhni had .748, Shohratgarh had .477, Birdpur had .826, Naugarh had .783, Jogia had .738, Uska Bazaar had .637, Banshee had .642 and Khesraha had R squared .533, whereas the other models like Itwa, Bhanbapur, Dumaria Ganj and Sweetwal had R squared respectively -4.885E-15, -2.220E-16, 1.943E-14 and -1.776E-15 which were tending to zero. Thus these predictions were not substantial and cannot be predicted more accurately as the goodness of fit is not commendable.

Table 23: forecast table of paddy area coverage (ha) of various blocks in district f Sidharthnagar

Forecast								
Model		**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Khuniyav-Model_1	Forecast	15781	15796	15630	15899	15902	15910	15856
	UCL	18631	19273	19815	20291	20722	21119	21488
	LCL	12932	12289	11748	11271	10840	10444	10075
Itwa-Model_2	Forecast	13722	13722	13722	13722	13722	13722	13722
	UCL	15523	15523	15523	15523	15523	15523	15523
	LCL	11921	11921	11921	11921	11921	11921	11921
Bhanbapur-Model_3	Forecast	15707	15707	15707	15707	15707	15707	15707
	UCL	19771	19771	19771	19771	19771	19771	19771

	LCL	11643	11643	11643	11643	11643	11643	11643
Barhni-Model_4	Forecast	10505	10515	10501	10491	10487	10509	10511
	UCL	11835	12386	12809	13166	13480	13764	14025
	LCL	9175	8624	8201	7844	7530	7246	6985
Shohratgarh-Model_5	Forecast	9169	9169	9169	9169	9169	9169	9169
	UCL	10234	10636	10950	11216	11451	11664	11861
	LCL	8104	7702	7388	7122	6887	6674	6477
Birdpur-Model_6	Forecast	14688	14855	15022	15189	15356	15523	15691
	UCL	16768	16936	17104	17272	17440	17609	17777
	LCL	12608	12774	12940	13106	13272	13438	13604
Naugarh-Model_7	Forecast	13256	13399	13541	13683	13826	13968	14110
	UCL	14373	14520	14668	14815	14963	15110	15258
	LCL	12140	12277	12414	12551	12688	12826	12963
Jogia-Model_8	Forecast	12671	12831	12991	13151	13311	13471	13631
	UCL	13507	13671	13835	13999	14164	14328	14492
	LCL	11835	11991	12147	12303	12459	12615	12771
Uska Bazaar-Model_9	Forecast	8376	8376	8376	8376	8376	8376	8376
	UCL	9754	10325	10763	11133	11458	11752	12023
	LCL	6998	6427	5989	5619	5294	5000	4729
Dumaria Ganj-Model_10	Forecast	15946	15946	15946	15946	15946	15946	15946
	UCL	18486	18486	18486	18486	18486	18486	18486
	LCL	13406	13406	13406	13406	13406	13406	13406
Banshee-Model_11	Forecast	13014	13069	13091	13106	13129	13121	13108
	UCL	15217	15476	15710	15926	16126	16315	16493
	LCL	10812	10553	10318	10103	9902	9714	9536
Sweetwal-Model_12	Forecast	15764	15764	15764	15764	15764	15764	15764
	UCL	17825	17825	17825	17825	17825	17825	17825
	LCL	13703	13703	13703	13703	13703	13703	13703
Khesraha-Model_13	Forecast	15836	15836	15836	15836	15836	15836	15836
	UCL	18745	19559	20224	20801	21318	21790	22227
	LCL	12927	12114	11448	10871	10355	9883	9446

For each model, forecasts start after the last non-missing in the range of the requested estimation period, and end at the last period for which non-missing values of all the predictors are available or at the end date of the requested forecast period, whichever is earlier

As depicted from above table 23, Khuniyav block had fitting R squared (near to 0.5) thus gave a average prediction of area under paddy cultivation in the block which was 15781 during 2018 and increased to 15856 till 2024. Bhanbapur and Itwa had apprehensive notations for fitting R squared values thus the predictions were unchanged. Barhni had shown an increment in the area under paddy cultivation from 10505 ha in 2018 to 10511 ha till 2024. Shohratgarh block had very weak R squared fitting, the predictive values remained unchanged which was 9169 ha throughout the span from 2018 to 2024. Birdpur block had an excellent goodness of fit which was 0.826, and thus had good predictive approach which was an increment from 14688 ha in year 2018 to 15691 ha in year 2024. Naugarh block had goodness of fit of 0.783 which can be considered to be reasonable and has given an excellent trend of increasing area under paddy production from 13256 ha during 2018 to 14110 ha in 2024. Just like Naugarh, block Jogiya had a trend of increasing area under paddy cultivation from 12671 ha to 13631 ha during the time of 2018-2024. Uska and Dumaria Ganj blocks have shown unreasonable goodness of fit and thus the model did not predict the proper trend thus the predictions were constant. Block Banshee had rational goodness of fit i.e. 0.685 and thus the predictions were 13014 ha in 2018 to 13108 ha in 2024. Sweetwal and Khesraha blocks have shown unchanged trend in area under paddy cultivation, as there had no availability of better predicting model and the area remained 15764 ha and 15836 ha respectively.

Constraints faced by paddy growers and other intermediaries during the supply chain and marketing, the paddy

Table 24: Various constraints faced by the growers, wholesalers and retailers in the whole system of paddy production and seed distribution

Farmers	Huge difference between final consumers price and farmer realization.
	Costly for small farmers
	Fluctuation in mandi prices due to delay arrivals of paddy.
	Fluctuation in farmers price for different farmers, depending on the groups.
	Lack of forward and backward integration at various levels from farmers' point.
	Poor linkage in marketing channels in meeting local production and demand.
	Unavailability of copious market space for Kalanamak variety
	Traders dominating supply chain and marketing channel supremacy
	Farmer more reliant on intermediaries; only source of demand details
	Lease governmental variety availability in the market.
	Failures in quality of the product, germination failures
	Price determination by external sources rather the government
	Inadequate subsidy support

Wholesalers and Retailers	Inadequate marketing skills like packaging, grading, standardization
	High storage charges
	Uneven quality distribution from farmers' lot.
	Lesser control of product safety due to manual mishandling.
	Wastage along supply chain, transportation and storage.
	Small retailers suffer poor supply system.
	Uneven demand due to change in government policies.
	Price variation due to local and interstate arrivals.
	Lack of marketing information due to uneven flow of produce supply, delayed arrivals of the lots.
	Market competitions.

Table 25: KMO and Bartlett test of significance

The analytical test	KMO	Bartlett	Significance
Factor affecting	0.701	809.4	0.006

In this table 25 factor analysis the agricultural/ marketing / administration and other issues for various farming community was estimated, here the data were recapitulated and assured the fitness of collected data under various factors. For sample adequacy the KMO i.e. Kaiser-Meyer-Olkins test has been used in factor analysis, this measures the variance amongst all variables. The KMO here is 0.701 which is quite significant and affirms suitability of the data according to the factors that were under consideration. The Bartlett test of sphericity is to visualise the comparison of correlation matrix to the identity matrix. In factor analysis when the data reduction is done to extract a meaningful interpretation, thus need to have reduction techniques. This test signifies that each factor is perfectly orthogonal that means the factors are uncorrelated and are not affecting each other significantly. Here the Bartlett sphericity approximated chi squared value is 809.4 and the significant level at 0.05 percent it is 0.006. Thus, the factors were least correlated and the extraction for various variables under multiples factors were extracted precisely.

Table 26: Variables of each of the factors and factor loading values obtained by rotation matrix

Particular factors	Variables affecting the growers, wholesalers and retailers in the whole system of paddy production and seed distribution	Factor loadings
Mazor issues at farmers end & Fragmented supply chain (at farmers' level)	Failures in quality of the product, germination failures	0.809
	Price determination by external sources rather the government	0.773
	Traders dominating supply chain and marketing channel supremacy	0.701
	Lack of forward and backward integration at various levels from farmers' point.	0.691
	Lease governmental variety availability in the market	0.601
	Costly for small farmers	0.533
	Unavailability of copious market space for Kalanamak variety	0.508
	Farmer more reliant on intermediaries; only source of demand details	0.422
	Fluctuation in farmers price for different farmers, depending on the groups	0.401
	Poor linkage in marketing channels in meeting local production and demand.	0.325
	Fluctuation in mandi prices due to delay arrivals of paddy	0.117
Integration issues (at the level of wholesaler and retailers)	Small retailers suffer poor supply system.	0.809
	Uneven demand due to change in government policies.	0.752
	Price variation due to local and interstate arrivals.	0.633
	Uneven quality distribution from farmers' lot.	0.591
	Market competitions	0.544
	Lack of marketing information due to uneven flow of produce supply, delayed arrivals of the lots.	0.402
	Inadequate marketing skills like packaging, grading, standardization	0.388
	Wastage Lesser control of product safety due to manual mishandling. along supply chain, transportation and storage	0.298
	High storage charges.	0.198

In the above table 26 the variables for each factor and their respective factor loadings were reciprocated in ascending manner. Here the factor loading in orthogonal fashion has been explained and the factors which were more prominent as constraint at farmers and wholesaler/retailers' level can be seen. At farmers level germination failures have scored highest factor loadings with 0.809 stood first showing the impact of germination percentage on paddy seed utility. Price determination by external sources rather the government has occupied second last position with 0.773 scoring suggesting that the paddy seed cost determination must be done by the government agencies, the paddy seed cost higher than actual realization. Traders dominating supply chain and marketing channel supremacy and showing no space for government led agencies to distribute the state-owned seeds scored 0.701. The farmers were also worries about Lack of forward and backward integration at various levels that led to no approaching assumptions to the farmers whether they could also participate in hybrid/researched seed production and this factor scored 0.691. Lease governmental variety availability in the market the small farmers were more distress due to Lease governmental variety availability in the market and this constrain bagged 0.601 scoring. Costly for small farmers had a factor loading of 0.533. Unavailability of copious market space for Kalanamak variety though the government of Uttar Pradesh had done various efforts to sustain Kalanamak variety as a promising dignity of the district but Unavailability of copious market space for Kalanamak variety also bagged a factor loading of 0.508 and this indicated that farmers were not interested to produce this indigenous variety. as usual the

Farmer more reliant on intermediaries; only source of demand details and thus the market-oriented approach has only pull factors from the farmers end which bagged 0.422 factor loading. A Poor linkage in marketing channels in meeting local production and demand also had shown an issue as the commission agents intervention increases the cost of hybrid seeds in certain interior pockets of the district and this factor had a factor loading of 0.325. Fluctuation in mandi prices due to delay arrivals of paddy due to seasonal variation or delay in plantation nad harvesting also increases price variation that reduced the enthusiasm of paddy production thus decreasing the seed utility and this factor had a factor loading of 0.325.

The wholesaler and retailer levels had different issues as there had been a lacking integration problem existed amongst themselves. a smaller level small retailers suffer poor supply system and this reduced the approaches to the distant area of the district this facet was major issue with 0.809 leadoig rank. Uneven demand due to change in government policies had also been very degenerative impact on paddy seed distribution, as during 2013 the paddy seeds were subsidies to more than 70 percent and that had given a boost to paddy seed distribution but after that the subsidy schemes had never been even in the administration level thus price determination also suppressed the seed distribution this ranked second with factor loading of 0.752. Price variation due to local and interstate arrivals has also seen different companies, some paddy seeds were coming from other state and thus were highly priced but local produced and researched varieties had lesser price constraints with a factor load of 0.633. Uneven quality distribution from farmers' lot envisaged that the small farmers were not getting better seeds due to lesser priced paddy seeds had lesser germination percentage and this factor had a factor load of 0.591.

Market competitions amongst various seed producing companies show better market heterogeneity but their lobbying and price discrimination tend the traders to choose those products with more margin and give least choices to the farmers, this trader issue had bragged 0.544 factor loading. Lack of marketing information due to uneven flow of produce supply; delayed arrivals of the lots, Inadequate marketing skills like packaging, grading, standardization, Wastage Lesser control of product safety due to manual mishandling, along supply chain, transportation and storage and High storage charges. Had their rankings respectively with factor loads of 0.402, 0.388, 0.298 and 0.198 respectively. Similar studies were found in (P Sadvi, July 2016) *et al.* Who had analyzed the constraints and suggestions elicited from the hybrid rice seed growers in hybrid rice seed production in Karimnagar district of Telangana state in India. Many intricacies in understanding and application of hybrid rice seed production technology, it is the high time to guage the psychological perspectives of farmers on hybrid rice seed production technology. There is a need for an objective analysis of identification of constraints and suggestions in hybrid rice seed production. Apart of paddy seed the vegetable seed production had similar issues pertaining to the study of (PRASAD, 2012) *et al.* had conducted study in renebennur taluka of shavri district of Karnataka which was about the vegetable seed production modus operand and related constraints in tomato and okra seed production. It was observed that 66.67% of the farmers were introduced to the crop by the company staff, and out of 30.00% by fellow farmers, 3.33% farmers took up the crop cultivation due to the advice relatives. It was observed that nearly 26.67% of the seed growers of hybrid tomato complained about non-availability of foundation seeds on-time. It was reported that nearly 90% of seed growers experienced the problem of non-availability of trained labor in crossing operations.

Conclusion

As far Indian seed industry is concerned, the seed industry is having roaring increment and trending with a CGAR of 12 percent. The voluminous growth indicates the heightened seed replacement rate in hybrid paddy and researched wheat growth in acerage. The contemporary biotech experiments and hitting the right traits for boosting the wholesome seed market in India. the SRR in paddy was calculated to be 33 percent in last decade and had maximum in Andhra Pradesh along with 87 percent and Uttar Pradesh scoring 31.61 percent during 2011, these nuances could be congratulated to governments tedious herculean task to enable the geographical expansion of the seed distribution through various organizations like government seed distribution centres, state universities, the various seed companies and their extreme dedicated work force. the BRAI (Biotechnology Regulatory Authority of India) mad all operational policy supports, encouragements for research and development supports, fiscal incentives like free import of various R&D processes and technologies, infrastructural development via PPP model for developing the hybrid/researched seed producing industry. During recent years government had allowed FDI in seed industry and that had boosted the seed production as various investors are investing in the seed industry via IPO. There has been facilitation of capital infusion in infrastructural development through IPO, giving young entrepreneurs to bloom and serve the local requirements of seed along with matching the modulation of 15 major climatic conditions and 46 soil types of the Indian subcontinent

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