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Relationship between Fund Utilisation and Agricultural Development in Post-Reforms Period in Odisha

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Abstract

The first ever National Agricultural Policy in India was announced in 2000.Government of Odisha also adopted two such separate policies in 2008 and 2013.Distinct policy options for increasing farmers' incomes resulted in growth of farmers' real income. Production in Odisha has increased manifold and yields of the major crops have increased more than three times. There are wide disparities in production and yield of crops in different agricultural zones of the State of Odisha.Improvement of agricultural production and productivity depends very much upon the way Government utilises its fund for the purpose. Hence an attempt has been made in this study to examine the relationship between the fund utilisation and agricultural development of the State.In order to evaluate the determinants of Agriculture growth, a three-step method is used to approximate the relationship and the Augmented Dickey Fuller (ADF) test followed by Engle Granger test to show that there exists no co-integration among the variables under study. Finally, stepwise ordinary least square model is developed to evaluate the predictors of agricultural growth in Odisha and followed by testing of hypotheses relating the predictors.It is concluded that the allocation and utilization of funds in agriculture and its allied sectors and irrigation and flood control measures are positively affecting the SGDPA and hence agriculture growthin Odisha.The farm mechanisation, gross cropped area, fertiliser consumption and average rainfall have positive and significant relationship while seed distribution, net sown area, agricultural credit and crop insurance has no significant relationship with SGDPA in post-reform era.

Keywords: Fund Utilisation, Agricultural Growth, ADF Test, SGDPA.

Introduction

The process of development is always concerned with multiplicity of issues for which most of the nations irrespective of their level of development frame policies basing upon their variations and succeed in achieving their ends. In our country also, policies have been framed for development of industrial sector from the very beginning after independence in 1948.But to utter surprise, the agricultural sector although provides livelihood to a larger section of population besides its contribution to food supply, industrial inputs, foreign exchange earnings and commerce and business of the nation, lacks such separate policy framework for a long period of time. The first ever National Agricultural Policy in India was announced in 2000. It is not that agricultural policy has not at all been implemented, but it was adopted under the banner of planning mechanism and special schemes and programmes depending upon the thrust areas in different points of time. Similar case is noticed in case of Odisha also. After implementation of National Agricultural Policy 2000, Government of Odisha also adopted two such separate policies in 2008 and 2013.Thus in this paper an attempt has been made to analyse the impact of fund allocation and utilisation due to such policies in development of agriculture in the State.

Review of Literature

A brief survey of literatures can throw some light on importance of policy options in development process of an economy. Effland (2000) on a study on US Farm Policy during first 200 hundred years pointed out that many policies have been rooted in different periods starting from Federal Land Policy in USA. Each period has ushered in a new policy approach meant for helping farmers improve their incomes in the face of ever-increasing production. Zahniser et al (2005) examined the agricultural policy reforms in North America covering USA, Mexico and Canada. Each of these nations have been revising their agricultural policies over the past several years to bring changes in process of agricultural development. Jiang (2009) in a study on Vietnam's agricultural development found that there is a direct link between its land policy and agricultural policy developments. Its agricultural policy has been able to create an atmosphere to produce the majority of daily food requirements.

Gulati et al (2020) in a study on "Reforming Indian Agriculture" noticed that the distinct policy options for increasing farmers' incomes resulted in growth of farmers' real income by 3.6 % per annum and agricultural growth rate by about 8.6 % during the period between 2002-03 and 2015-16. Farmers' incomes increased broadly in line with the growth of agricultural GDP of the Nation. Arora (2013) put importance upon necessity of a policy initiative to attract private investment in agriculture for a long-term growth and competitiveness of the sector. Patra(2014) in a research paper on "Agricultural Development in Odisha" opined that farm production in Odisha has increased manifold and yields of the major crops such as paddy, pulses, oilseeds and vegetables have increased more than three times in last four and half decades. But he calls for adopting area-specific plans and long-term policy to bridge the widening disparities over the years. So also, Singh (2017) suggests for policy measures in the State of Odisha for further improvement of agricultural production and productivity, since a large majority of population in the State are living on this sector. Otherwise they will continue their miserable life and reel under poverty.

Statement of the Problem

Odisha has been performing well at present in terms of better economic growth. The standard of living of people in Odisha has improved with rise in per capita income. But its gap from the national average continues. There is structural shift from the primary to tertiary sector over the years (Sahu, 2016). Agriculture sector has a decelerating trend although continues to remain a priority sector because of its high potential for employment generation. So the problem is to find the reasons behind the deceleration and the impact of the policies adopted in Odisha in recent years on fund allocation for the growth of agriculture.

Need of the Study

The need of the present study concentrates on the consequences of fund allocation and its utilisation through implementation of agriculture policy in 2008 and 2013 in the State of Odisha. There are many factors responsible for bringing changes in the agricultural production in Odisha so that the State Domestic Product from Agriculture improves in recent years. Hence, the allocation of funds by Govt. of Odisha for these factors influence the State Gross Domestic Product from Agriculture (SGDPA herein after). The present study involves the changes in SGDPA before and after implementation of agricultural policy in Odisha during post reform period.

Objectives of the Study

The following objectives have been chosen in this study.

1. To study the relationship between utilisation of fund and SGDPA in the State of Odisha during post reform period.
2. To examine the relationship between SGDPA and each of the factors that are responsible for the growth of agriculture in Odisha.

Hypotheses of the Study

The hypotheses of the present study are as follows.

H_1

There is no significant positive relationship between SGDPA and the state's total fund allocated for agriculture and allied sector.

H_2

There is no significant positive relationship between SGDPA and the state's total fund allocated for irrigation and flood control measures.

H_3

There is no significant positive relationship between SGDPA and the state's total seed distribution.

H_4

There is no significant positive relationship between SGDPA and the state's total power consumption in agriculture.

H_5

There is no significant positive relationship between SGDPA and the state's total farm mechanization.

H_6

There is no significant positive relationship between SGDPA and the net sown area of Odisha.

H_7

There is no significant positive relationship between SGDPA and the gross cropped area of Odisha.

H_8

There is no significant positive relationship between SGDPA and the state's total fertilizer consumption.

H_9

There is no significant positive relationship between SGDPA and the state's total agriculture credit provided to the farmers.

H_{10}

There is no significant positive relationship between SGDPA and the total crop insurance provided to the farmers.

H_{11}

There is no significant positive relationship between SGDPA and the average rainfall in Odisha.

Research Methodology

Sample Selection

The present study covers the Agricultural Sector of the whole State of Odisha. Since attempt has been made to study the impact of fund allocation on SGDPA the factors responsible for agricultural production comes under the study. Agricultural development depends on several exogenous and uncontrollable factors like rainfall and climatic condition as well as some endogenous factors like irrigation, fertilizer consumption, farm mechanisation,net sown area(NSA), area sown more than once (ASMO), gross cropped area (GCA) etc. The information relating to irrigation potential, power consumption, farm mechanisation, fertilizer consumption, and seed distribution relating the whole State has been included.

Sources of Data

The period of study ranges from 1990 to 2019. The data on SGDPA have been collected from State Economic Survey, Directorate of Economics and Statistics in Orissa, but data relating to irrigation potential, rainfall, power consumption, farm mechanisation, fertilizer consumption, and seed distribution and from the Annual Agricultural Statistics published by the government of Odisha. Similarly, land used for cultivation, NSA and GCA has been compiled from the agriculture statistics reports of Odisha. Data on the use of fertiliser(including nitrogen, phosphate and potash) has been collected from the State Fertilizer Statistics for Orissa. The amount of power consumption for agricultural purposes in Odisha is obtained from the economic survey reports. The data on allocation of funds has been collected from the Ministry of Agriculture and Farmers' Welfare, Government of Odisha.

Period of Study

The period of present study covers the post reforms period starting from 1990-91 to 2018-19. Since the Govt. of Odisha has adopted agricultural policy in 2008 and 2013, the study covers both the periods before and after the policy adoption.

Tools used in the Study

The research used secondary time-series data. In order to evaluate the determinants of Agriculture growth, a three-step method is used to approximate the relationship between agricultural development and selected independent variables. First of all, the secondary data is transferred to its natural logarithm value so that it can be incorporated in the Augmented Dickey Fuller (ADF) test. A unit root test i.e. Augmented Dickey Fuller (ADF) test on the variables of the model have been carried out to decide if it is stationary. Based on the outcome of the Augmented Dickey Fuller tests, the second step involves evaluating whether the series is co-integrated (i.e. verification for the existence of any long-term relationship among the variables) using Engle and Granger's (1986) two-step residual based procedure. The purpose of adopting this approach is to examine the elasticity of the independent variables. The null hypothesis associated with the Engle Granger test is that there exists no co-integration among the variables under study and the alternative hypothesis is that there exists co-integration. Finally, stepwise ordinary least square model is developed to evaluate the predictors of agricultural growth in Odisha. In this study on the agriculture, the GSDP at constant prices has been considered for the regression analysis rather than current prices. For minimising the impact of price changes or inflation, the state domestic product was calculated by measuring the prevailing prices of the products and services in the base year (i.e. 1990-91). The base year is updated to the very recent base with an intention to capture the practical economic growth that should be meaningful for study then there is a systemic development in the economy. Further, the static regression model is presented below.

$Y_t = \beta_0 + \sum\beta_t X_{ti}$ where i=1….n or $Yt = \beta_0 + \beta_1 Xt_1 + \beta_2 Xt_2 + \beta_3 Xt_3 + \beta_4 Xt_4 + \beta_5 Xt_5 + \beta_6 Xt_6 + \beta_7 Xt_7 + \beta_8 Xt_8 + \beta_9 Xt_9 + \beta_{10} Xt_{10} + \beta_{11} Xt_{11} + \beta_{12} Xt_{12} + g_t$

Where Yt = Log(yt) = the natural logarithm of the dependent variable 'y'

Xti=Log(xti) = the natural logarithm of the independent variables 'xi' Where, Yt is the dependent variable represented by SGDPA at constant prices

Xt_1 is the total fund allocated for agriculture and allied sector in year 't' (FAAS)

Xt_2 is the total fund allocated for irrigation and flood control in year 't' (FIFC)

Xt_3 is the Irrigation Potential (IP)

Xt_4 is Seed Distribution (SD)

Xt_5 is Power Consumption in Agriculture (PC)

Xt_6 is Farm Mechanisation (FM)

Xt_7 is Net Sown Area (NSA)

$Xt_8$is the Gross Cropped Area (GCA)

Xt_9 is the total Fertilizer Consumption (total of NPK Fertilizer) (FC)

Xt_{10} is the Agriculture Credit provided to the farmers in the state (AC)

Xt_{11} is total Crop Insurance in terms of Insurance sum assured (ISA)

$Xt_{12}$is the Average Rainfall (AR)

B_0 is the Constant term in the regression equation called the intercept.

$B_1, \beta_2, \beta_3 \ldots \beta_{12}$ are the Regression Coefficients for the independent variables and

g_t is the error term of the regression equation.

Data Analysis

Plan Schemes and Budget Outlays

The Odisha agriculture department has a mission to plan, develop, use and manage state capital effectively and efficiently in order to ensure agriculture growth, increase in farmers income level and ensure food security (Odisha Government, Budget, 2016-17). To this end, the Government of Odisha has agreed on the implementation of various plans, policies and schemes. The Table no.-1 presents the total fund allocated by the government Odisha towards two major sectors such as agriculture and allied sector and irrigation and flood control, that influence the agriculture productivity in the state.

Table-1: Plan Year Wise Fund Utilised in Agriculture and allied sector in Odisha (Amount in Crores)

Plan Year	Fund Utilised in Agriculture & Allied Activities	Year wise Growth in percentage	Total Fund Utilised in Five-year plans	Growth in Percentage
1990-91	49.30	Base Year	101.96	
1991-92	52.66	6.82		
1992-93	79.47	50.91		
1993-94	89.76	12.95		
1994-95	98.88	10.16	480.78	Base Year
1995-96	100.20	1.33		
1996-97	112.47	12.25		
1997-98	110.40	-1.84		
1998-99	124.56	12.83		
1999-00	135.34	8.65	633.57	31.78
2000-01	129.33	-4.44		
2001-02	133.94	3.56		
2002-03	71.69	-46.48		
2003-04	43.97	-38.67		
2004-05	46.95	6.78	272.75	-56.95
2005-06	51.84	10.42		
2006-07	58.30	12.46		
2007-08	175.01	200.19		
2008-09	398.45	127.67		
2009-10	377.30	-5.31	2808.97	929.87
2010-11	711.58	88.60		
2011-12	1146.63	61.14		
2012-13	1661.43	44.90		
2013-14	2223.72	33.84		
2014-15	3008.19	35.28	15690.81	458.60
2015-16	3676.56	22.22		
2016-17	5120.91	39.29		
2017-18	3692.12	-27.90		
2018-19	5070.99	37.35	8763.11	

Source: Economic Survey and Annual Budget, Government of Odisha

From the table no.-1 it is revealed that only after 2008, the fund allocated in the agriculture sector has witnessed growth. But prior to that, agriculture seems to be ignored although the contribution of agriculture to the GDP is significant. The growth trend also reveals that there is three-digit growth in investment pattern in the past one decade or in the recent five-year plans.

Table-2: Plan Year Wise Fund Utilised for Irrigation and flood control measures in Odisha (Amount in Crores)

Plan Year	Fund Utilised for Irrigation & Flood Control	Year wise Growth in Percentage	Total Fund utilised in Five-year plans	Growth in Percentage
1990-91	209.30	Base Year	513.52	
1991-92	304.22	45.35		
1992-93	178.87	-41.20		
1993-94	184.85	3.34		
1994-95	189.49	2.51	943.84	Base Year
1995-96	190.33	0.44		
1996-97	200.30	5.24		
1997-98	218.87	9.27		
1998-99	221.85	1.36	1146.91	21.5
1999-00	239.49	7.95		

2000-01	242.33	1.19		
2001-02	224.37	-7.41		
2002-03	563.95	151.35	2519.04	119.6
2003-04	456.39	-19.07		
2004-05	445.03	-2.49		
2005-06	503.67	13.18		
2006-07	550.00	9.20		
2007-08	1544.85	180.88	8205.39	225.7
2008-09	1575.40	1.9		
2009-10	1601.13	1.63		
2010-11	1641.82	2.54		
2011-12	1842.19	12.20		
2012-13	2178.17	18.24	18577.23	126.4
2013-14	2493.02	14.45		
2014-15	3205.35	28.57		
2015-16	4735.09	47.72		
2016-17	5965.60	25.99		
2017-18	8501.16	42.50	17064.19	
2018-19	8563.03	0.73		

Source: Economic Survey and Annual Budget, Government of Odisha

From the above table the data reveals that it is only after 2007-08, the fund allocated and utilization for irrigation and flood control has increased significantly. However, similar trend of increased utilisation can be observed in the year 2002-03. Further, it can be inferred that the investment in this particular sector has increased tremendously after 2014-15 i.e. during the 12th five-year plan. Unlike the fund allocation and investment pattern in the agriculture and allied sector, there is a higher investment in irrigation and flood control measures because the state is highly affected by cyclones, floods and other natural disasters. The plan period growth trend also reveals that there is no negative trend in investment pattern in any of the plan years.

Table-3: Plan Year Wise Total Fund utilised in Agriculture and Irrigation projects in Odisha (Amount in Crores)

Plan Year	Total Fund utilisedin agriculture and irrigation in Odisha	Year wise Growth in Percentage	Total Fund utilised in Five-year plans	Growth in Percentage
1990-91	258.60	Base Year	615.48	
1991-92	356.88	38.00		
1992-93	258.34	-27.61	1424.62	Base Year
1993-94	274.61	6.30		
1994-95	288.37	5.01		
1995-96	290.53	0.75		
1996-97	312.77	7.65		
1997-98	329.27	5.28	1780.48	25.0
1998-99	346.41	5.21		
1999-00	374.83	8.20		
2000-01	371.66	-0.85		
2001-02	358.31	-3.59		
2002-03	635.64	77.40	2791.79	56.8
2003-04	500.36	-21.28		
2004-05	491.98	-1.67		
2005-06	555.51	12.91		
2006-07	608.30	9.50		
2007-08	1719.86	182.73	11014.36	294.5

2008-09	1973.85	14.77		
2009-10	1978.43	0.23		
2010-11	2353.40	18.95		
2011-12	2988.82	27.00		
2012-13	3839.60	28.47	34268.04	211.1
2013-14	4716.74	22.84		
2014-15	6213.54	31.73		
2015-16	8411.65	35.38		
2016-17	11086.51	31.80		
2017-18	12193.28	9.98	25827.30	
2018-19	13634.02	11.82		

Source: Economic Survey and Annual Budget, Government of Odisha

The Table-3 presents the information relating to the total fund utilised in agriculture and allied activities as well as irrigation and flood control.It is evident that the first phase of growth in fund allocation and corresponding utilisation is observed in 2002-03 and a second phase of increase is observed in 2007-08. The total fund allocated follows the trend observed in case of irrigation and flood control.Again, it is also apparent that the total allocation during 11th and 12th five year plan is constantly growing. Similarly, the five-year growth pattern is also increasing positively.

Correlation Analysis and ADF test

The table-4 presents the correlation matrix of the variables considered for the study. The prime intention behind this test is to verify the correlation between the dependent and independent variables as well as the multi-collinearity effect among the independent variables. In the table the independent variables showing correlation value 'r' greater than 0.8 indicates the existence of multi-collinearity effect.Again, the correlation for the variable power consumption with other variables is not significant at all. This indicates that the variable, power consumption is having no relationship and role in the agriculture development. This behaviour of the variable is also confirmed again in the Augmented Dickey-Fuller test where it is not significant at 1stlag difference. Further, it is wise to drop the variables which are having high correlation and only one variable is enough to be used in the regression model to get reliable result.

Table-4: Pearson Correlation Matrix for the Variables taken for the study

	AC	AI	ARF	FAAS	FC	FIFC	FM	GCA	IP	NSA	PC	SD	SGDPA
AC	1												
AI	**.900****	1											
ARF	.105	-.057	1										
FAAS	.653**	.528**	-.008	1									
FC	**.880****	**.852****	-.006	.758**	1								
FIFC	**.861****	.731**	.046	**.897****	**.862****	1							
FM	.787**	.768**	-.105	.695**	**.897****	.740**	1						
GCA	-.306	-.502**	.495**	-.295	-.438*	-.314	-.549**	1					
IP	.784**	.610**	.204	.901**	.840**	**.936****	.696**	-.083	1				
NSA	**-.911****	-.875**	.011	-.718**	**-.930****	-.852**	**-.863****	.489**	-.772**	1			
PC	-.219	-.339	.091	.368*	-.158	.158	-.129	.242	.233	.207	1		
SD	.703**	.695**	-.024	.679**	**.896****	.700**	.766**	-.450*	.698**	-.835**	-.272	1	
SGDPA	.884**	.797**	.044	.878**	.948**	.947**	.893**	-.403*	.909**	-.915**	.042	.814**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

To test for co-integration between the twelve non-stationary time series variables, first, the OLS regression analysis has been done, and then the ADF test is used to determine if the residual having a unit root at level I(0) or it is stationary(Table-5). This process is like the two-step residual test of Engel and Granger (1986). The time series is assumed to be co-integrated if the residual is stationary. In turn, the non-stationary I (1) series cancel each other to generate a stationary I(0) residual. Table-5 shows the Augmented Dickey Fuller Test for the variables as well as the residual. It rejects the null hypothesis of non-stationarity at 1% level of significance. It is established that there exists co-integration between

SGDPA, AC, AI, ARF, FAAS, FC, FIFC, FM, GCA, IP, NSA, SD. But in case of Power consumption (PC) the ADF test is not significant both in level and 1st difference. Therefore, this particular variable has been dropped from the final regression model.

Table-5: Augmented Dickey-Fuller test statistic

Sl.No.	Variable Name	Leg	t-Statistic	Prob.*
1	SGDPA	Level	-0.38962	0.898
	SGDPA*	1st difference	-8.37698	0.000
2	ARF	Level	-6.23413	0.000
	ARF*	1st difference	-10.3591	0.000
3	FAAS	Level	-0.12289	0.937
	FAAS*	1st difference	-3.43281	0.019
4	FC	Level	-1.23207	0.646
	FC*	1st difference	-5.84045	0.000
5	FIFC	Level	0.57672	0.986
	FIFC*	1st difference	-6.13055	0.000
6	FM**	Level	-3.52101	0.015
	FM*	1st difference	-5.09336	0.000
7	GCA	Level	-2.01613	0.279
	GCA*	1st difference	-9.54347	0.000
8	IP	Level	0.46207	0.982
	IP*	1st difference	-8.57483	0.000
9	NSA	Level	-0.95515	0.755
	NSA*	1st difference	-4.03065	0.005
10	PC	Level	-1.03584	0.726
	PC	1st difference	-2.5474	0.117
11	SD	Level	-2.15474	0.226
	SD*	1st difference	-4.38603	0.002
12	AC	Level	-0.88201	0.779
	AC*	1st difference	-5.27022	0.000
13	AI	Level	-1.19959	0.660
	AI*	1st difference	-3.50176	0.016
14	Residual[#]	Level	-4.41287	0.002

Lag Length: 1 (Automatic - based on SIC, maxlag=6)
**Significant at Lag-1 i.e. I(1)*
***significant at Lag-0 i.e. I(0)*
[#]*ADF test of the residual termed as Engle-Granger cointegration test, a significant value at level indicates that there is a long-term relationship between the variables*.

The Regression Model to establish the predictors of Agriculture growth in Odisha

The table-6 shows the model improvement summary. i.e. in the step wise regression, the R-square value has been increased in every step to reach a higher value of R-square for ensuring a best model. Here in this case the R-square value has been increased by adding and eliminating one independent variable by another and finally reached a value of R=0.994 and R-square i.e. the coefficient of determination is 0.989. Hence, it can be inferred that the model with the selected independent variables explains 98.9% variability in the dependent variable.

Table-6: Linear Stepwise Regression Model Summary

Model	R	R Square	Adjusted R Square	S.E. of the Estimate
1	.948[a]	.898	.895	.11667
2	.982[b]	.964	.961	.07092
3	.991[c]	.983	.981	.05007
4	.993[d]	.986	.983	.04645

5	.994[e]	.989	.986	.04201

a. Predictors: (Constant), FC
b. Predictors: (Constant), FC, FIFC
c. Predictors: (Constant), FC, FIFC, FM
d. Predictors: (Constant), FC, FIFC, FM, ARF
e. Predictors: (Constant), FC, FIFC, FM, ARF, FAAS

Table-7: Test of ANOVA[a] for goodness of model fit

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.248	1	3.248	238.616	.000[b]
	Residual	.368	27	.014		
	Total	3.616	28			
2	Regression	3.485	2	1.742	346.437	.000[c]
	Residual	.131	26	.005		
	Total	3.616	28			
3	Regression	3.553	3	1.184	472.479	.000[d]
	Residual	.063	25	.003		
	Total	3.616	28			
4	Regression	3.564	4	.891	412.991	.000[e]
	Residual	.052	24	.002		
	Total	3.616	28			
5	Regression	3.575	5	.715	405.221	.000[f]
	Residual	.041	23	.002		
	Total	3.616	28			

a. Dependent Variable: SGDPA
b. Predictors: (Constant), FC
c. Predictors: (Constant), FC, FIFC
d. Predictors: (Constant), FC, FIFC, FM
e. Predictors: (Constant), FC, FIFC, FM, ARF
f. Predictors: (Constant), FC, FIFC, FM, ARF, FAAS

Table-8: Stepwise OLS Regression Model Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.718	.363		1.976	.058
	FC	2.195	.142	.948	15.447	.000
2	(Constant)	2.367	.326		7.251	.000
	FC	1.188	.170	.513	6.974	.000
	FIFC	.322	.047	.505	6.861	.000
3	(Constant)	3.845	.365		10.522	.000
	FC	.456	.185	.197	2.467	.021
	FIFC	.348	.033	.545	10.381	.000
	FM	.098	.019	.314	5.212	.000
4	(Constant)	3.012	.503		5.992	.000
	FC	.416	.172	.179	2.411	.024
	FIFC	.343	.031	.537	11.003	.000
	FM	.106	.018	.341	5.968	.000
	ARF	.293	.130	.056	2.247	.034
5	(Constant)	2.823	.461		6.128	.000
	FC	.505	.160	.218	3.159	.004*
	FIFC	.261	.043	.409	6.083	.000*
	FM	.097	.017	.311	5.861	.000*
	ARF	.314	.118	.060	2.651	.014*
	FAAS	.066	.026	.130	2.519	.019*

Dependent Variable: SGDPA
**Significant at 0.05 level*

The results of the OLS Regression model provided in Table-8 could be achieved using it as step wise regression method. It is used to extract only those variables which are contributing towards the agricultural development in Odisha in terms of state's agriculture GDP.The final regression model given in table-7 is perfectly meaningful and not spurious, even though it is built on non-stationary data levels. In addition, there is a long-term positive association between SGDPA,Fund Allocated in Agriculture and allied Sector, Fund allocated in Irrigation and Flood Control in the state, Fertilizer Consumption, Farm Mechanisation, Average Rainfall in Odisha.

It is important to recognize that time series data have a general tendency to increase with time, directly induced by changes in another variable. In certain cases , two time series processes seem to be correlated just because they all evolve over time for causes that may be linked to other unobserved variables (Wooldridge, 2009).In other words, it is necessary to take into consideration the unobserved, trending variables that influence the dependent variable being correlated with the independent variables. If this possibility is ignored the model will have a spurious association between one dependent variable and the independent variables. According to Granger and Newbold, R-squared > d, where d is the Durbin-Watson statistic, is a strong rule of thumb for the assumption that the estimated regression model is spurious one i.e. a non-sense model. From Table-9, it can be observed that R-squared < d; thus, it can be inferred that the calculated regression is not spurious.

Table-9:OLS Regression Model-1 showing R-square and DWS (d)

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
FAAS	0.066	0.026	2.519	0.019
FIFC	0.261	0.043	6.083	0.000
FC	0.505	0.160	3.159	0.004
FM	0.097	0.017	5.861	0.000
ARF	0.314	0.118	2.651	0.014
Constant	2.823	0.461	6.128	0.000
R-squared	**0.989**	Mean dependent var		6.321
Adjusted R-squared	0.986	S.D. dependent var		0.359
S.E. of regression	0.042	Akaike info criterion		-3.320
Sum squared residual	0.041	Schwarz criterion		-3.037
Log likelihood	54.140	Hannan-Quinn criteria		-3.231
F-statistic	405.221	Durbin-Watson stat (d)		**2.116**
Prob(F-statistic)	0.000			
Dependent Variable: SGDPA, Method: Least Squares Sample: 1990 2018, Included observations: 29				

Table-10: Excluded Variables[a] from the regression model-1

Model		**Beta In**	**t**	**Sig.**	**Partial Correlation**	**Collinearity Statistics Tolerance**
1	FAAS	.375[b]	6.119	.000	.768	.426
	FIFC	.505[b]	6.861	.000	.803	.257
	AC	.222[b]	1.781	.087	.330	.225
	AI	-.039[b]	-.329	.745	-.064	.274
	ARF	.050[b]	.813	.424	.157	1.000
	FM	.222[b]	1.647	.111	.307	.196
	GCA	.014[b]	.208	.837	.041	.808
	NSA	-.244[b]	-1.491	.148	-.281	.135
	PC	.196[b]	3.886	.001	.606	.975
	SD	-.178[b]	-1.301	.205	-.247	.197
	IP	.384[b]	4.411	.000	.654	.295
2	FAAS	.189[c]	2.448	.022	.440	.195
	AC	-.010[c]	-.112	.911	-.022	.184
	AI	-.033[c]	-.460	.649	-.092	.274
	ARF	.025[c]	.647	.523	.128	.990
	FM	.314[c]	5.212	.000	.722	.192
	GCA	-.026[c]	-.605	.550	-.120	.793
	NSA	-.059[c]	-.548	.589	-.109	.125
	PC	.066[c]	1.454	.158	.279	.639
	SD	.009[c]	.094	.926	.019	.177
	IP	.052[c]	.474	.639	.094	.120
3	FAAS	.121[d]	2.094	.047	.393	.184
	AC	-.029[d]	-.464	.647	-.094	.184
	AI	-.037[d]	-.737	.468	-.149	.274
	ARF	.056[d]	2.247	.034	.417	.945
	GCA	.039[d]	1.218	.235	.241	.678
	NSA	.031[d]	.393	.698	.080	.118
	PC	.043[d]	1.306	.204	.258	.626
	SD	.098[d]	1.549	.134	.302	.165
	IP	.135[d]	1.814	.082	.347	.115
4	FAAS	.130[e]	2.519	.019	.465	.183

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	AC	-.062[e]	-1.056	.302	-.215	.174
	AI	-.028[e]	-.580	.568	-.120	.271
	GCA	.006[e]	.178	.860	.037	.502
	NSA	.032[e]	.438	.666	.091	.118
	PC	.038[e]	1.245	.226	.251	.623
	SD	.107[e]	1.867	.075	.363	.165
	IP	.076[e]	.935	.359	.191	.091
5	AC	.035[f]	.511	.614	.108	.106
	AI	.040[f]	.790	.438	.166	.196
	GCA	.000[f]	-.007	.995	-.001	.499
	NSA	-.017[f]	-.246	.808	-.052	.108
	PC	-.005[f]	-.143	.887	-.031	.408
	SD	.056[f]	.906	.375	.190	.130
	IP	-.051[f]	-.549	.589	-.116	.059

a. Dependent Variable: SGDPA
b. Predictors in the Model: (Constant), FC
c. Predictors in the Model: (Constant), FC, FIFC
d. Predictors in the Model: (Constant), FC, FIFC, FM
e. Predictors in the Model: (Constant), FC, FIFC, FM, ARF
f. Predictors in the Model: (Constant), FC, FIFC, FM, ARF, FAAS

The table-10 shows the variables which are excluded from the stepwise regression process. The excluded variables again separately used as independent variable for analysing their contribution towards the agriculture growth measured in terms of SGDPA. The corresponding OLS regression model is presented in table-11. The regression model parameters give convincing results with R-square value 0.964 and Durbin-Watson statistics (d) 1.432 which is greater than the R-square value. This indicates that the model is not spurious. From the regression model it can be inferred that irrigation potential is showing a significant positive impact on the growth of SGDPA whereas, the GCA is having a negative relationship with the Growth in the model. However, its first lag difference i.e. D(GCA) is positively and significantly related to the first lag of SGDPA (Table-12). on the other hand, NSA, Agriculture insurance as total sum assured, Agriculture Credit provided to the farmers, seed distribution is not significantly predicting the agriculture growth in Odisha.

Table-11:OLS Regression Model-2 showing R-square and DWS (d)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.853	7.613	2.608	0.016
IP	1.339	0.182	7.368	0.000*
AC	0.040	0.029	1.354	0.190
SD	0.092	0.103	0.895	0.381
NSA	-1.300	2.121	-0.613	0.546
GCA	-2.856	0.825	-3.461	0.002*
AI	0.002	0.025	0.071	0.944
R-squared	0.964	Mean dependent var		6.321
Adjusted R-squared	0.955	S.D. dependent var		0.359
S.E. of regression	0.077	Akaike info criterion		-2.096
Sum squared residual	0.129	Schwarz criterion		-1.766
Log likelihood	37.388	Hannan-Quinn criteria		-1.992
F-statistic	99.218	Durbin-Watson stat (d)		1.424
Prob(F-statistic)	0.000			

Dependent Variable: SGDPA, Method: Least Squares
Sample: 1990 2018, Included observations: 29
**significant at 5% level*

Table-12: OLS Regression Model-3 showing R-square and DWS (d)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.049	0.009	5.629	0.000
D(GCA)	0.999	0.410	2.435	0.022*

D(NSA)	1.138	1.247	0.913	0.370
R-squared	0.358	Mean dependent var		0.044
Adjusted R-squared	0.306	S.D. dependent var		0.053
S.E. of regression	0.044	Akaike info criterion		-3.314
Sum squared residual	0.048	Schwarz criterion		-3.172
Log likelihood	49.401	Hannan-Quinn criteria		-3.271
F-statistic	6.965	Durbin-Watson statistic (d)		2.384
Prob(F-statistic)	0.004			

Dependent Variable: D(SGDPA), Method: Least Squares
Sample (adjusted): 1991 2018, Included observations: 28 after adjustments

Findings of the Study

The findings of the study can be well known from the results of the hypotheses.

Following are the inferences drawn from the hypotheses.

H_1: There is no significant positive relationship between SGDPA and the state's total fund allocated for agriculture and allied sector.**(Reject, p<0.01)**

H_2: There is no significant positive relationship between SGDPA and the state's total fund allocated for irrigation and flood control measures.**(Reject, p<0.01)**

H_3: There is no significant positive relationship between SGDPA and the state's total seed distribution.**(Accept, p>0.05)**

H_4: There is no significant positive relationship between SGDPA and the state's total power consumption in agriculture.**(Not Tested as variable is eliminated from the final model)**

H_5: There is no significant positive relationship between SGDPA and the state's total farm mechanization.**(Reject, p<0.01)**

H_6: There is no significant positive relationship between SGDPA and the net sown area of Odisha.**(Accept, p>0.05)**

H_7: There is no significant positive relationship between SGDPA and the gross cropped area of Odisha.**(Reject, p<0.01)**

H_8: There is no significant positive relationship between SGDPA and the state's total fertilizer consumption.**(Reject, p<0.01)**

H_9: There is no significant positive relationship between SGDPA and the state's total agriculture credit provided to the farmers.**(Accept, p>0.05)**

H_{10}: There is no significant positive relationship between SGDPA and the total crop insurance provided to the farmers.**(Accept, p>0.05)**

H_{11}: There is no significant positive relationship between SGDPA and the average rainfall in Odisha.**(Reject, p<0.01)**

Conclusion

This study covers the analysis of the utilization of funds in agriculture and allied sector in the plan periods starting from 1990 to 2019. Using OLS regression, the effect of the fund allocated for agriculture and allied sector as well as for irrigation and flood control measures has been analysed. It has been concluded that the allocation and utilization of funds in these two sectors are positively affecting the SGDPA and hence agriculture growth in Odisha. The second regression model predicts that irrigation potential in Odisha is positive predictor of agriculture growth again. In the same model it can be found that the seed distribution, net sown area, agricultural credit and crop insurance has no significant relationship with the SGDPA. However, it can also be noticed that farm mechanisation, gross cropped area, fertiliser consumption and average rainfall have positive and significant relationship with SGDPA. It can also be verified that the first difference model of regression for NSA and GCA is positively predicting the Agriculture GDP in the state.

Suggestions

Govt. Policy should be directed to revamp the seed distribution system, expansion of agricultural credit and its timely supply and effective crop insurance mechanism along with the measures to broaden the net sown area so that these factors will have their impact in the agricultural growth of the State of Odisha. It can further be suggested that the process of farm mechanisation and the timely distribution of fertiliser by Govt. should be expanded so as to induce further growth of agriculture in State.

Limitations of the Study

The present study has its own limitations in the sense that the study relies on the data that have been collected as the accurate. If any inaccuracy is encrypted, then the study do not have any yardstick to measure it. It also bears with the limitations that the used model possesses.

Scope for Further Research

It is expected that the researchers will come forward to have further research to study the impact of the factors on the growth of the State Gross Domestic Product from Agriculture covering the period prior to the economic reforms adopted in the nation.

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