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Editor's Desk

Amidst the global economic crisis and growing agrarian distress triggered by COVID-19 pandemic, India's stance towards assuring food security led to a spectrum of policy changes and mechanisms. The policy approach highlights a range of programs and budget allocations that have been prioritized and implemented to tackle food and nutrition aspects in our food systems. To cite, Government of India's National Food Security Act, 2013 has a greater role in transforming our food systems to make it more inclusive and sustainable for higher incomes, employment, and nutrition security. Moreover, sequential policy measures in terms of enhancing agriculture productivity, credit and insurance, adoption of land reforms, technology driven Agri reforms has placed the country in a comfortable position.

Despite the sea change, agriculture sector still grapples with many issues. Declining contribution of the sector to GDP and the slippage of the country in the ranks of food security index (71) and global hunger index (101) compared to others, cemented the centrality of focus for a comprehensive agriculture policy. There is a need for a concrete follow up not only at national but also at state level to achieve the commitments. Accordingly, a refurbishment of agricultural practices namely raising the incomes of the households, diversifying crop production, enhancing agriculture productivity; subsidizing the production and consumption of nutrient rich food crops and facilitating smooth agri value chains and strengthening the labor force participation hopefully bring a real change.

Recognizing the importance of these prioritized areas, the current issue compiles the articles on the following topics: underemployment in India, State Finances, Viability of PDS in Telangana, digitalization of bank credit in India and cropping pattern and agriculture growth in UP.

The article on underemployment highlights the importance of employment guarantee programme in India and is recognized as a safety net for the unemployed youth. Interestingly, we have a paper on Andhra Pradesh State finances which projects the state's inability to meet the FRBM norms laid in Fourteenth Finance Commission.

Similarly, a paper on automated Public Distribution System in the Telangana State finds the technology driven PDS as the most powerful and effective mechanism in the distribution of food grains in the State compared to the traditional manual system. Moving further down the technology driven sector, paper on digitalization of bank credit confirms that increased digital payments leads to an increase in credit outstanding. Finally, the study on regional cropping patterns in Uttar Pradesh observes declining trend in the share of agriculture in the Net State Domestic Product during the study period and marginal change in land use pattern of different crops.

Usha Nori
Editor

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Underemployment in India: Patterns and Determinants

P. Aparna[1]
K. Alivelu [2]

Abstract

This paper attempts to estimate the recent trends in underemployment and unemployment among youth in India by using the Periodic Labour Force Survey, 2019-20. The paper attempts to describe the visible underemployment situation at the all-India level. In this process, it discusses four methods of measuring visible underemployment. The underemployment among workers who work on major time of the year, unemployment of those who work in current week, time related underemployment and volume of time related underemployment. In order to estimate the underemployment based on time, the paper uses the International Conference of Labour Statisticians (ICLS) methodology. The paper finds that the volume of time-related underemployment is higher among urban females compared to other segments of the labour market and more among younger age groups, i.e., 5-14 and 15-29 years. Imparting training among the younger working group may lead to a high wage per hour situation. Provision of employment through the Employment Guarantee Programme reduces underemployment and acts a safety net. This strengthens the argument for the provision of similar works in urban areas too.

Keywords: Skill Training, Time Related Underemployment, Underemployment, Unemployment, Youth, Wage Income

Introduction

For an economy to contour the development configurations and results, the essential prerequisites are the structure of the labour market, patterns of employment growth and labour market institutions. Continuous increase in unemployment leads to loss of income for individuals and reduced collection of taxes for governments, impacting progress and increasing

1 Assistant Professor, Centre for Economic and Social Studies, NO Campus, Hyderabad and can be reached at aparna@cess.ac.in

2 Associate Professor, Centre for Economic and Social Studies, NO Campus, Hyderabad and can be reached at galivelu@cess.ac.in

spending on unemployment benefits and social subsidies. Long-term unemployment can also affect social cohesion, lead to negative opinions about the effectiveness of democratic models, prompt cross-border migrations, and threaten the economy of trading partners (IMF, 2018).

The World Employment and Social Outlook: Trends 2018 has shown the global unemployment rate as a stabilizing trend after an increase in 2016. It was anticipated to have touched 5.6 per cent in 2017, with the total number of unemployed exceeding 192 million persons. The robust performance of labour markets in developed countries attributed to a positive trend during 2017-18, enabling the unemployment rate to decrease by an additional 0.2 percentage points. However, in the case of developing countries, employment growth is likely to be less than the labour force, however, improved compared to 2016. However, this positive trend has not made any progress in decreasing the jobs with no security and low wages. In other words, vulnerable employment stood at 1.4 billion workers in 2017 and 35 million more workers are expected to join this group by 2019 at the global level.

The number of unemployed persons in the early 2000s to mid-2000s stood at 10 million in India while it reached nearly 29 million (more than double) in 2017-18, which is quite alarming. In this period, while there was an increase in the labour force by around 18 million, the jobs that were added in the same period stood at less than one million. Further, there is an increase in the urban labour force as compared to the rural labour force, coupled with a decline in rural jobs and an increase in urban jobs. This led to a sharp increase in male unemployment and also higher than the female unemployment in rural areas. Across the Indian states too it is observed that there is the convergence of unemployment, implying that the worsening on the employment front is consistently spread spatially (Mitra, Singh, 2019).

The recent Periodic Labour Force Survey (PLFS) 2017-18 estimated the unemployment rate in India at around 6 per cent according to the Usual Status criterion and is at an all-time high. It has been the highest since 1977-78 among the males and the highest since 1983 among the females in rural as well as in urban areas (Mitra, Singh, 2019). Further, it is observed that a large percentage of workers are engaged in informal employment and a huge majority of them have low earnings with limited or no social protection (India Labour Employment Report 2014). Despite several government initiatives to formalize the economy, a large percentage of total employment is informal (Santosh, Parida, 2019).

While unemployment is the traditional measure of the labour market, an important dimension of the labour market – underemployment is always missed. Underemployment can be a temporary transitional period for acquiring additional skills and experience, a stepping stone or bridge into

more desirable situations, or a stop-gap before career decisions are made (Alpin et al., 1998, Batenburg and DeWitte, 2001).

Underemployment or marginal workers seeking work has two aspects – (i) the overall underutilisation of labour time (ii) incidence of underemployed in the labour force. The problem of underemployment is more serious than chronic or full unemployment in rural India (Paul, S 1988). The phenomenon of underemployment relates closely to the phenomenon of over-education, which goes back to the 1970s when the supply of educated workers outpaced the demand in the labour market, apparently resulting in a substantial reduction in the returns to schooling (Freeman 1976; McGuinness 2006). While underemployment finds a large echo in the media, there is surprisingly little work on the determinants of underemployment and its implications for business (Regis, Yanos, 2019).

Against the above background, the present study attempts to study the underemployment and unemployment in the recent time in India, by examining the PLFS data. Further, the study also focuses on the correlates of underemployment and unemployment by scrutinizing the distribution of underemployment and unemployment by their characteristics like structural change (farm to non-farm activity) and education.

Objectives

- To estimate youth underemployment and unemployment among males and females in rural and urban areas at all India level.
- To study how socio-economic, job related and institutional factors impact the underemployment and unemployment rate in India and across the states.

In the subsequent paragraphs the study discusses about the sources of data, methodology for the estimation of underemployment and unemployment, various measures and determinants of underemployment and the summary in that order..

Sources of Data and Methodology

PLFS data are scrutinised to comprehend the nature of underemployment and unemployment both in rural and urban areas and among males and females in India and across the states. Further, the study estimates the time-related underemployment using the survey data.

The measurement of underemployment suggested by the sixteenth International Conference of Labour Statisticians (ICLS) is based on time-related underemployment. A number of persons and volume of work in terms of days or hours are the two elements of time-related underemployment. In order to consider a person as being underemployed, the person must satisfy all the three criteria such as willingness to work for

additional hours, available for additional hours and should have worked below the specified threshold during the reference period. However, most of the labour force surveys collect information on the willingness and availability to work additional hours jointly as it is difficult for the survey respondents to distinguish their availability for additional work from the desire for additional work. According to the ICLS definition, the time-related underemployed includes those employed persons who are willing and available to work additional hours only if the total hours worked were below the threshold. This threshold will be determined by the boundary between full-time and part-time employment, median values, averages, or norms for hours of work as specified by legislation or labour practices in countries. All the underemployed persons under this measure will have the same-weights irrespective of the number of additional hours that they are available for. The volume of time-related underemployment accounts for such differences. The rate of volume of time-related underemployment is measured by taking the ratio of hours available to the potential time for work of employed persons (hours worked + hours available) (ILO Bureau of Statistics, Hussmanns, Ralf, 2007).

Following the above guidelines, the present study attempts to measure underemployment based on the Periodic Labour Force Survey unit-level data pertaining to 2018-19 and 2019-20. The survey provides estimates of actual hours worked and additional hours available for work based on current daily status. Underemployment among workers is estimated by considering the actual hours worked of those available for additional hours. The median hours, i.e. 56 hours per week as the threshold, is taken into consideration.

Further, OLS regression technique is administered to find out the possible factors that influence underemployment among the youth population in India Demographic, socio-economic characteristics such as age, education, training etc., work-related viz., type of employment, farm and non-farm sector and income-related aspects such as per capita wage incomes of the household are the determining factors of underemployment covering both the demand and supply sides.

Underemployment in India

Unemployment is defined as the situation of a lack of work. In many developing countries, there is limited coverage of workers by social security and many people cannot afford to be unemployed. Thus, unemployment is low in these countries. People undertake many activities though inadequate and for a lesser time period for their survival. Hence employment situation cannot be completely described by unemployment data alone, statistics on underemployment need to be supplemented. The concept of underemployment has been integrated into the labour

force framework to identify the situations of partial lack of work. Due to changing employment situations, labour market flexibility, and rise of various forms of non-standard employment, underemployment is relevant even for developed countries.

There are two forms of underemployment – visible and invisible. The situation of insufficient employment depicts the visible underemployment while low-wage, under-utilisation of skill and low productivity describe the invisible underemployment. The present study presents the visible underemployment situation in the country.

There are two categories of visible underemployment. Firstly, some persons who are usual workers may not get employment throughout the year due to seasonality in work and are unemployed during the current week and hence underemployed. Secondly, persons who have been categorised as workers during the current week may not have work throughout the week and are willing to and available for work are defined as underemployed.

Category I of Visible Underemployment

It is measured as those who are workers as per the principal status but are unemployed as per the current weekly status. The visible underemployment as per this definition is 1.97 per cent at the all-India level during 2019-20. It is at 2.13 per cent for males and 1.52 per cent for females and 2.08 and 1.69 per cent in rural and urban areas respectively (Table-1). Thus, the underemployment rate is higher in rural areas than that in urban areas and across the gender, it is higher among males as compared to that of females. The latter observation may be due to the reason that when there is no work available for women, they will not declare themselves as unemployed but continue to engage themselves in free collection of goods and backyard poultry etc. and increase their real wages being out of labour force.

Across the age groups, the visible underemployment of category-1 is higher among the younger age group, i.e. 15-29 for both males and females at 2.82 and 2.02 per cent respectively. However, underemployment is also found among boys belonging to the 5-14 years age group in urban areas. The underemployment for boys is at 4.48 per cent highest among all the categories considered.

Table-1: Visible Underemployment-Category I- 2019-20 (%)

Gender	Age-Group	Rural	Urban	Total
Male	5-14	0.00	4.48	1.83
	15-29	2.92	2.57	2.82
	30-59	2.14	1.45	1.93
	60+	1.47	2.17	1.62
	All	2.27	1.79	2.13

Gender	Age-Group	Rural	Urban	Total
	5-14	0.00	0.00	0.00
	15-29	2.27	1.38	2.02
Female	30-59	1.37	1.36	1.37
	60+	1.69	0.98	1.55
	All	1.58	1.34	1.52
	5-14	0.00	3.66	1.14
	15-29	2.77	2.31	2.64
Persons	30-59	1.91	1.43	1.77
	60+	1.52	1.94	1.61
	All	2.08	1.69	1.97

Note: 0.00 indicates a very insignificant percentage

Source: Unit record data of PLFS 2019-20

Category II of Visible Underemployment

It is measured as those who are categorised as workers during the current week but not on all the seven days. There are some days of the week when there is no work for them. It is measured as the percentage of current weekly workers who have reported themselves as unemployed during some days of the current week in the total workers as per the current weekly status. According to this measure, underemployment is higher than that of category I. It is because of the 'major time criteria' that decides the activity status of a worker. For example, if a worker works for 4 days and remained unemployed for three days, he is considered as worker on the basis of 'major time criteria'. The underemployment rate as per this definition is 9.31 among males while it is 8.62 for females (Table-2). Thus, nearly 10 per cent of workers have not worked on all the days of the reference week and the average number of unemployed days is ranging between 2.5 to 3 days during the reference week. These rates are higher in rural areas than in urban areas for both males and females. While 11 per cent of males from rural areas fall in this category and 6.9 per cent of males from urban areas, belong to this category. These rates for female are lower than that of male but the rural female has shown a higher percentage than their counterparts in urban areas. Around 10 per cent of rural females and 4.4 per cent of urban females are reported as underemployed according to this category.

Across the age groups, though the rates are lower among the children (5-14 years) around 7 per cent of boys in rural areas and 9 per cent of boys in urban areas have been reported as underemployed. However, the highest percentage of underemployed is found among 15-29 years males while among females it is found in the 30-59 age group.

Table-2: Visible Underemployment-Category II- 2019-20 (%)

Gender	Age-Group	Rural	Urban	Total
	5-14	6.71	9.06	7.60
	15-29	13.81	8.37	12.20
Male	30-59	10.60	6.41	9.31
	60+	7.46	5.45	7.03
	All	11.10	6.85	9.84
	5-14	8.21	0.00	7.06
	15-29	8.97	1.99	6.97
Female	30-59	10.12	4.71	8.90
	60+	10.82	11.06	10.87
	All	9.94	4.38	8.62
	5-14	7.43	7.28	7.39
	15-29	12.70	6.97	11.02
Persons	30-59	10.46	6.02	9.19
	60+	8.19	6.55	7.85
	All	10.78	6.30	9.52

Note: 0.00 indicates very insignificant percentage

Source: Unit record data of PLFS 2019-20

Time-Related Underemployment

It is measured as a percentage of those who are categorised as workers worked less than the threshold/normal working hours in a week and available for additional hours of work to total workers according to current weekly status. The results show that 2.45 per cent of rural workers and 1.49 per cent of urban workers have been reported as underemployed on the basis of time-related criteria (Table-3). Similar to the measures mentioned in previous sections, these rates are also higher in rural areas than in urban areas. However, contrary to the results observed in the other measures, females have shown higher underemployment rates than that of males particularly in urban areas. Around 2.8 per cent of rural females as against 2.33 per cent of rural males have reported underemployment, while 3 per cent of urban females as against 1 per cent of urban males have shown underemployment as per the time-related underemployment measure during 2019-20. Further, time-related underemployed is found among the children, i.e. 5-14 years across all the categories. These observations show that child labour is still continuing in India though the incidence is low. When we examined the average number of unemployed days for those who categorised as time-related underemployed, we found nil or very less number of unemployed days. It may be that when there is no work,

children withdraw from work and might take part in household duties, free collection of goods or attending educational institutions.

Table-3: Visible Underemployment-Time Related Underemployment -2019-20 (%)

Gender	Age-Group	Rural	Urban	Total
	5-14	2.28	1.49	1.98
	15-29	1.91	1.27	1.72
Male	30-59	2.38	0.97	1.95
	60+	3.01	0.86	2.55
	All	2.33	1.04	1.94
	5-14	7.29	5.57	7.05
	15-29	4.14	2.38	3.64
Female	30-59	2.43	3.39	2.65
	60+	2.44	1.73	2.30
	All	2.78	3.04	2.84
	5-14	4.68	2.29	4.00
	15-29	2.42	1.51	2.15
Persons	30-59	2.40	1.52	2.15
	60+	2.89	1.03	2.49
	All	2.45	1.49	2.18

Source: Unit record data of PLFS 2019-20

Volume of Time-Related Underemployment

It is mentioned that under time-related underemployment, all the underemployed will have the same weight irrespective of the number of hours they are available for additional work. If the time-related underemployment (those who work less than the threshold and available for more hours of work) is taken as a ratio of potential time of the workers (additional hours available to work + actual hours worked), it will explain the volume of time related underemployment.

Table-4: Visible Underemployment-Volume of Time Related Underemployment **- 2019-20 (%)**

Gender	Age-Group	Rural	Urban	Total
	5-14	22.0	54.8	30.2
	15-29	29.7	26.7	29.0
Male	30-59	25.4	21.7	24.8
	60+	24.2	28.4	24.5
	All	26.2	23.6	25.7

Gender	Age-Group	Rural	Urban	Total
	5-14	11.6	44.4	16.7
	15-29	29.9	37.8	31.4
Female	30-59	25.0	35.9	28.3
	60+	22.9	35.2	24.7
	All	26.2	36.3	28.8
	5-14	14.6	48.8	20.8
	15-29	29.7	30.2	29.8
Persons	30-59	25.3	28.3	25.9
	60+	24.0	30.6	24.5
	All	26.2	28.9	26.7

Source: Unit record data of PLFS 2019-20

The volume of time-related underemployment is estimated at 27 per cent during 2019-20 and it is slightly higher in urban areas (28.9 per cent) as compared to rural areas (26.2 per cent). These trends show that the potential rate of employment during the reference week is 73.8 per cent in rural areas, while it is 71 per cent in urban areas. Across the gender, the volume of time-related unemployment is higher among females in urban areas while it is the same for both males and females in rural areas. Thus, underemployment to the potential level of workers is higher in urban areas, more so among female workers in India. The volume of time-related underemployment is lower among the younger age groups i.e. 5 to 14 years. However, urban areas have shown a higher percentage of the volume of time-related underemployment in this age group at 55 per cent among boys and 44 per cent for girls. These results need to be taken carefully because working few hours than their potential leave them with low wage income and put them neither in education nor in workplace in full-time. Provision of employment through the Employment Guarantee Programme reduces underemployment and acts as a safety net. This strengthens the argument for the provision of similar works in urban areas too.

Determinants of Underemployment

An attempt is made here to find out the determinants of underemployment in India. Underemployment measures the unused potential working hours of the youth which will affect the productivity of the country. Economic fluctuations, low or no growth of employment, technical advancements, employer's preferences and characteristics of jobs are some of the demand-side factors. Changes in the skill composition of the workforce,

increasing number of graduates, increased expectations of graduates, poor health and unavailability of child care services are the supply-side factors. Implementation of minimum wages, employee protection legislations, trade unions etc., form the institutional factors (Lacmanovic, Sabina et al. 2016).

The time-related underemployment in terms of percentage is the dependent variable. The explanatory factors are categorised as socio-economic factors, type of employment, job characteristics and institutional factors. Age, years of education and skill training are socio-economic factors, self-employment, regular employment and casual employment constitute the type of employment, employment in agriculture and in non-agriculture sectors are the variables representing the characteristics of job and wage income per capita represents institutional factors (Table-5).

Table-5: Description of Variables for Regression Equation

Variable		Description
Dependent Variable		
Underemployment	Time related underemployment	Percentage
Explanatory variables		
X_1 Gender		Male=0; Female =1
X_{1D}- Age	Age	15-29=0; 15-59=1
X_2-Average years of education (general and technical)	Years of education	No of years
X_{3D-} Skill training	Training	Not received training=0; Received training=1
X_{5D--} Wage-employed	Wage employed	Others=0;Wage employed=1
X_{7---D-} Per Capita Wage income	Per Capita Wage income	Income in Rs

Analysis of Regression Results

The sample size is 2778 workers aged 15 to 59 years spread across the country, 2088 workers in rural areas and 690 workers in urban areas. The overall R^2 for the estimated model output was found to be 0.0886 (or about 9 per cent) while its associated Adj. R^2 was observed to be 0.0863. The *Mean VIF was found to be 2.74 indicating no presence of multicollinearity* among the variables in the dataset. Further, Breusch-Pagan / Cook-Weisberg test for heteroscedasticity revealed an estimated chi2 (1) = 98.78 (with Prob > chi2 = 0.0000), indicating the presence of heteroscedasticity in the above model dataset (Table-6)

Among the above 6 variables we further observe that barring 'no of years of formal education', which was found to be insignificant and 'skill training dummy,' which was found to be significant at 5 per cent level of significance. All other variables were found to be highly significant at 1 per cent or lower level of significance.

Regarding gender; the level of underemployment was found to be higher for females by 3.316 units. Among the age groups, the level of underemployment was found to be lower for the age group 30-59 years by -3.545 units. In the case of training, the level of underemployment was found to be lower for those who received training by -3.448 units. As regards casual labour, the level of underemployment was found to be lower for the other workers by -7.785 units.

The institutional factor i.e. per capita wage across workers has shown a negative sign indicating that higher wage level lowers the underemployment. It is expected that workers seek additional hours of work to earn more at lower wage levels.

Thus, underemployment is more among the younger generations who work as manual casual labour, which will have a greater impact on the levels of living of a major section of the population in the country.

Table-6: Determinants of Time Related Underemployment-Regression Results

Model	Initial Model	Final Model with Heteroscedasticity	Final Model with Heteroscedasticity-consistent Robust Standard Errors
Dependent Variable (% of time related underemployment)			
	(1)	(2)	(3)
GenderDummy	3.134***	3.316***	3.316***
AgeDummy	-3.874***	-3.545***	-3.545***
TrainingDummy	-3.601*	-3.448*	-3.448*
Casual LabourDummy	-7.924***	-7.785***	-7.785***
Years of formal education		0.109	0.109
Wage income per capita	-0.0007***	-0.0008***	-0.00076***
Constant	40.90***	39.40***	39.40***
N	2782	2782	2782
Prob>F	0.000	0.000	0.000
R^2	0.0876	0.0886	0.0886
Adj. R^2	0.0856	0.0863	-
RMSE	14.233	14.227	14.227

Source: Author's Calculation: t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Summary and Conclusions

Underemployment is an important dimension of the labour market in India. It reflects the overall underutilization of labour which is more serious than unemployment. Further, there are visible and invisible kinds of underemployment in the country. Though the former can be measured, it has various dimensions - underemployment of those who work in most part of the year, unemployed days of those who work in for the reference week, working less than the threshold hours of work for a week and available for an additional hour, the gap in the additional hours and potential hours

of work. The latter two are termed as time-related underemployment and volume of time-related underemployment. According to the ICLS definition, the time-related underemployed includes those employed persons who are willing and available to work additional hours only if the total hours worked were below the threshold. The limitation of this measure is that it will not differentiate workers based on the number of additional hours of availability. However, the volume of time related underemployment accounts for such differences. It measures the hours available as a proportion of the potential hours of a worker.

The estimates on underemployment for all the four methods are made for rural and urban areas across the gender and age groups for all-India based on PLFS 2019-20 unit data. The estimates as per the first two methods are higher in rural areas as compared to that of urban and across the gender, these rates are more for men than men. The lower estimate for the female is due to the fact that when there is no work, female workers continue to work for the household for both economic and non-economic activities and they do not explicitly consider themselves as underemployed or unemployed. The underemployment as per these two methods is higher among younger age groups than older.

The estimates according to time-related underemployment and volume of time-related underemployment, similar to the above, are higher in rural areas than in urban areas in the case of the former while it is converse in the case of the latter. However, contrary to the results observed in the other measures, females have shown higher underemployment rates than that of males, particularly in urban areas. Thus, tackling the underemployment situation of the urban female is a serious challenge for the labour market. Provision of employment through the Employment Guarantee Programme reduces underemployment and acts as a safety net. This strengthens the argument for the provision of similar works in urban areas too. Another worrisome fact is that underemployment rates are higher among younger age groups than older. The worrying situation is that children in the age group 5-14 are working and available for additional hours to work in urban India. That shows they are neither in education nor in work on a full-time basis. Provision of training to the unskilled youth may lead to a situation of better employment and wages.

The regression results also show that underemployment is more among females, youth and unskilled casual workers. Further underemployment declines as wage income increases which show that wage per hour is more important than the number of hours worked. Imparting training among the younger working group may lead to a high wage per hour situation.

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Andhra Pradesh State Finances: Initial Years of AP Reorganisation Act, 2014[1]

N. Sreedevi[2]

Abstract

Andhra Pradesh Reorganisation Act, 2014 (APRA, 2014) pushed Andhra Pradesh (AP) into murkiness in almost all aspects. The consequence of split of the state is multidimensional. Illogicalities in APRA, 2014, mainly relating to allotment of tax arrears; disappointing economic composition; with seven backward districts (of the total 13 districts), very few urban areas; and deprivation of eclectic and engrained Organizations of National reputation pressurizes the economic and social development and ultimately state exchequer. AP state, which had a revenue surplus situation tumbled into a dearth condition. Having reservations regarding assessment of Resource Gap for 2014-15 fiscal year further burdened the state budget. Incompatibility between high-speed growing expenditures and slow-uptake of own resources led to a dependency on central transfers. Hence, the AP state fails to reach the FRBM norms such as fiscal deficit / GSDP and debt / GSDP indicators set by Fourteenth Finance Commission.

Keywords: Expenditure, Fiscal Deficit, GSDP, Public Debt, Receipts, Revenue Deficit

Prologue

On 01 March 2014, APRA, 2014, for reorganization of AP, received the President's nod. June 02, 2014 was the 'appointed day' for the bifurcated state(s). With this effect AP state, which had 23 districts, truncated to 13 districts (Recently these 13 districts were restructured into 26 districts). State reorganization, obviously, altered and also impaired the existing system of AP state by disappointing economic composition on one hand

1 This paper highlights a few fiscal issues taken from the Study on Evaluation of Andhra Pradesh State Finances (May 2019) sponsored by (submitted to) 15th Finance Commission). This study was undertaken at Centre for Economic and Social Studies, Hyderabad – 500 016, Telangana, India.

2 Faculty (Retired), Centre for Economic and Social Studies, Hyderabad, Telangana. At the Centre, the author was the lead researcher of the Study on Evaluation of Andhra Pradesh State Finances sponsored by (submitted to) 15th Finance Commission. Currently, the author is an Invited Faculty at Central University of Andhra Pradesh, Anantapuramu and can be reached at nsreedevi2009@gmail.com

and the state's dismal fiscal situation on the other. Restoration of sound public finance of AP state again depends on the existing unfavourable economic composition of Gross State Domestic product (GSDP)/ Gross Value Added (GVA). Hence it is a herculean task to truncated state of AP.

AP was one among innovative sub-nationals to begin reforms in economic and fiscal sectors earnestly in middle of 1990s. The efforts made by the AP gave significantly favourable results. State's Revenue deficit situation turned into a surplus revenue situation by 2006-07 - attaining the goal of Fiscal Responsibility and Budget Management (FRBM) Act. This achievement is two years in advance of the set period by FRBM Act. This revenue surplus financed nearly 50 per cent of the state's gross fiscal deficit. Since then, in spite of the fiscal disturbances, revenue surplus situation being maintained by the AP state till the date of bifurcation.

With the effect of state partition, Revenue Surplus situation turned into a revenue deficit. In addition to this, many backward districts, no state capital, unfavourable economic composition of Gross Value Added (GVA) and their growth rates held the state in an uncomfortable zone.

With this backdrop, the objective of the present paper is to study peripherally,

- composition of AP GVA, its comparison with All India average
- sectoral growth rates of AP GVA
- the fiscal situation during the financial year of state bifurcation i.e., 2014-15 and
- the fiscal situation during initial years of state bifurcation - 2015-16 to 2018-19

Sources of Data, Time-frame of the Study and Method Approached

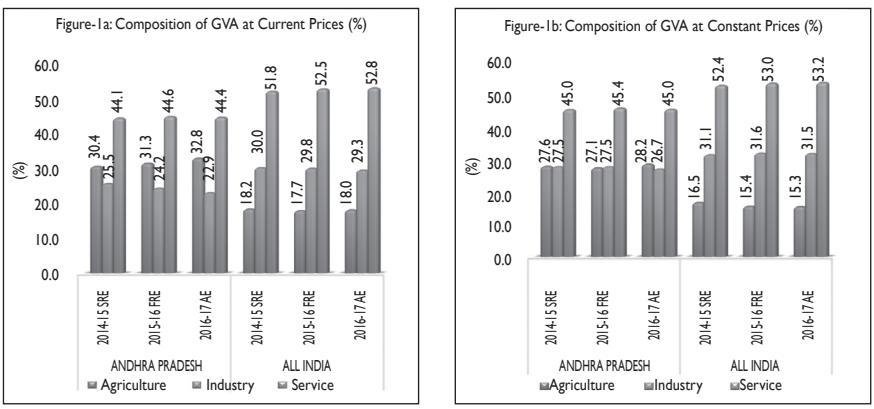
The study is mainly based on secondary sources of information. AP State government budget documents, Socio-Economic Survey, and its associated publications, Finance Accounts and Audit reports published by the Comptroller and Auditor General, Hyderabad. As AP reformation commenced w.e.f. June 2, 2014, public finance data, i.e., budget data (accounts / actuals), for the fiscal year 2014-15, are available only for 10 months. Thereafter data for full financial years are available. The study has Accounts for the fiscal years 2015-16 as well as 2016-17. For the years 2017-18 and 2018-19, the data are related to revised estimates (RE) and budget estimates (BE), respectively. Thus, the period of the study wraps the initial four years of APRA, 2014. The study applied only naïve or unsophisticated statistical tools such as ratios / percentages year-on-year growth rates for the purpose of analysis.

This paper gives an economic and financial status of AP during the ten months period of 2014-15 i.e. at the time of state division followed by fiscal scenario for the remaining study period mentioned above. Later, elucidates the Own Revenues of the State and Expenditure, its Trends and Patterns. Discussing further the deficits and public debt trends in the state, the paper wraps up providing holistic view of the State finances post reorganization Act.

Economic and Fiscal Situation of AP - 2014-15

The impact of APRA, 2014 is multidimensional on AP State. Perceptibly, the state exchequer and socio-economic development were hard-pressed by following whys and wherefores (a) no State Capital, (b) AP has Low tertiary and secondary sectors and high primary sector that mirrored in GVA of the economy when matched with All India GVA, both in money(current) and real(constant) prices – in short,compositional change (Figure-1), (c) seven backward districts out of the total 13 districts, (d) insufficient urbanization and (e) deprivation of eclectic and engrained Organizations of National fame. The year-on-year growth rate of state GVA also shows a higher growth rate in the agriculture sector, followed by the other two resulting in lower growth in total GVA (Figure-2).

Figure-1: Composition of GVA at Current and Constant Prices: AP vs All India (%)

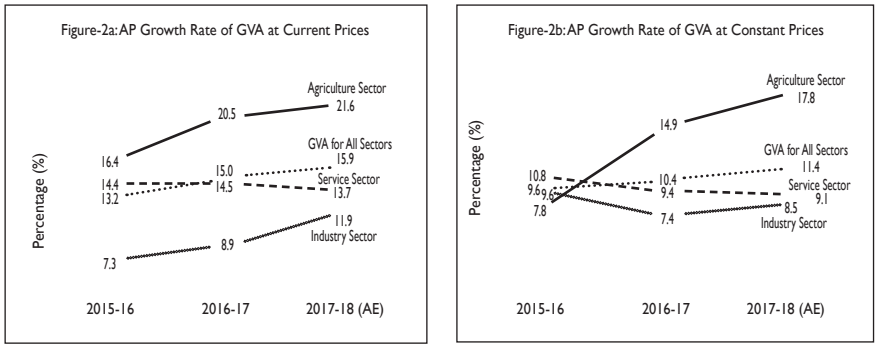


Note: GVA: Gross Value Added; SRE: Second Revised Estimates; FRE: First Revised Estimates; AE: Advanced Estimates

Source: Socio-Economic Survey 2017-18, Planning Department, Government of Andhra Pradesh

State Reorganization has thrown down AP state finances into deficit situation (Figure-3).Apprehensiveness w.r.t. Resource Gap assessment for the fiscal year 2014-15 and inconsistencies within APRA, 2014, (Source: Foundation for Democratic Reforms)

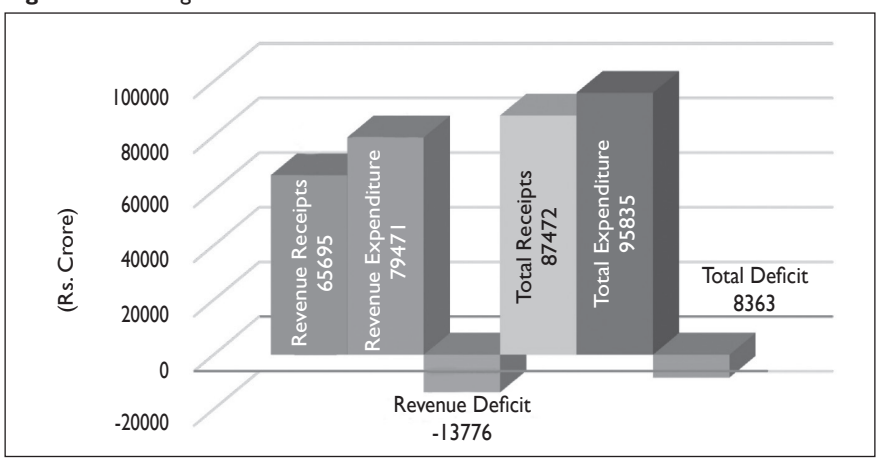
Figure-2: Yearly Growth Rate of AP GVA at Current and Constant Prices (%)



Source: Socio-Economic Survey 2017-18, Government of Andhra Pradesh

Independent Group of Experts Report on Issues Related to AP Reorganisation Act, 2014 (2nd August 2018)) burdened state exchequer. Allotment of tax arrears to the state added trouble to the state budget (Box 1). UDAY scheme impacted the burden of interest payment, deficits (both revenue and fiscal) and mounting liabilities. Concurrently adherence to the Fourteenth Finance Commission set targets - fiscal consolidation path and the fiscal targets - became a colossal task for AP to uplift the state public finance. In this vulnerable fiscal situation, a paper on the Assessment of AP Finances becomes essential.

Figure-3: AP Budget at a Glance: 2014-15



Source: AP Budget Documents and

Government of Andhra Pradesh (2017): Report of the Comptroller and Auditor General of India on State Finances for the year ended March 2016, *Report No. 3*

Box 1: Anomalies in APRA 2014, specifically relating to the distribution of tax arrears

APRA, 2014, Section 50, offers the entitlement to recuperate tax arrears or duty on property, comprising arrears of land revenue, shall belong to the inheritor State in which the property is situated, and the right to recover arrears of any other tax or duty shall go to the inheritor State in whose domains the place of valuation of that tax or duty is included on the appointed day.

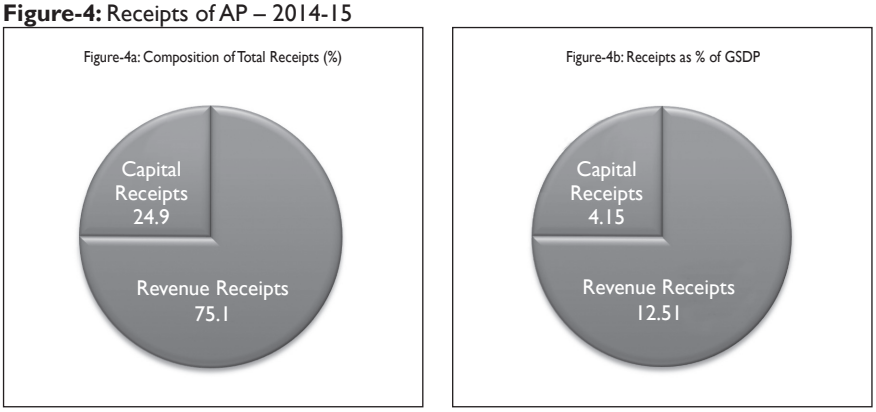
Since arrears belongs to pre state bifurcation period, rationality lies in the division of collected arrears between the two successor states. This anomaly in section 50 of the Act, prompted the AP government to assess the loss which turned out to be around Rs. 3,820 crores. Similar anomaly in Section 56 of the Act that makes the State liable to refund any tax or duty on property including land revenue, shall be apportioned between the successor's states on the basis of population ratio.

Source: Foundation for Democratic Reforms. Independent Group of Experts Report on Issues Related to AP Reorganisation Act, 2014 (2nd August 2018)

State Government Receipts – 2014-15

State's Revenue Receipts, in total receipts, constituted 75 per cent and the leftover 25 per cent came through capital receipts (Figure-4). The percentage of total revenue and capital receipts to GSDP constituted 12.51 per cent and 4.15 per cent respectively – together accounted for 16.66 per cent of GSDP.

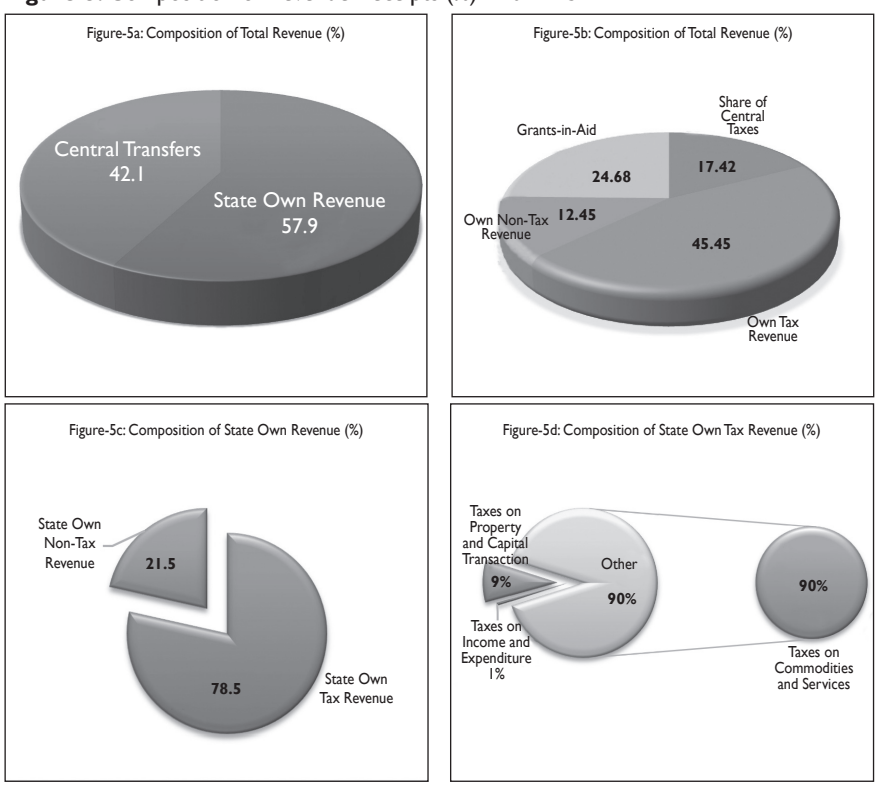
Figure-4: Receipts of AP – 2014-15

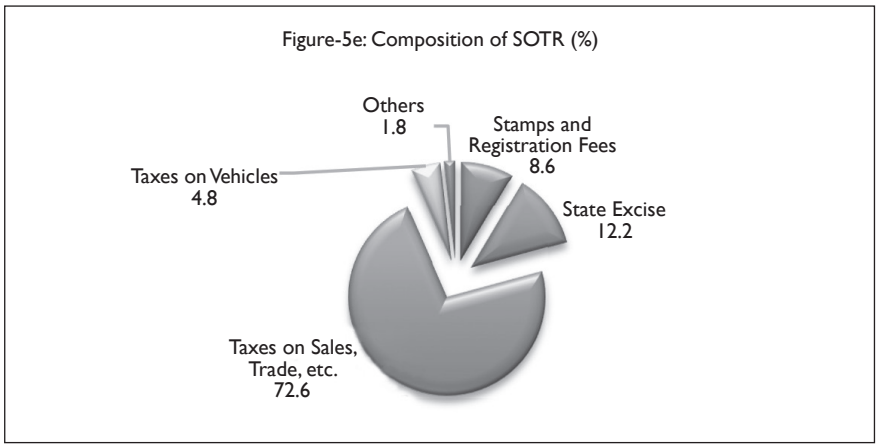


Major sources of total revenue consists of own tax and own non-tax (together called AP's own revenue) and Central shared taxes and grants-

in-aid (put together called central transfers). About 58 per cent of the total revenue was covered by the State own revenue, while the remaining 42 per cent came from resources transfers from the Centre (Figure-5a). The proportion of grants-in-aid was more than the share in central taxes (Figure-5b). This showed the state's fiscal reliance mainly on central grants-in-aid. The State's own tax revenue constitutes nearly 46 per cent of total revenue (Figure-5b) and nearly 79 per cent of state own tax revenue (Figure-5c). A major portion of own non-tax revenue was through interest receipts. Other non-tax revenues consist of services such as general, social and economic followed the earlier. State own non-tax revenue remained a minimal contributor either to the total revenue or to the own revenue. Major sources to own tax revenue include Revenue from the commercial tax, state excise duty, stamp duty and registration fee and motor vehicles tax including goods and passengers' tax. Of the total tax revenue, about 90 per cent is collected by levying taxes on commodities and services (Figure-5d). While revenue from sales tax contributed major portion around 73 per cent to the state own tax revenue,rest of the portion spreads across other major taxes and duties (Figure-5e).

Figure-5: Composition of Revenue Receipts (%) - 2014-15





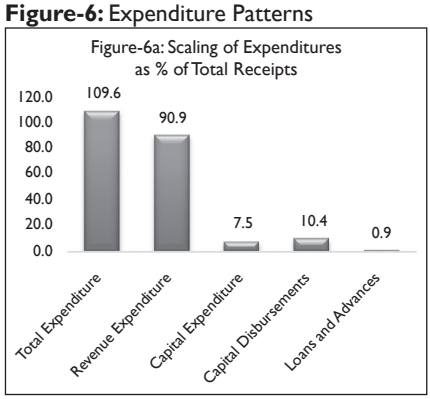
Expenditures of the State Government

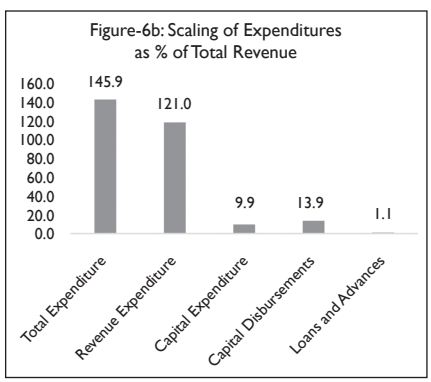
As has been already mentioned, aggregate or total expenditure is more than aggregate or total receipts by 9.6 percentage points (Figure-6a). It is more than total revenue by 46 percentage points (Figure-6b).

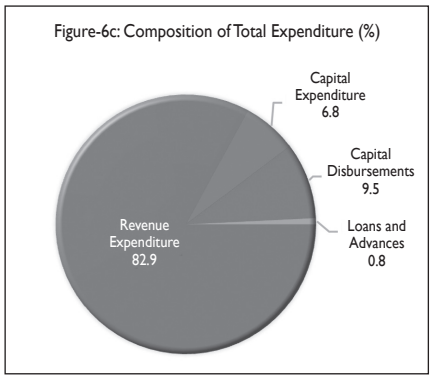
Under the Revenue account, expenditure is larger than revenue by 21 percentage points, denoting the inadequate revenue receipts to cover the repetitive expenses under the revenue account. Revenue expenditure comprises around 83 per cent of total expenditure (including disbursements). About 92 per cent (Figure-6c and Figure-6d) of total expenditure (net of disbursements) absorbed by revenue expenditure.

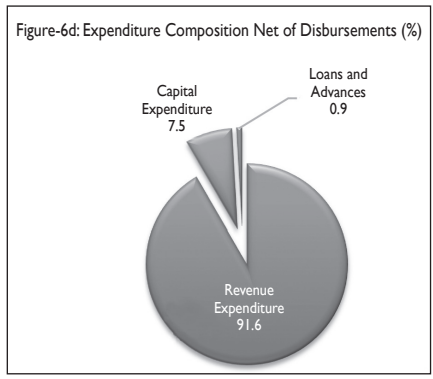
The share of total expenditure (together with disbursements) is 18.26 per cent of GSDP (Figure-6e). The share of revenue expenditure in GSDP is 15 per cent. The other components of expenditure are very meagre.

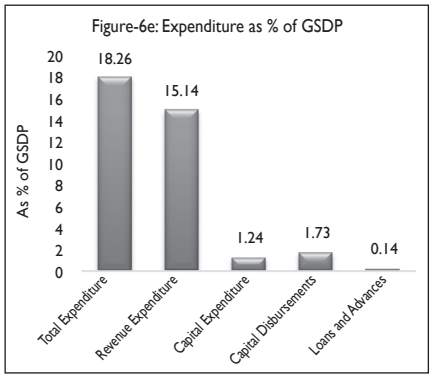
Figure-6: Expenditure Patterns

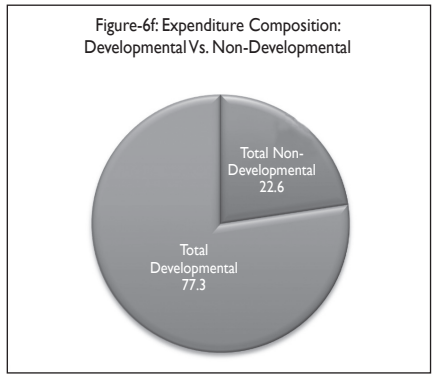












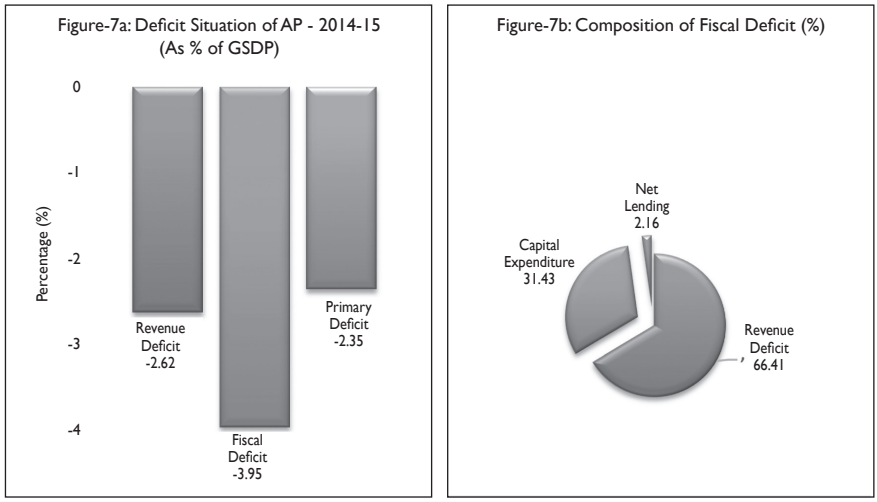
Developmental expenditure constitutes more than three-fourths of total expenditure (net of capital disbursements) while non-developmental expenditure covers less than one-fourth (Figure-6f).

Deficit and Debt Situation

Both receipts and expenditure together i.e., net result, shows the fiscal health of an economy. The revenue deficit situation raised because of excessive revenue expenditure over total revenue, (Figure-7a). AP State reached Fiscal deficit / GSDP to 3.95 per cent which is more than the FRBM target fixed by Fourteenth Finance Commission i.e., 3 per cent.

The decomposition of fiscal deficit (Figure-7b)) showed that revenue deficit constituted 66.41 per cent while capital expenditure and net lending, which are meant for development purpose, constituted 31.43 per cent and 2.16 per cent respectively.

Figure-7: Deficit Situation of AP -20114-15



Again, it is important to see how the borrowings (Public debt) are spent. In 2014-15, the public debt raised amounted to Rs. 21480.79 crores. Out of this amount, repayments made amounted to Rs. 9098.82. Thus, more than 40 per cent of the borrowings are channelled towards debt repayments (Figure-8). Henceforth, the net debt Rs. 12381.96 crores (approximately 58 per cent of the debt raised) was left in the hands of the state government. This net debt is not adequate to meet at least the revenue deficit. So, the argument of net-debt funding growth-related activities, for example, capital outlay and net lending, is ruled out. To fill the remaining part of the fiscal deficit, the state relies upon the public account borrowings.

Figure-8: Public Debt: Raised, Repaid and Net (Rs. Cr)

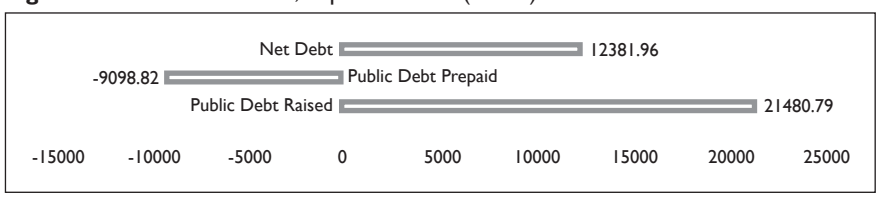
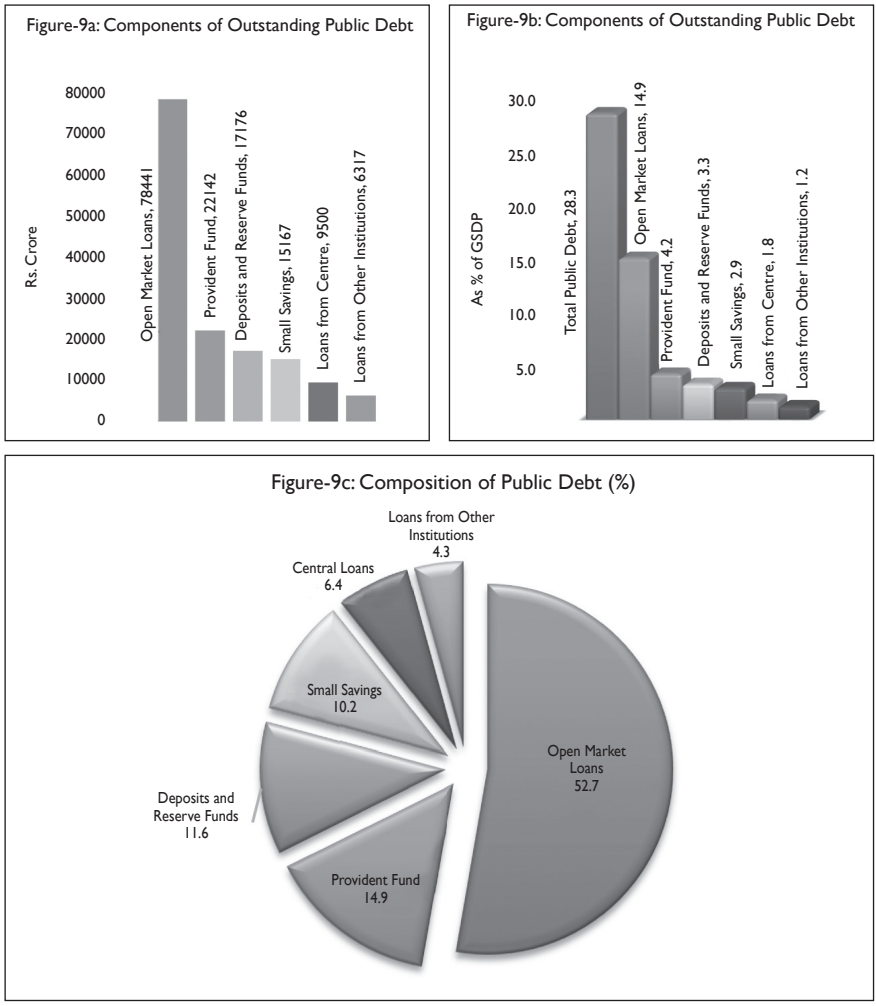


Figure-9a and Figure-9b explains the overall outstanding public debt (Rs. 148743.5 crores) and Debt / GSDP (28.33 per cent) respectively. Repayment of public debt absorbed about 42.36 per cent of the debt raised. In addition to the net debt (nearly 58 per cent of the debt raised), the state relied on the resources of the public account. Open market operations constituted over 50 per cent of the outstanding debt (Figure-9c).

Figure-9: Public Debt: Components and Composition



Source: Government of Andhra Pradesh (2018): Table– 9**,** Volume VI, Andhra Pradesh Budget in Brief 2018

For GSDP, Socio Economic Survey 2017-18, Planning Department, Government of Andhra Pradesh

AP Fiscal Scenario – 2015-16 to 2017-18 RE

Revenue augmentation measures are given a special position in the context of the necessities to decrease fiscal disproportions at any level of the economy. These measures largely focus on the improvement of the tax receipts through altering the structure of tax – modification in the rates of tax, widening the tax base – refining tax submission or compliance. Another key proposal associated is the introduction of Goods and Service Tax (GST). Measures to augment non-tax revenue comprise streamlining

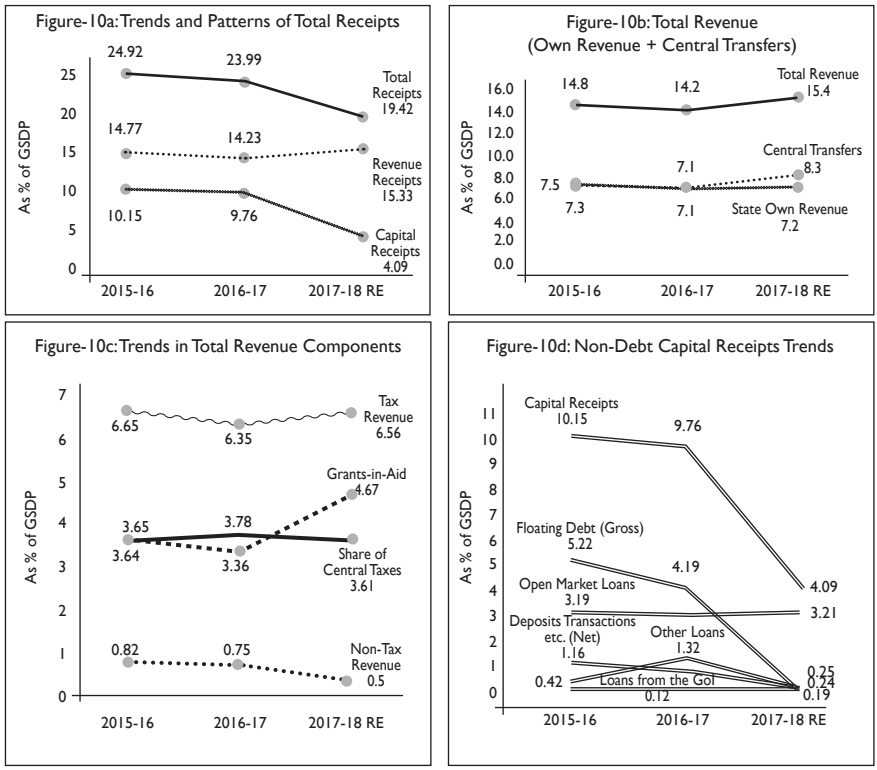
the fee or charges from the user. But the issue of the validity of these fees or charges rests on the delivery of quality services upheld and sustained.

Total Receipts Scenario

The total receipts / GSDP decreased to 24 per cent in 2016-17 from 25 per cent in 2015-16 and again decreased to 19 per cent in 2017-18 RE (Figure-10a). This fall was largely owing to decreasing capital receipts, mainly floating debt.

The revenue receipts / GSDP decreased to 14.23 per cent in 2016-17 from 14.77 per cent of previous year of 2015-16 (Figure-10b). It has changed the direction and showed an upsurge by one per cent in 2017-18 RE largely for the reason of more grants-in-aid (revised estimates) from the Centre. Figure-10c and Figure-10d explains trends of components of total revenue and non-debt capital receipts respectively.

Figure-10: Receipts Scenario (As % of GSDP)

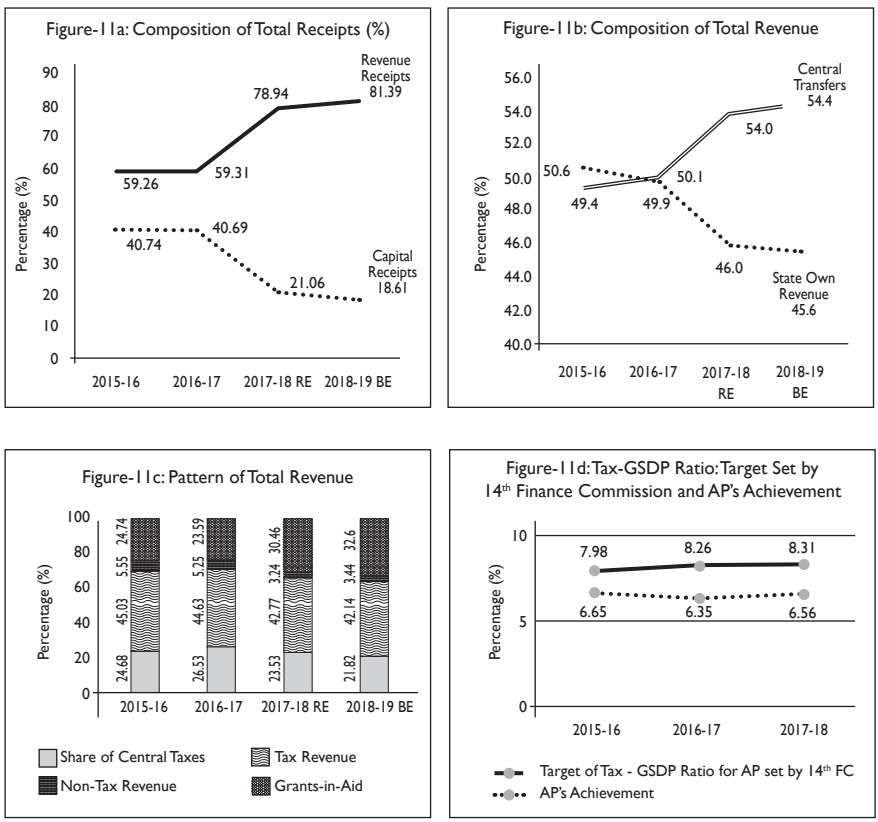


Composition of Total Receipts

Of the total receipts in 2015-16, revenue receipts comprised about 59 per cent, while the capital receipts contributed the remaining 41 per cent (Figure-11). In the first two years (2015-16 and 2016-17) this composition

remained unchanged, whereas the revised (2017-18) and budget estimates (2018-19) of subsequent years presented a substantial rise (fall) in revenue receipts (capital receipts). The share of capital receipts in total receipts dropped in the last two years generally because of (a) higher estimations in revenue receipts and (b) absolute decline in the estimates of capital receipts itself which in turn mainly owing to a fall in floating debt, deposits, transactions and other loans.

Figure-11: Trends and Composition of Receipts (%)



Composition of Total Revenue (Figure-11b and Figure-11c) shows that the state's own revenue in 2015-16 encompassed almost 51 per cent (of which own tax revenue comprised 45 per cent and own non-tax revenue nearly 6 per cent). Central Transfers formed residual 49 per cent (of which central shared taxes and grants-in-aid encompassed 24.68 per cent and 24.74 per cent correspondingly). Following periods witnessed the decline in relative shares of own tax and own non-tax (together with state own revenue) where as total central transfers augmented (while the share in central taxes dropped and that of grants-in-aid rose).

The higher proportion of central transfers in total revenue when compared with that of own revenue showed the increased dependency of the state on the central government more specifically on central grants.

State Own Tax Revenue Receipts

The year-wise breakup of the state own tax revenue shows that the proportion of tax revenue in total revenue was about 45 per cent in 2015-16. In 2016-17 it decreased to 43 per cent in 2017-18 RE. It is estimated to fall again to 42 per cent 2018-19BE. The impact of GST, with effect from 1st July 2017 (GST was implemented on the superseding night of 30 June and 1 July 2017.) needs to be studied separately and in detail.

The proportion of state-own tax revenue / GSDP was 6.65 per cent in 2015-16. It varied in the succeeding years and has not touched the 2015-16 position. The state's own tax revenue / GSDP proportions were found to be lesser than the estimates of the 14th Finance Commission (Figure-11d).

In brief, AP state government receipts varied in terms of GSDP and total revenue maybe because of the oscillations in their growth rates. Therefore, the emphasis may be on rationalizing and strengthening present tax and non-tax collection systems. Plugging of revenue leakages is another measure. Earnestness in fiscal marksmanship and curtailing anomalies raised by CAG in revenue collections may lessen volatilities in rising the resources, mainly own revenue.

Expenditure Scenario – 2015-16 to 2017-18 RE

Expenditure: Budgetary Classification, Trends and Patterns

The expenditure trends and patterns specify the direction and prioritization of the spending policies of the government. This section discusses the general classification of expenditure which contains (a) expenditure under the revenue account (revenue expenditure) (b) expenditure outside the revenue account (capital expenditure) (c) loans and advances and (d) capital disbursements. It also converses the changes of expenditure composition, taking only the first three components into account. Another classification Developmental and non-developmental expenditure – is also discussed.

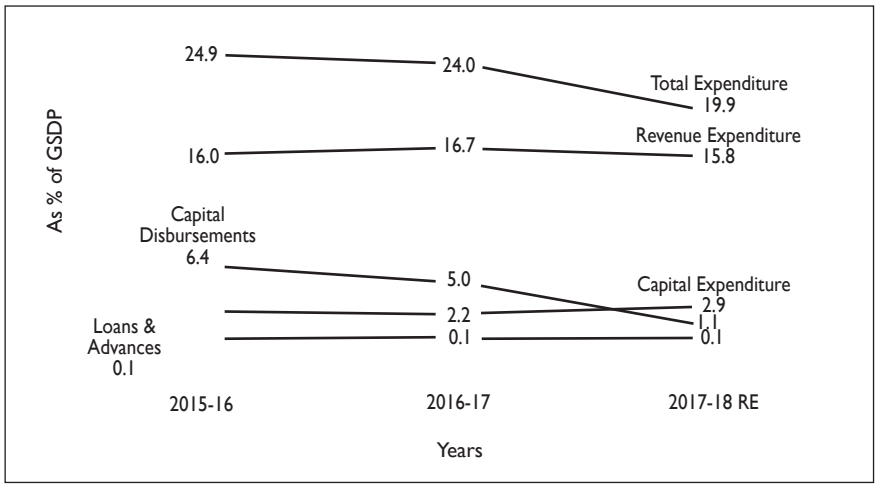
Budgetary Expenditure

Figure-12 gives, for the period of 2015-18, the total budgetary expenditure/ GSDP proportions. Year-wise data / calculations show an incessant fall. The overall budgetary expenditure / GSDP decreased from 24.89 per cent in 2015-16 to 19.88 per cent in 2017-18RE. This is mostly a result of

- Steady fall of capital disbursements in all the years, i.e., in 2015-16, 2016-17 and 2017-18RE
- Modest oscillations of about 16 per cent in the revenue expenditure / GSDP proportion, despite a continuous rise in the interest payments / GSDP proportion.

- Capital expenditure and loans and advances decreased in 2016-17, however, increased afterwards
- Unstable capital outlay / GSDP with a rise / fall in alternate years.
- Insignificant loans and advances

Figure-12: Expenditure Trends



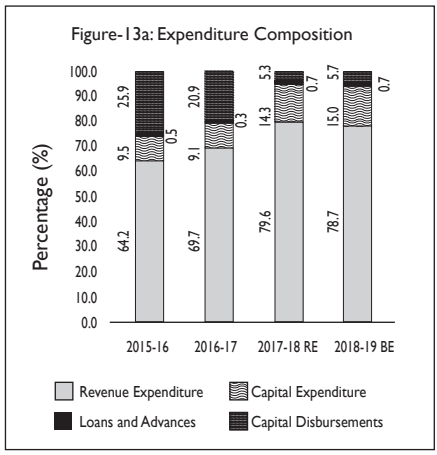
To elaborate, the Revenue expenditure / GSDP ratio rose from 15.98 per cent in 2015-16 to 16.70 per cent in 2016-17. This rise is mainly because of DISCOMS and the constant escalation of interest payments / GSDP proportions. In the subsequent year, there found a substantial fall in the growth rate of revenue expenditure.

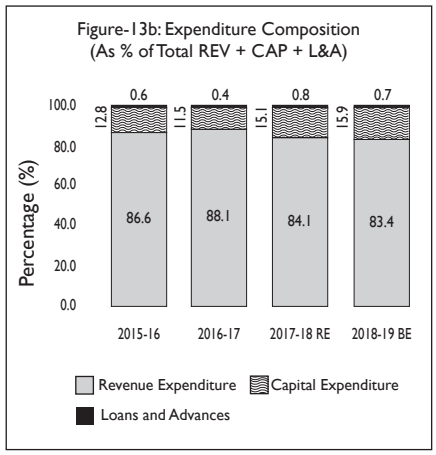
The fall in revenue expenditure / GSDP ratio may be attributed to

- Inconsistent growth rate Revenue receipts have affected the expenditure under the revenue account.
- Decrease in certain sub-components of revenue account expenditure such as salaries, pensions and subsidies - in short, committed expenses.

Budgetary Expenditure: Its Composition

The rise in the relative share of expenditure under revenue account in total expenditure is mainly because of the falling and nominal portion of debt repayment requirements. The lower shares of capital disbursements exhibit that maximum borrowings are directed to the accomplishments except for repayment of debt. The effect of the revenue account was on capital expenditure too. However, relative shares of higher revenue expenditure and lower capital expenditure, capital disbursements and loans and advances – show a major portion of the expenditure is in the form of current expenditure, allowing not much room for capital spending in resource creation and substructure (Figure-13a).



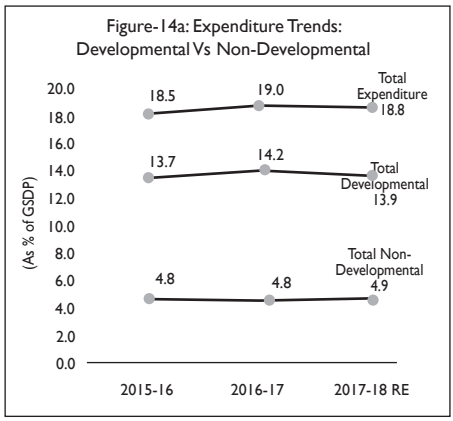


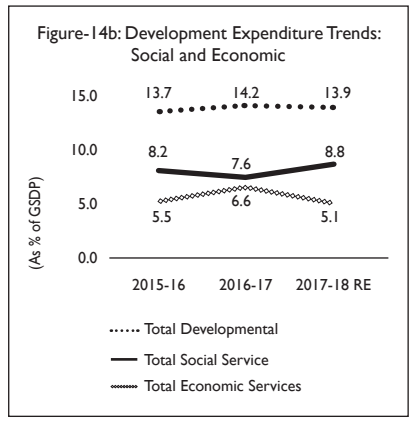
Trends in Expenditure (Net of Capital Disbursements)

For the period 2015-18, as discussed previously, in AP, the average proportion of total expenditure / GSDP was 18.77 per cent. Segregation of this total expenditure / GSDP shows that a major portion is reserved for the revenue account (16.16 per cent). A meagre portion of 2.49 per cent and negligible portion of 0.11 per cent was allocated to capital account and loans and advances. The upsurge of total expenditure (Total of Revenue, Capital and Loan accounts) in 2015-16 (18.45 per cent) and in 2016-17 (18.96 per cent) was an outcome of an increase in revenue spending and a decrease in the other two (loans and advances and in capital outlay). Conversely, in the subsequent year, the minimal drop in total expenditure is the result of both fall in revenue spending and rise in remaining two (Figure-13b).

UDAY scheme (Rs. 8,256 crore) chiefly made revenue expenditure/ GSDP ratios to increase in 2016-17. This ratio dropped in 2017-18RE. This is mostly owing to the collective outcome of (i) an upsurge in interest payments, (ii) a moderate decline in expenditure towards varied components of general services and (iii) oscillations in revenue spending on developmental activities – social as well as economical services. Thus the deviations in revenue expenditure/ GSDP shares were spread across expenditures on both non-developmental (general services) and developmental (social and economic services) (Figure-14a and Figure-14b). There was a rise in the total developmental revenue expenditure owing to a decline (upsurge) in economic services (social services). This could be largely for the reason that the consideration is given in the direction of the social welfare packages to make public withstand the present socio-economic circumstances.

Since 2016-17, owing to the reduction in committed expenditure (barring interest payments), AP state experienced a decrease in the percentage of revenue expenditure w.r.t. state own revenue / total revenue.





The study discloses budgetary preferences of AP government i.e., allocation patterns – social services (human development) or economic services (economic development) or both. The percentage of total expenditure (revenue + capital + loans and advances) in GSDP shows fluctuations in between which has mirrored in the increase (decrease) of economic services (social services) in 2016-17 and in the opposite direction in 2017-18RE (Figure-14b)

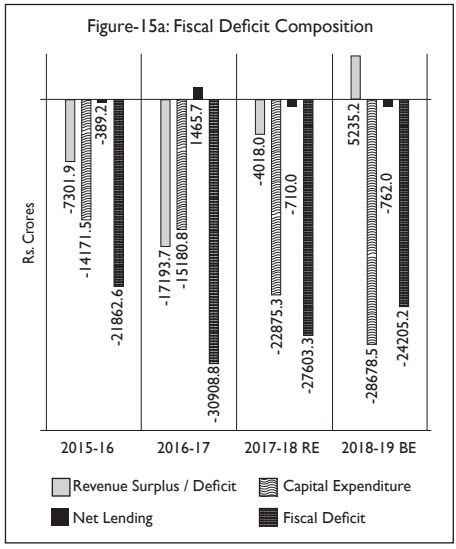
Deficits and Public Debt

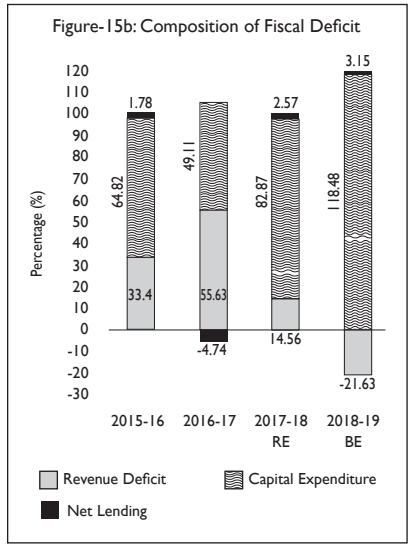
Whether it is Union or State Government, the fiscal performance mirrors in the important indicators for example revenue deficit (RD), gross fiscal deficit (GFD) and primary deficit (PD), Debt-GSDP ratios etc. The fiscal deficit represents the mismatch of the total receipts (revenue receipts and loan recoveries) and total expenditure (revenue, capital and loans and advances). This gap is experienced obviously with higher expenditure and relatively lower receipts). Hence, the borrowings are necessary to cover the fiscal incompatibility between receipts and expenditure. Composition of the deficit reveals government's judiciousness in the fiscal administration.

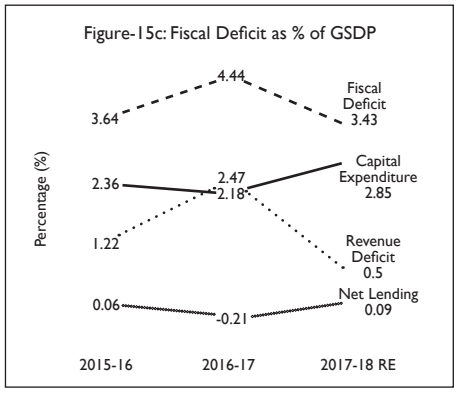
Revenue Deficit and Fiscal Deficit

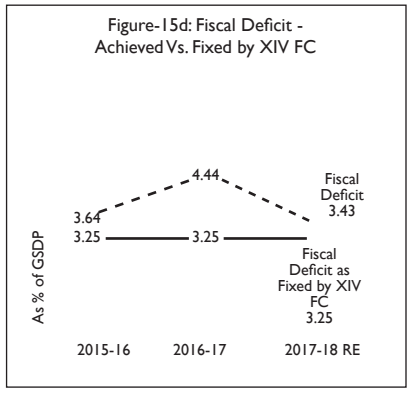
AP state government's Fiscal deficit in 2015-16 amounted to Rs. 21862.56 crores and exacerbated in 2016-17 by striking at Rs. 30908.82 crores. The deteriorated fiscal deficit was the outcome of worsened revenue account deficit, a modest rise in capital expenditure and solace from loan recoveries (Figure-15a). Ujwal Discom Assurance Yojana (UDAY) amounting to Rs. 8,256 crore is considered as the main reason for the deteriorating revenue deficit situation. Improvement in the fiscal deficit position is projected in 2017-18RE and 2018-19BE

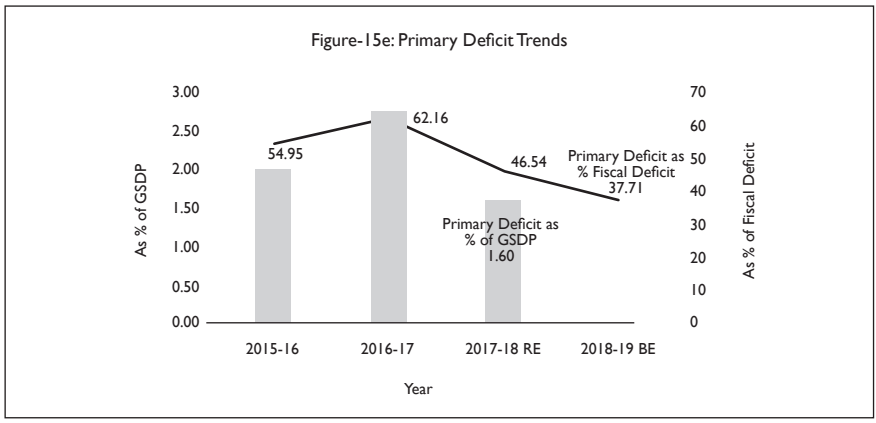
A study of fiscal deficit (Figure-15b) shows that the revenue deficit / fiscal deficit ratio rose to 55.63 per cent in 2016-17 from 33.40 per cent in 2015-16. This proportion is estimated to decrease to 14.56 per cent in 2017-18 RE and move towards a surplus revenue position in 2018-19(BE).This estimated betterment in revenue account (excepting 2016-17 on account of UDAY Scheme) anticipates to paving the way for a steady increase in capital expenditure / fiscal deficit ratio. With the surplus revenue situation, the economy gets the opportunity to engross a major portion of the borrowings in 2017-18RE and by 2018-19 and also most of the revenue surplus. Merely a fraction of revenue surplus was confined to net lending. Expenditure towards net lending is also for developmental activities.











The RE (2017-18) BE (2018-19) estimated contraction of fiscal deficit largely owing to estimated improvement in revenue deficit (2017-18RE) and revenue surplus (2018-19BE). The estimated revenue surplus in 2018-19BE was mostly because the state government was hoping to receive all the dues from the Government of India as per the APRA, 2014.

Estimated progress in the revenue account resulted in increased capital expenditure / GSDP. This, in turn, indicates the upgradation in the quality of expenditure. It also resulted in a slight rise in the net lending / GSDP ratio during the corresponding period (Figure-15c). Consequently, the influence of the surplus revenue account is apparent on the remaining constituents of the fiscal deficit. In short, the entire surplus revenue and borrowings are estimated to spend on towards developmental activities.

However, the fiscal deficit / GSDP ratios of the AP state government are above the target fixed by the Fourteenth Finance Commission (Figure-15d) - a cause of concern.

In 2015-16, the Primary deficit / fiscal deficit ratio constituted remained almost 55 per cent revealing the fact that remaining 45 per cent spent towards interest payments (Figure-15e). Primary deficit / fiscal deficit ratio increased to 62.16 per cent in the subsequent year indicating a reduction in the interest payment burden. But status quo has not been maintained in the following years. Interest payments burden is expected to increase indicated by the decline in Primary deficit / fiscal deficit in the revised budget estimates. This instability may not lead the state to sound fiscal health.

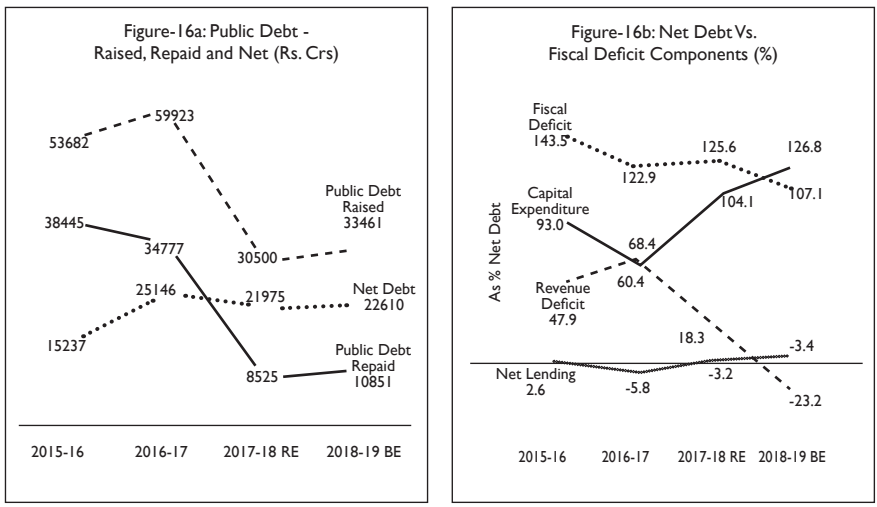
Deficit Financing in AP

Loans from Open Market Operations (Market loans)stayed as a most important resource of deficit financing. Other sources are thinly spread. The State government has dropped its dependence on the National Small Savings Fund (NSSF) as recommended by the Fourteenth Finance Commission.

Usage of Public Debt and Debt Stock

In 2015-16, about 72 per cent of the public debt raised was disbursed towards the repayment of previous debt. The leftover 28 per cent (net debt) is to meet the shortage in revenue account i.e., revenue deficit and other components of fiscal deficit (Figure-16a and Figure-16b). But net debt is too meagre to fulfil the fiscal deficit requirements. This led to inevitable reliance on the resources (about 43 per cent) of public account. Since 2016-17, the net debt accessibility to the state government has amplified. In 2018-19BE, the estimated surplus revenue account may perhaps upkeep the activities of developmental nature. Furtherance of these circumstances let the entire net debt raised spent towards snowballing the capital expenditure.

Figure-16: Direction of Public Debt Spent

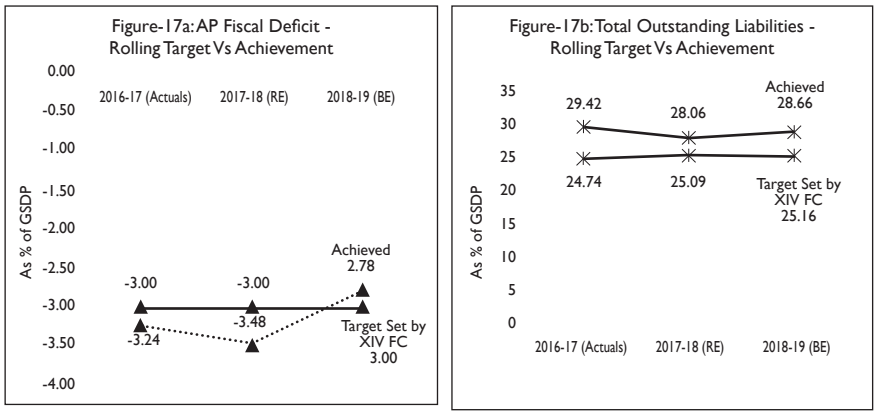


Execution of FRBM Act and Targets Accomplished

The AP state government lessened its revenue deficit, however not as per the set yearly targets. This is largely owing to the undesirable effect of state bifurcation on state fiscal situation. While it is very difficult to augment resources, it is much more challenging to deal with the mounting expenditure, mainly in the opening years of AP state bifurcation.

Figure-17 gives the details of targets fixed by FRBM either for deficits, debt or for liabilities. As has been already mentioned, the state government is able to decrease the revenue deficit. However, it has not reached the levels, either in fiscal deficit (Figure-17a) or in outstanding liabilities (Figure-17b), as per the set annual targets by Fourteenth Finance Commission. This is mainly because of unfavourable effect of state bifurcation on state finances.

Figure-17: Fiscal Indicators-Rolling Targets



Note: The above indicators are excluding Uday Bonds.

Source: Statement of Fiscal Policy to be laid on the table of the A.P. State Legislature in March 2018

Summary and Conclusions

The effect of APRA, 2014, on AP state has numerous ways. AP state experienced Topsy-turvy. Comparison with All India revealed slackness in tertiary and secondary sectors and ascension in the primary sector in AP GVA. Seven backward districts, insufficient urbanization and deprivation of well-established national-level institutions hampered the AP state. The impact of bifurcation is obviously on AP finances too. AP finances come across deficit conditions. The assessed Resource Gap for the fiscal year 2014-15 is another discomfort. Irregularities in APRA are mainly related to the allotment of tax arrears.

The study revealed that Revenue expenditure is outpacing total revenue causing a revenue deficit situation. With this Fiscal deficit / GSDP increased – crossing the FRBM limit. In 2015-16, out of total debt raised, about 72 per cent was channelled to clear the old debt. The remaining 28 per cent (net debt) was too meagre to tackle the fiscal deficit. Therefore, it has become inevitable to rely on the public account. The dependence on public account was high at 43 per cent. Ever since 2016-17, the accessibility of net debt in the hands of the state government has increased. The estimated

revenue account surplus for the year 2018-19BE signalled that there would be an improvement in the state finances of AP.

To guarantee justifiable improvement in fiscal consolidation, AP state requires to investigate into revenue resources of tax and also non-tax. It is also necessary for the AP state to cater quality services with efficient expenditure. Therefore, AP state needs to strengthen the management of revenue earning as well as spending departments. As the impact of state division is harsh on AP, support from the central government is essential for AP to reach a sound fiscal state.

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National Food Security Act (NFSA) 2013: Viability of Public Distribution System in Telangana State, India

R.K. Mishra[1]
Usha Nori[2]
P.S. Janaki Krishna[3]

Abstract

India's public distribution is one of the largest food security schemes aimed at reducing poverty and hunger among vulnerable groups. With the enactment of National Food Security Act, (NFSA) 2013, end-to-end computerization of public distribution system (PDS) acquired great prominence. Adhering to the provisions made in the NFSA, 2013 and ePDS (Control) Order, 2015, the Government of Telangana vibrantly moved forward and adopted the technology-driven public distribution system in the entire state. As the success of PDS can be ascertained only through a deeper understanding of the system through effective monitoring and evaluation of the scheme, the present paper focuses on its transmission and implementation at the ground level in the Nalgonda and Ranga Reddy districts of Telangana State. The paper discusses various components of PDS automation, viz; Aadhar Seeding, Biometric authentication, ePOS sales, ePDS, GPS monitoring, online supply chain management, portability, etc., that will have a bearing on the successful implementation of NFSA in the State thereby contributing to the development of sustainable societies with 'Zero Hunger'. The evaluation of the automated PDS in the districts of Nalgonda and Ranga Reddy demonstrates the effective functioning of the system.

Keywords: Automation of PDS, Food Security, NFSA, Public Distribution System (PDS),

1 Senior Professor, Institute of Public Enterprise, Hyderabad India and can be reached at rkmishra@ipeindia.org

2 Assistant Professor, Institute of Public Enterprise, Hyderabad, India and can be reached at ushanori@ipeindia.org

3 Professor, Institute of Public Enterprise, Hyderabad, India and can be reached at janaki@ipeindia.org

Introduction

Globally, the central focus of the poverty reduction programs is to achieve food security for all. It is widely believed that food security is achieved only when every citizen has access to adequate and nutritious food enabling the individual to have a prolonged and healthy living. The World Food Summit of 1996 recognizes that greater access to food only can guarantee food security rather than just its availability. For a reason, many countries across the globe have been trying relentlessly to distribute food grains at affordable prices to vulnerable groups. Special programs have been designed in developed and developing economies to reduce hunger and poverty. India is no exception in the implementation of these food-related schemes. India placed quite a number of government programs such as the Targeted Public Distribution System (TPDS), nutrition programs like mid-day meals and Integrated Child Development Scheme (ICDS) to improve food and nutrition security.

The most vital scheme of all is the Public Distribution System (PDS) which acts as the main vehicle through which the Government of India delivers food security to people of this country, especially the economically vulnerable groups. In 2013, the National Food Security Act (NFSA) was passed with the overall objective of providing food and nutrition security to the people by providing access to food grains at affordable prices. In fact, promulgation of National Food Security Act (2013) in India to meet the food security challenge opens up the debate on the functioning of the PDS.

Traversing a long distance in providing food security to millions of people, the Government of India moved a step further and modernized the system by making end-to-end computerization of its operations. With the enactment of the National Food Security Act, 2013 (NFSA), the computerization of PDS acquired great prominence. Digitization of PDS is initiated to ensure smooth, transparent and timely delivery of services to the end-users. Adhering to the provisions made in the NFSA, 2013 and TPDS (Control) Order, 2015, the Government of Telangana vibrantly moved forward and adopted the technology-driven system in the entire State. As the success of PDS can be ascertained only through a deeper understanding of the system by effective monitoring and evaluation, the present paper focuses on its transmission and implementation at the ground level in the two districts viz., Nalgonda and Ranga Reddy of Telangana State.

The main objective of the study is to assess the overall progress of implementation of NFSA (2013) across Telangana State and measure and monitor the change it has brought in, specifically:

- At systemic level: Assess and analyse the progress of implementation of various aspects of the NFSA 2013

- At beneficiary level: Evaluate the benefits of NFSA on the target groups to achieve the objectives of the NFSA.

Literature Review

India's public distribution system entails a critical evaluation as it has been revamped time and again to eliminate poverty in its entirety. The evaluation studies carried out in the recent past across the states of India, by and large have cited serious flaws in the functioning of the system viz., diversion of subsidized food grains to open market; lack of transparency in the selection of PDS beneficiaries; the prevalence of ghost cards; poor quality of food grains; large exclusion of poor below BPL and from PDS network, lack of infrastructure and shortage of funds with the State Governments, cost ineffectiveness etc. Planning Commission's study in the year 2005 finds that implementation of TPDS is plagued by targeting errors, the prevalence of ghost cards and unidentified households. The report says that though the off-take per household has increased, coverage of HHs in the system remains at 57% only. Fair Price shops were found unviable due to low annual turnover and stifled with leakages and diversions. Khera (2011) study points out that grain leakage has doubled to 54% by 2004-05 compared to 24% in 1999. More recently, Gulati et al (2012) estimated the leakage for the year 2009-10 to be 40.4% Kavitha's (2014) study raises similar views and points out that multiple flaws in the distribution are the cause for the failure of PDS in the country. Outlining as a social safety net measure, Lara Faya and Mule, G (2014) analyzed the effectiveness of PDS in the states of Andhra Pradesh and Karnataka and found that PDS has significant impact on the reduction of poverty and inequality. However, the study makes a striking observation that the lower stratum of rural poor is more dependent on PDS than others. PDS turns out to be an effective government intervention strategy in rural areas due to the supply of most basic food needs at the doorstep of the real needy. Harsh Mandar (2015) in FAO report, indicates states' recognition in enhancing social protection through the provision of food embodied in the law.

Khera (2011a, 2011b) and Aggarwal (2011) in their works points out that PDS turned effective because of the substantive steps taken by states to overhaul the delivery system. These studies further threw light on the diversion of grains issue and find that the diversion ratio, though declined remains still higher. According to Khera (2011a), drastic reduction in diversion rates is seen in states such as 23% to 8% in Andhra Pradesh, from 85 to 47% in Jharkhand, from 76 to 30% in Orissa and from 52 to 11% in Chattisgarh. The argument put forth for the success of PDS in some states in reducing diversion rates and other leakages is attributed to the implementation of IT-based transparency measures. IT-based services did provide some relief to the exchequer in reducing the wasteful expenditures;

however, no effort has so far been made to analyze the cost-effectiveness of this innovative measure. The NFSA, 2013 recommend for IT applications-end-to-end computerization of PDS, set up of monitoring cell in the form of vigilance committees and courts to plug leakages from PDS (Gulati et al. 2012). During then, Sakshi Balani (2013) strongly felt that State governments must moderate PDS or look for alternatives.

Rashmi et al. (2016) paper confirms that automated PDS offers various advantages in terms of effective delivery of grains, rightful entitlement to the customers in terms of quantity and reduction in corruption in the system. Technology-based reforms took the form of digital ration card distribution, allocations to FPS via computers, usage of smart cards, creation of GPS technology and web portals.

Replacement of food grains with cash transfers is even viewed as an efficient mechanism in comparison to the earlier as it could lead to less corruption and supports poor people with rich dietary food. However no definitive and valid argument could be built up in favour of cash transfers as many felt that the new system has its own complexities in terms of coverage in rural areas. The cash may be misappropriated for unproductive activities in rural households questioning the whole concept of food security. The basic opposition is not to cash transfers but to cash replacement for food. Thus, reiterating the need to continue the PDS, sincere efforts have gone into the strengthening of the programme. Shikha Jha and Bharat Ramaswami (2010) study analyses the economic benefits of food subsidies on the vulnerable groups in both India and the Philippines and finds that these nations replicated food subsidy programs with similar mandates, functional procedures and with substantial budgetary outlays. To make the PDS work efficiently and equitably, greater thrust is given to computerization, digitization and automation of the system. Further, automation is recognized as the only route to bring in more transparency to the system. Automation of PDS takes the form of replacing the ration cards with ration smart cards which possess the details of the beneficiaries and system. Technical scholars like Golden Bagul et al (2017) suggested for introducing QR codes to access the beneficiary details stored in the government's database to authenticate food grains transactions, using biometric sensors.

Major Reforms in TPDS

Rightful Targeting of Food Subsidies

- PDS and Aadhar Seeding: Aadhar seeding of the beneficiaries is considered a significant step towards plugging leakages in the system.
- End-to-end Computerization of Targeted Public Distribution System

To realize the objective of NFSA, TPDS is coined as e PDS wherein every step in the process, viz. Issue of food security cards; card management;

allocation of food grains, movement of food grains from warehouses to the ultimate beneficiaries, revamping Fair Price Shops as electronic point of sales (ePoS) and provision of Grievance Redressal cell etc. all have been brought under the online system which ensures greater transparency and creates wider access to food grains for the beneficiaries.

Aadhar seeding of the beneficiaries is considered a significant step towards plugging leakages in the system. The ePoS devices work with Aadhaar based biometry, wherein the biometrics (fingerprints of the members of the ration card) will be captured at the time of withdrawal of ration from PDS outlets. Distribution of grains holds good only with the authentication of the fingerprint of the beneficiary in the ePOS device.

Further Govt. of Telangana introduced Global Positioning System (GPS) to monitor the movement of vehicles carrying food grains from godowns to the Fair Price Shops (FPS) and check the diversions of food grains during transit to the open markets.

Key Achievements under the scheme:

- Digitization of ration cards is fully completed in the state
- Supply chain process is spread across the State
- Transparency portals are set up in the state
- Grievance Redressal Cell: Access to Toll-free Helpline is created in the State
- ePoS machines have been updated time and again with latest features as per the requirement to make user-friendly for non-tech savvy people.
- Introduction of IRIS (Intelligent Retinal Imaging System) to identify genuine ration card holders to distribute grains at FPS outlets.
- Portability facility is newly introduced to enable PDS beneficiaries lift the grains from any FPS shop where the ePoS devices are installed.

Methodology

The paper is based on the survey conducted in the two districts of Telangana viz., Nalgonda and Ranga Reddy using structured questionnaires. The sample size covers 150 HHs which includes 52 rural and 23 urban from each district. Accordingly, 75 HHs from Ranga Reddy district and 75 HHs from the Nalgonda district were covered for the study. A total of 10 villages were taken up (5 villages from each district). Splitting further, a total of 15 NFSA HHs (10 PHH and 5 AAY) were covered in each village thus totalling to 75 HHs (15x5=75) in each district. In addition to the HHs, interactions with various stakeholders' viz., Vigilance Committee and Fair Price Shops (FPSs) were held to elicit information on the important issues related to automated PDS like key online RCMS services, FPS viability issues etc. Besides, the supply chain management is well captured from Mandal Level Service (MLS) points tracking information on commodity storage, stock maintenance, portability of food grains and so on.

Field Survey Findings

The survey focuses on the distribution and consumption aspects of digitized PDS. Looking at district fact sheets, coverage of NFSA is hovering around 70 to 84% and all the FPS are running online mode indicating the rampant spread of technology at districts (Table-1 & 2).

Table-1: District Fact Sheet: Nalgonda District

A. Population			B. Number of Households			C. % of Population Covered Under NFSA	
1618416			401728			84.26%	
D. NFSA Coverage Details			**E. Number of Fair Price Shops**			**F. Godowns (storage points)**	
AAY cards	PHH cards	PHH members	PoS (Online)	PoS (Offline)	Manual	Numbers	Capacity (in MTs)
28915	420555	1363726	958	0	33	8	12000

Table-2: District Fact Sheet: Ranga Reddy District

A. Population			B. Number of Households			C. % of Population Covered Under NFSA	
2458925			819642			70.15%	
D. NFSA Coverage Details			**E. Number of Fair Price Shops**			**F. Godowns (storage points)**	
AAY cards	PHH cards	PHH members	PoS (Online)	PoS (Offline)	Manual	Numbers	Capacity (in MTs)
35209	482732	1632295	919	0	0	9	15227

Beneficiary Identification

About 65% of beneficiaries belong to the casual workers/daily wage earners category, followed by the self-employed (9.3%) in agriculture having a land less than one hectare. This is a clear cut evidence to claim that these families have eligibility to hold NFS cards. The economic status of these Hhs further substantiate the argument (Figure-1 & 2).

Figure-1: Occupational Structure of HHs in Nalgonda District

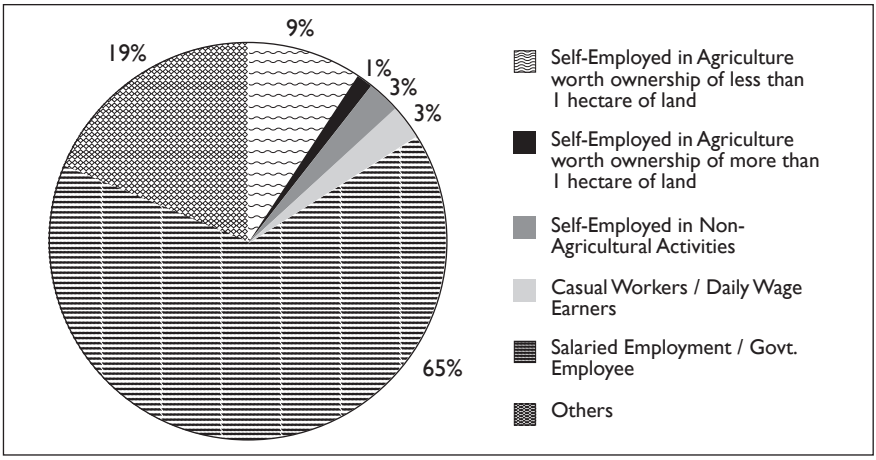
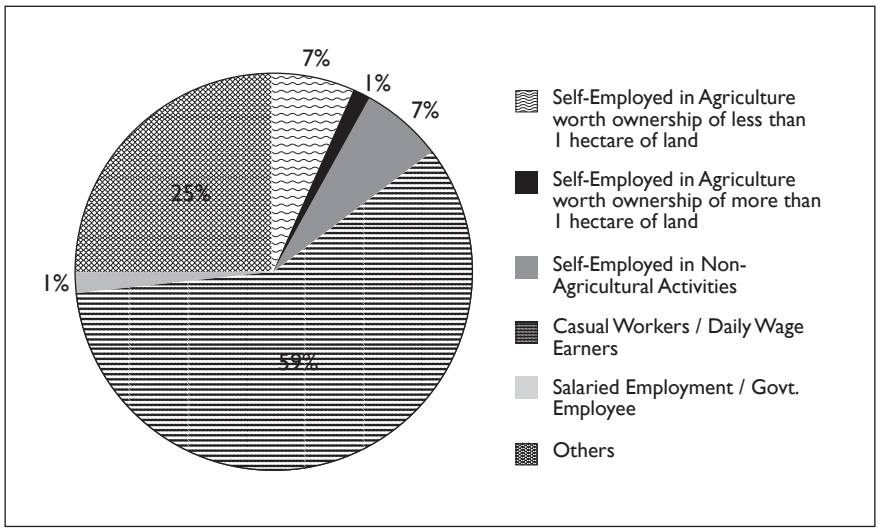


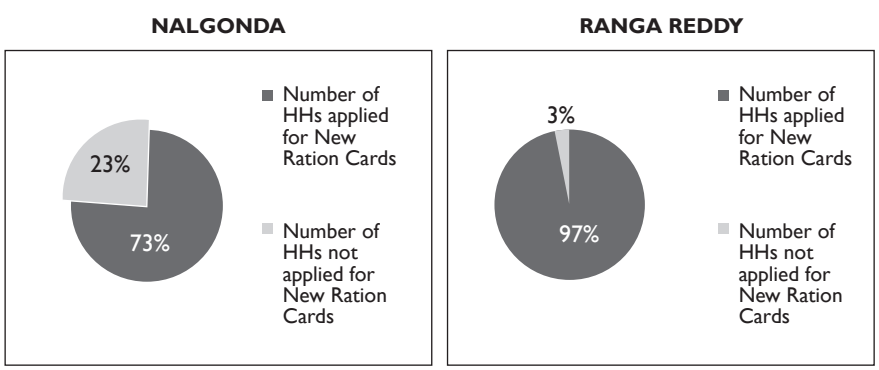
Figure-2: Occupational Structure of HHs in Ranga Reddy District



The remarkable presence in PDS however did not limit the Hhs to purchase grains from outside markets. Their only complaint was that the PDS serves inferior quality grains, hence they fill the other portion from Non-PDS shops. However, this did not preclude them from availing grains from PDS. It is evident that new cards are being added time and again stating that PDS is active and coverage is wider. Nearly 73% of the HHs in Nalgonda and 97% of HHS in Ranga Reddy have applied for new cards (Figure-3).

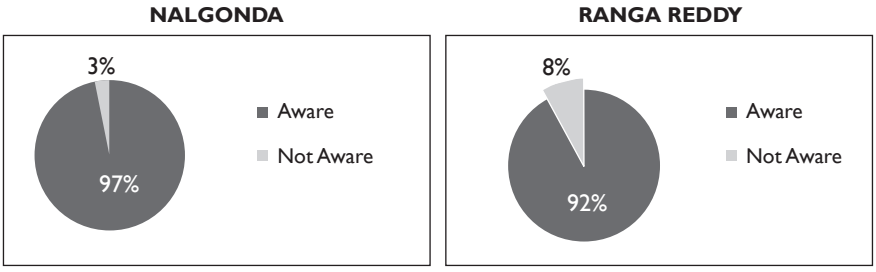
From the survey, it is understood that still 20 to 25% of beneficiaries are unaware of the new system, thus finding it difficult to obtain cards and in turn grains. Due to which their dependency on department officials causing delays, hence they have been depending on open market for grains, paying high prices.

Figure-3: Details of New Ration Card/Addition and Deletion /Duplicate Card Holders in Nalgonda and Ranga Reddy Districts



Further, frequent visits to departments result in heavy transport costs to beneficiaries. Beneficiaries expressed that those procedures were neither displayed on office notice boards nor explained by any official. No doubt, 97% of beneficiaries in Nalgonda and 92% in Ranga Reddy are aware that such an online system exists but are quite ignorant of its operations (Figure-4).

Figure-4: Beneficiaries Awareness on the Online Facility



Aadhar Based Biometric Authentication (ABBA)

The survey results evidence the fact that Telangana is in the frontline in terms of Aadhar seeding of ration cards. Beneficiaries all possess bank accounts, and their FS cards are fully seeded with the bank accounts.

The move to make ABBA mandatory for PDS did not result in any low transaction rate, instead helped in fair and good conduct of transactions. Beneficiaries are quite satisfied with biometric authentication as they find the system transparent and easy. However, biometric authentication is rife with technical issues like a biometric failure in terms of shortage of power supply, poor net connectivity, low speed of the server, poor quality print of the ePoS bills and administrative gaps such as inadequate failure reporting and backup systems. Further, the system is unable to recognize the fingerprints of old age people that call for attention.

For continuous and smooth flow of transactions, the beneficiaries are informed about the stock arrivals through SMS alerts. System-generated messages are sent to beneficiary's mobile to avoid long queues at the shops. FPS dealers are found to be quite cooperative with the beneficiaries in providing accurate information about the stock availability.

Despite SMS alerts, beneficiaries make quick visits to the shops to find out if the stocks are available at FPSs, as they are located close to their residences. The beneficiaries have no grievances against the distribution of food grains and in fact they are fully satisfied with the services rendered by the dealers. Beneficiaries are of the view that if other food items like wheat, cereals, sugar, pulses etc., are supplied, besides the regular item rice, their nutritional values would be fully met and reduce hunger to a large extent.

Portability

Minimizing human interface and maximizing online transactions through ePoS is the first step to achieve the desired objective of NFSA. The second step involves the creation of greater access to beneficiaries which is now possible with the portability facility.

One of the striking features of the Telangana PDS is the introduction of portability facility. Portability offers the advantage of picking up ration from any FP shop located in the state. This adds as cushion for those who migrate to other places in search of work during the slack season. Especially the rural people are quite happy with the arrangement and even the urbanites find it more convenient to draw the food grains in other places if the stocks get dried up in the shop where they are allotted cards.

Under portability, the percentage of transactions is highest in Ranga Reddy (9%) amounting to Rs.9351534 when compared to Nalgonda (2.9%) amounting to Rs.174254.1 in the last three months. This shows that the ePoS portability benefitting a greater number of beneficiaries in urban areas than in rural areas (Table-4).

Table-4: ePoS Portability Summary Report (01/04/2018 to 29/06/2018)

District	No. of Transactions	AFSC Rice (kgs)	FSC Rice (kgs)	AAP Rice (kgs)	Wheat (packets)	Sugar (kgs)	Kerosene (Litres)	Salt (packets)	Total Amount (Rs)
Ranga Reddy	252943	332229	5015885	0	123504	7417	118318	1	9351534
Nalgonda	83893	180218	1503235	30	372	4139	21	13	1742541
Telangana State	2882098	4826555	55548955	17194	1167548	95598	937656	319	93910094

ePDS-GPS Monitoring

Godowns and the FPSs are other significant touch points for achieving higher levels of efficiency and transparency. Accordingly, one finds fully automated (ePDS) godowns and FPSs in the districts. Under this system, delivery of food grains from PDS outlets would be done through GPS-enabled vehicles after due weighment of the grains electronically. GPS monitoring enables the grains to reach the FPSs in time without any diversions and delays.

Automation of FPS

Further, automation of FPSs is taken up by placing ePOS devices wherein the complete details of the beneficiaries are stored. With the help of this device, there is a greater reduction in illegal transactions as the devices help in tracking every minute detail of the beneficiary and the grains are released only when the thumb impression of the beneficiary matches with the data stored in the device. The beneficiaries draw their full entitlements as per their eligibility.

The study team noticed that automation brought down the food grain leakages and enhanced the quality of services and transparency, which were an all-time major issue of PDS. Specifically, the present system reduced the scope for corruption, fraud and manipulation of records. The greatest advantage of FPS automation is that the beneficiaries get their rightful entitlement in terms of quantity. Diversion of quotas to the open markets is curtailed to a large extent due to GPS monitoring and ePoS-enabled bills on sales and distribution that act as evidence.

Tagging of online system to Mee Seva centres for facilitating new licenses and cancelling of old ones is another significant step for wider accessibility of grains and mitigating risks from dealers. Issuing new licences enhances the number of shops thus increasing the services to the poor. Any dealer found indulging in fraud will immediately lose his registration.

While the automated PDS is making progress in one way, on the other, certain teething problems are seen over the use of ePoS machines. Biometric authentication is a fool-proof mechanism which validates the beneficiary's authentication with the support of an ePoS device and cross-checks it with the "Aadhaar" information stored for the beneficiary on the UIDAI servers. The authentication is extended to every member of the family so that whoever visits the FPS can draw food grains once the authentication process gets completed. However, the ground reality was that fingerprints of the elderly, children and of those engaged in manual work, could not be read by the PoS devices. This necessitated multiple visits by beneficiaries to the FPS causing inconvenience and redundancies like loss of a day's job of a daily wage labourer, longer queues and delays in the release of food grains.

Non-identification of fingerprints of the beneficiaries derails the process and leads to exclusion problems. Use of 'iris' scans as an alternative to fingerprints are however used at certain points to resolve the issue.

Another serious problem encountered by the aged or disabled beneficiaries is that they find very difficult to visit the FPS every month to claim their entitlements. As a reason, the beneficiaries opine that they should be provided with an option to nominate one or two individuals to purchase rations on their behalf. These nominees' Aadhaar details should be linked to the beneficiary's ration card for authentication.

Poor internet connectivity further compounds the problems that stall PDS transactions especially in rural areas. This is quite prominent in the rural side of the district. Currently, the dealers have adopted the offline mode to resolve the issue under these circumstances. Commodities are distributed to the beneficiaries based on the information provided on the FS cards and recorded manually on a paper and later the information is fed into the ePoS device. Frequent power failures often disrupt the smooth and continuous

supply of food grains. The solution lies in introducing alternative sources of energy.

The sustainability of the scheme rests on the viability of FPS operations. This can be achieved by introducing honest practices and providing adequate compensation for the FPS owners for rendering their services. Dealers expressed that they should be paid a regular salary instead of commission derived out of selling items at shops as their net income is found inadequate to lead a decent living. Further, they are expecting support from the government to sell various other food items in their outlets for better earnings. Encouragement of PPP models is being contemplated in this direction but no affirmative plan is prepared due to mixed results of the model in other parts of the country.

With the introduction of automation, storage problems have been considerably brought down. There is no waiting or storage period to hold the grains beyond a reasonable time due to the reduction in the time gap between stock arrivals and distribution. Therefore, keeping this technology-driven system intact, if further efforts are made in the direction of improving the quality of grains, much more progress can be seen in the near future.

Installation of ePOS Device

The spread of ePDS across the State significantly curbed leakages in the system. Nearly 12 to 15 per cent of rice stocks are being saved every month which amounts to saving of 2 lakh metric tonnes of rice for the government by effectively preventing the diversion of unclaimed PDS rice from beneficiaries. The real needy are being protected and hoarding of grains by dealers and black marketing is completely checked.

Supply Chain Management

Online checking of the real-time in ferrying of food grains from storage houses of the Food Corporation of India (FCI) to Fair Price Shops (FPS) by the team, is found impressive. No fudging of entries is happening at any point in the supply chain. Complete transparency and accountability are maintained at every stage from receipt of food grains from godown, receiving payment from FPS dealer, issuance at District depot, generation of delivery order, generation of truck challan, gate-pass and recording the acknowledgement receipt received from FPS dealer.

Transactions between godown in-charge and FPS dealer is regularly updated in the PDS server. Once the payment is done by the dealer and obtains RO, stocks are released and recorded online. The godown in charge tracks information after receiving ROs on electronic transactions of FPS

enabling real-time MIS on opening stock, daily sales and closing stock, monthly allotment etc., to release the stocks through the PDS server.

Another important step taken by the government to stub the diversion of essential commodities meant for PDS to the open market is the installation of Global Positioning System (GPS) gadget in all the vehicles, ferrying food grains from godowns to the outlets. Godowns in both the districts are fully equipped with CC cameras to detect any fraudulent transactions. Further, districts are connected to the command control centre to keep an eye on the godowns-cum-supply points. In addition, micro-level monitoring at district and mandal levels to check diversions and irregularities in the weighing of rice is put in place by the State.

The study team while interacting with the district officials and other stakeholders, noted that illegal diversions that usually happen between MLS points and FPSs, have been reduced to 80 per cent now with the introduction of GPS in the state. Dealers who were earlier involved in diverting their quota to rice mills for profits are now completely put under heavy check with the support of GPS.

The information put up on the ePDS website is automatically being monitored by all the respective godown in charges, FPS dealers, and State and District Civil Supplies Department officials as they are also connected to the ePDS website. One of the biggest advantages the system offers is that new shops can be created through apps without an engineer's physical visit to the site. A ticketing system has been introduced to monitor the deviations.

The end-to-end computerization mechanism with tracking devices records the delivery/acceptance and the number of bags delivered at every MLS point, resulting in efficient inventory management. The GPS system introduced at the district level not only tracks the vehicle but also ensures the movement up to sack level to ensure delivery.

Besides faster delivery of goods, supply of quality goods needs to be ensured. Hence maintenance of rice quality, creation of infrastructure at godowns and other basic mechanization is the need of the hour. Lot of spillages had been observed in the godowns. These need to be equipped with simple mechanization such as conveyor belts and small forklifts. Manual loading of the bags results in spillages and is time-consuming. Further, food grain quality needs improvement and the availability of weighing bridges at the godowns is the need of the hour to reduce loss of quantity from the bags. The experience at godowns calls for immediate replacement with modern equipment to handle the stocks without any loss of quantity.

Grievance Redressal Mechanism

Under GRM, State has set up a robust and internal system of grievance redressal (a call centre-based helpline) with toll-free number for disposal of the complaints relating to the Act. The beneficiaries can register their complaints using an internal S No. 1967 and further a web-based grievance redressal portal was initiated for the effective implementation of the Act in the State.

Beneficiaries are well aware of the GRM, but their lack of understanding of the online procedure prohibits them from registering their complaints. Toll-free number is however accessed by them. They depend on department officials or carry forward their grievances to the DGRO who plays a proactive role in solving the problems at the government programme called Jana Hita organized every Monday at the district.

Way to Digital Economy

To give a big push to the cash less economy, PDS transactions are set to go cashless in many states. The Telangana Govt. in the run-up to catch its neighbouring State has been endlessly trying to make the PDS transactions cashless. The outcome of its efforts is the linkage of Aadhaar based system with the bank account of the beneficiaries.

The beneficiaries in the selected districts, despite holding Aadhaar linked bank accounts are not utilizing the facility as the amount paid by them is quite negligible. Further, their ignorance of the banking mode of transactions compels them to go for conventional practices.

Above all, inadequate banking infrastructure in the State inhibits the implementation process. Beneficiaries have difficulty in reaching banks as they are located in far-off places from their habitats. Further, they do not possess smart phones where they can make payments even if they are knowledgeable in operating phones. It is quite evident that digital payments may not be of great use for the beneficiaries unless they are aware and accustomed to the technology-driven system.

Poor network connectivity is another barrier putting the beneficiaries at inconvenience. Of all, the beneficiaries have no information as to whom they should approach that is the bank or the department, in case they meet any discrepancies while making payments online. There is no clarity on this issue and the GRM has no mention about how to address grievances.

PDS in the state has undergone multiple restorations and throws a challenge for the State government's to make it better and cost-effective. Digitization is the way forward, but to reap the economic benefits of this process quickly, a strategic plan of action by the government can put the system in place.

All the beneficiaries reported that they prefer food grains instead of cash transfers as this guarantees them food security. The basic reason for not accepting cash transfers is that all the beneficiaries felt that they would be compelled to pay higher prices for grains if purchased outside PDS and the cash may be used for other unproductive purposes rather than intended.

Conclusions and Recommendations

There is a greater improvement in the service delivery with the introduction of PDS automation. Beneficiaries have greater satisfaction in receiving all commodities at one time, which was not the case earlier. Today, the portability of grains and continuous replenishment of commodities at FPS led to a reduction in average waiting time to about half an hour.

If further efforts are directed towards addressing the technical glitches like poor net connectivity, power failure and poor maintenance of the devices etc. a lot more progress can be achieved with in a short span of time.

Supply of other items along with rice is expected to fulfil their complete nutritional diet, hence could be considered for the successful implementation of NFSA in the State. Above all, the system's success depends on how empowered the beneficiary is. Greater efforts should be made in the direction of educating the beneficiary to get into this technology-driven system.

The present evaluation of the automated PDS demonstrates the effective functioning of the system. However, the system is grappling with certain critical issues at the distribution point. Keeping these in view, further steps need to be taken with immediate effect, viz., regular monitoring and updating of online database to weed out bogus cards, imparting training to beneficiaries to make optimum use of the automated PDS; ensuring distribution of fine rice at outlets and improvement of infrastructure at the distribution points.

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Impact of Digitalization on Banks' Credit in India

Shivam Agarwal*

Abstract

For the economic development of any country, the banking sector is crucial. Since the change of era, banks have shown many changes in how they operate and circulate money. Banks in India are digitizing their payment systems and becoming more technology-driven. In this study, time-series data are analysed over a period of 11 years**,** beginning in 2009-10 and ending in 2019-20. All data were collected from SCBs in India. The study was based on two variables, namely Credit and Digitization. Credit Outstanding is used as a proxy for Credit Demand. Digital Payments are used as a proxy for Digitalization in the economy. Payments are measured using five indicators: CCIL, RTGS, Retail, Card, and PPI. The relationship is examined via a regression analysis based on a bivariate as well as multivariate model. A significant relationship has been found in the bivariate model showing that Credit Outstanding increased with an increase in Digital Payments in India. However, Retail was only found to be statistically significant in the multivariate analysis. Multivariate analysis showed that Retail was positively sloped.

Keywords: Card, Credit Outstanding, Digital Payments, Digitalization, Retail, RTGS, UPI

Introduction

Banks are financial institutions that accept public deposits and provide credit to the public in exchange for an interest rate. In other words, it's a financial institution with authority to receive deposits and make loans. Banks also offer financial services, such as currency exchange, wealth management, safe deposit boxes, and sometimes investment facilities. There are several types of banks, including retail banks, commercial and corporate banks, and investment banks.

* Student, Department of Applied Economics, University of Lucknow, Lucknow, Uttar Pradesh, India and can be reached at shivam.agarwal2398@gmail.com

Banks are regulated under the Banking Regulation Act, 1949, and are managed and controlled by the Reserve Bank of India, which was established under the Reserve Bank of India Act, 1934. Under both Acts, banks are defined as follows (Reserve Bank of India, About Us, n.d.):

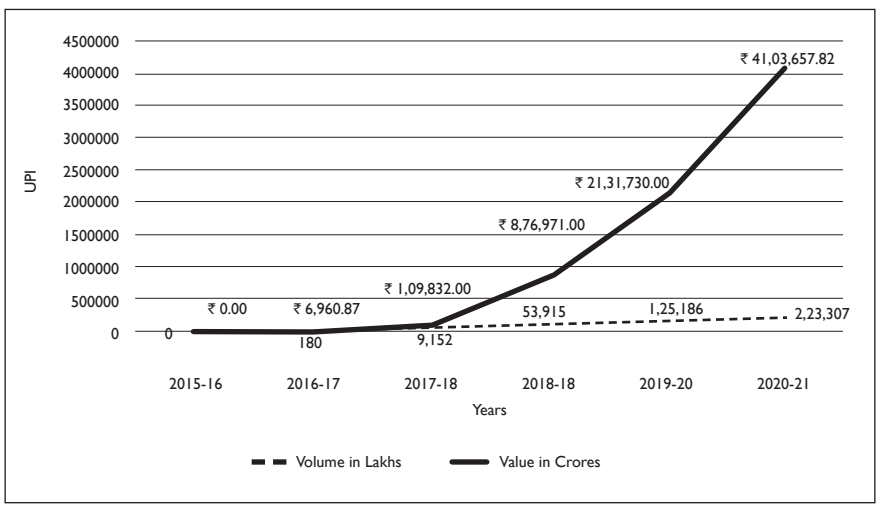
"The Bank shall be a body corporate by the name of the Reserve Bank of India, having perpetual succession and a common seal, and shall by the said name sue and be sued." – (Reserve Bank of India Act, 1934).

"A 'Banking Company' means any company which transacts the business of banking in India, where 'Banking' means the accepting, for the purpose of lending or investment, of deposits of money from the public, repayable on demand or otherwise, and withdrawal by cheque, draft, order or otherwise" – (Banking Regulation Act, 1949).

The Digital India campaign was launched by the Government of India on *1 July, 2015* to ensure that the Government's services are made available to citizens electronically. It also emphasised on the digital payment system and launched the *Unified Payment Interface (UPI) System* and *Bharat Interface for Money (BHIM)*.

Trends of UPI, as shown in Chart-1, showed that UPI was increasing simultaneously from its starting in 2015-16 to 2020-21.

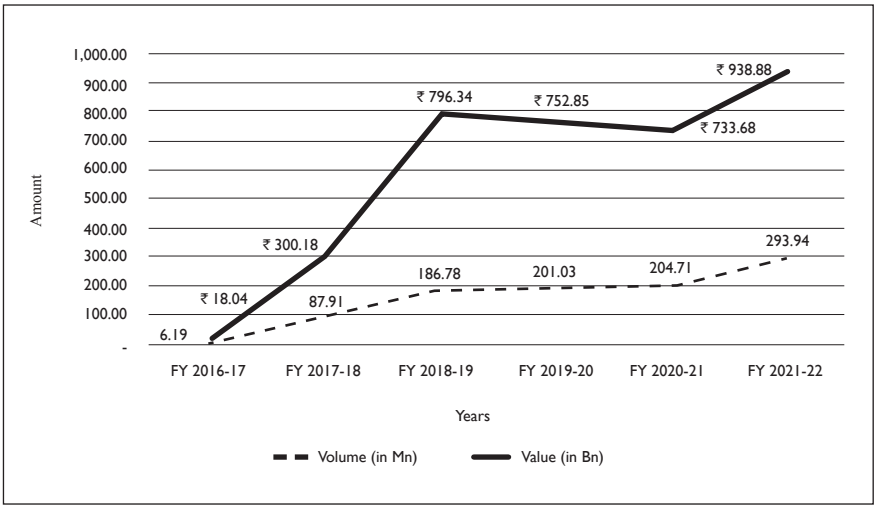
Chart-1: Trend of UPI in India



The Chart-2, the BHIM App's trend shows that the value of the transaction is increasing faster than volume, and it also shows that both value and volume are increasing from 2020-21 to 2021-22.

The present study tries to assess the role of digitalization on banks' credit. This study has talked about how digitalisation of banks impacts their growth. It revolves around the plan of Digital India started by the Government of India in 2015 and its implication on the banking sector.

Chart-2: Trend of BHIM App in India



The literature reviews are:

(Elferink, 2020) in his study on European Banks**,** have worked on 116 banks in Europe divided into 20 countries and their digitalization process. In this**,** he has worked on the relationship between credit of banks and digitalization. He has done this study consisting of data from 1993 to 2018, which covers the first steps of the implementation of digital financial services. In this, he concluded that the gradual implementation digitalization process in Europe has increased the amount of total loans and also their Non-Performing Loans. It also showed that an increase in Non-Performing Loans is more than the increase in total loans given by banks, meaning that the implementation of digitalization has caused problems for banks in collecting their loans. Through this, they have concluded that the increase in digitalization has decreased their profit by increasing the Non-Performing Loans of banks.

(Herwadkar, et al., 2019) suggest that Domestic credit to the private sector as percentage of GDP, which is an indicator of financial development, was also found to lead to higher value/volume of transactions at POS terminals. The authors also suggest that the number of ATMs was found to be positively associated with the value/volume of digital transactions as with higher number of ATMs, people tend to carry less cash. Also, most of the ATM cards have debit/credit features which leads to higher usage at POS terminals. Their results suggest that an increase in per capita income and education level (proxied by school enrolments) are determinants of an increase in the value/ volume of transactions at POS terminals. The positive relationship between income and education levels is in line with findings in the literature**,** which show that the increase in the level of income and

education results in lower usage of cash and increases the probability of using electronic modes of payments.

(Avari, et al., 2021) has worked on how digitalization is impacts the usage of money in the economy. Their study show that online payment's clients are continuously growing and making online transactions, as well as it also showed that this method of payment is increasing used for making payments for online or on-site purchase daily. This study helps to understand how digital payments are progressing.

(Chugh, et al., 2020) have shown that penetration level of debit/ credit is growing as the government initiative to move to a cashless economy will primarily grow in India, after Demonetization, UPI Payments took the lead in the online payments as it doesn't require any bank or beneficiary's details in making payments. They also recommended that there is certainly a very difficult task to make 100% penetration of the online payment system, but Govt. can take precautionary measures to provide literacy to all the young youth using these methods of payment.

(Das & Tewari, 2020) found out that the digital banking system reduced the cost of banks. So, the banks can make more profit. As well as Digital banking system helps and makes a safe way to handle financial transactions. As all the records are maintained electronically fraud, corruption and financial crime can be controlled to some extent. They also found out that the Reserve Bank of India removed the payment of RTGS or NEFT for promoting digital banking.

(Joshi, 2017) in his study showed the changes in the value of retail payments from 2014 to 2017. He concluded that in the three years, there has been a remarkable growth in digital payment initiatives started by the Government of India. The new modes of payment system have got more usage than old methods of payment. He also concluded that Demonetisation have amplified the usage of digital payment instruments like NACH, UPI, IMPS, AEPS, BBPS, BHIM (UPI) and NETC. This concludes that NPCI retail payment products have shown growth in his research.

Objectives

The objectives of this study are:

- To study the status of some digital payment products in recent years.
- To examine the impact of digitalization of the payment system on the working of Indian banks.
- To assess and analyse the role of various digital payment instruments on the credit demand of the Indian Banking sector.
- To study the impact of digitalization on the performance of banks in terms of certain selected financial indicators.

Methodology

In his study (Elferink, 2020) has said that with an increase in digitalization the ease of taking credit will also increase, which leads to a substantial increase in the demand for credit in the economy. While (Herwadkar et al., 2019), in their study, found out a positive relationship between Credit in the private sector to GDP Ratio and Digitalization in different countries. While taking their studies into consideration, in this study, the following hypothesis has been formulated:

H0 – The increase in the level of digital payments will have a negative or no effect on Credit Outstanding.

H1 – The increase in the level of Digital Payment (a proxy for Digitalization), will affect the Credit Outstanding in a Positive way, i.e., they are positively related with each other.

The study is purely based on secondary data. The data is mainly collected from the RBI – Database of Indian Economy, NPCI. Other than the mentioned source, the data was collected from various published and unpublished sources. The data was analysed using OLS regression model and trend analysis for analysing the dependent variable.

The period of the study is from 2010-2020. The study has been done on the Indian banks for this period. The study has used the following tools for **the** analysis of data:

- **Trend Analysis** – Used for checking the trend of credit variables in the recent time period. The analysis was used to show the growth rate of credit outstanding and credit limit in recent years.
- **Inferential Statistics** – Used for analysing the impact of digitalization on Credit Outstanding using OLS regression model and testing hypothesis for the model.
- **Augmented Dickey Fuller Test (ADF)** – Used for testing the stationarity of variables in the model.
- **Phillips – Perron Unit Root Test (PP)** – Used for testing the stationarity of variables in the model.

Formulation of Model

To measure the trend of dependent variable on time, a regression analysis was made, where time is the independent variable:

$$Yd_t = \beta_1 + \beta_2 T_t + \mu_i$$

Where,

$Yd_t = Credit\ Outstanding\ at\ time\ t$

$T_t = Change\ in\ time$

$\mu_i = Error\ term$

In the above equation**,** dependent variable is credit outstanding on which a natural log was applied to reduce its variability so that the data can be easily interpreted. So, the new function formed can be shown as:

$$\ln(Yd_t) = \beta_1 + \beta_2 T_t + \mu_i \quad \ldots(i)$$

Like the above equation, the same equation for credit limit was formed to check which is more significant in trend analysis to compare both the credit variables. Here, in this study, credit outstanding is assumed as credit demand and the credit limit is assumed as credit supply. So, the equation for credit limit is:

$$\ln(Yc_t) = \beta_1 + \beta_2 T_t + \mu_i \quad \ldots(ii)$$

Where,

$\ln(Yc_t) = Natural\ Log\ of\ Credit\ Limit\ at\ time\ t$

The result of this trend analysis is given in Table-2, of the Result and Analysis section.

For testing the hypothesis, a bivariate linear regression model was made**,** which was shown as follows:

$$Yd_t = f(Digi_t)$$

$$Yd_t = \alpha_1 + \alpha_2(Digi_t) + \mu_i \quad \ldots(iii)$$

Where,

$Yd_t = Credit\ Outstanding\ at\ time\ t$

$(Digi_t) = Total\ Digital\ Payments\ at\ time\ t$

$\mu_i = Error\ term$

The above equation shows the impact of total digital payment on credit outstanding. The digital payment was measured with the value of the transaction. Since both variables have an amount in 'Crores, the variability of variables are large. So, to reduce the variability**,** the variables have been converted into a log function. The new equation can be presented as:

$$\ln(Yd_t) = \alpha_1 + \alpha_2 ln(Digi_t) + \mu_i \quad \ldots(iv)$$

The variable $(Digi_t)$ is the sum of variables: RTGS, Clearing Corporation of India Ltd (CCIL) operated systems, paper clearing, retail electronic clearing, Card payments, and Prepaid Payment Instruments (PPIs). In the study of (T, et al., 2019), they used these variables as the proxy of digital payment to see the impact on economic growth. Based on (T, et al., 2019) study, the formulated multiple regression model has been presented below:

$$\ln(Yd_t) = \alpha_1 + \alpha_2 \ln(X_{1t}) + \alpha_3 \ln(X_{2t}) + \alpha_4 \ln(X_{3t}) + \alpha_5 \ln(X_{4t}) + \alpha_6 \ln(X_{5t}) + \mu_i \quad \ldots(v)$$

Table-1: Variable Definitions

Variables	Proxies
(Yd_t)	Credit Outstanding in India at time t
(X_{1t})	Total Value of RTGS for India at the time t
(X_{2t})	Total Value of CCIL Operating System for India at the time t
(X_{3t})	Total Value of Electronic Retail Clearing for India at the time t
(X_{4t})	Total Value of Card Payments for India at the time t
(X_{5t})	Total Value of PPIs for India at the time t

All values of dependent and independent variables are logged values.

RTGS transactions include customer transactions and interbank transactions. CCIL operated systems reflect Collateralized Borrowing and Lending Obligations (CBLO), Government Securities clearing and Forex clearing. Electronic Clearing Service (ECS), National Electronic Fund Transfer (NEFT), Immediate Payment Services (IMPS), Unified Payment Interface (UPI) and National Automated Clearing House (NACH) transactions represent Retail Electronic Clearing. Card payments include both debit and credit cards. Prepaid payment instruments are represented by m-wallets, PPI cards, and paper vouchers.

In this study, it has been assumed that the digital payment is affecting the banks' credit alone and no other variable is affecting the credit. Its product variables have an independent effect on credit.

It has also been assumed that banks in the Indian economy is working to ease the experience of customers and the Indian economy is having an upward trend toward becoming a cashless society.

In this study, two tests were used to check stationarity in the data, they are: a) Augmented Dicker Fuller Test, and b) Phillip Perron Test. The results of both the tests are presented in the next section.

So, now for stationarity on variables in equation it can be shown by putting 's' as superscript on variable. This can show that all variables are at stationary position. The new equation showing stationarity is given below:

$$\ln (Yd_t)^s = \alpha_1 + \alpha_2 \ln(X_{1t})^s + \alpha_3 \ln(X_{2t})^s + \alpha_4 \ln(X_{3t})^s + \alpha_5 \ln(X_{4t})^s + \alpha_6 \ln(X_{5t})^s + \mu_i \quad ...(vi)$$

Results of the empirical model are discussed in the next section.

Results

The results **of** trend analyses of the two equations (equation (*i*) and equation (*ii*)), are shown below in Table-2.

Table-2: Results of Trend Analysis on Credit from the Year 2010-21

T_t	$\ln(Yd_t)$	$\ln(Yc_t)$
Time	Credit Outstanding	Credit Limit
2010	15.02303	15.39834
2011	15.22054	15.85875
2012	15.38481	15.85499
2013	15.52485	15.93607
2014	15.65321	16.0678
2015	15.74391	16.16263
2016	15.83343	16.23136
2017	15.88463	16.32664
2018	15.9865	16.41924
2019	16.1078	16.48855
2020	16.16868	16.57193
Trend Growth Rate		
Period from 2010 to 2020	0.10892867 (1.83699E-08)	0.100224 (1.25E-06)
Period from 2010 to 2014	0.156467954 (0.000295052)	0.141624044 (0.045243117)
Period from 2015 to 2020	0.087109565 (4.65981E-05)	0.083162 (1.79E-06)

In the above table, we can see that the growth rate of Credit Outstanding for 11 years, i.e., from 2010-20, is almost 10.89%. In the first 5 years, i.e., from 2010-14, the growth is 15.65% per year, while in the next 6 years (from 2015-20), the growth is only 8.71%. This can be due to some factors like Demonetization, increasing level of Non-Performing Advances, are some of the probable reasons for the decrease of growth rate in last 6 years.

In the above table, we can see that the growth rate of Credit Limit for 11 years, i.e., from 2010-20, is almost 10.02%. In this for first 5 years, i.e., from 2010-14, the growth is 14.16% per year while in next 6 years (from 2015-20), the growth is only 8.32%. This can be due to some factors like a decrease in Credit Outstanding.

The above models were analysed as the following:

$$\ln(Yd_t) = \alpha_1 + \alpha_2 ln(Digi_t) + \mu_i \quad \text{...}(iv)$$

The equation (*iv*) is a bivariate model where $ln(Digi_t)$ is a log of total digital payments that occurred in the Indian Economy at time t. $(Digi_t)$ is an independent variable measured by adding CCIL, RTGS, Retail Payments, Card Payments and PPI. This method was adopted from the RBI report on Payment System Indicators. CCIL is added in this model because it gives ease to customers. This variable is used as a proxy for digitalization of banks in India. $\ln(Yd_t)$ is a log of total credit outstanding

amount released by banks at time t. (Yd_t) is obtained from an RBI report named Bank Credit of SCBs. This variable can be seen as a proxy for Credit Demand in the Indian Economy. So, now the results of this bivariate model are given as follows:

Table-3: Ordinary Least Square Regression (Bivariate)

Included observations: 11 Dependent Variable: Credit Outstanding

Sr. No.	Independent Variable	$\ln(Yd_t) = \alpha_1 + \alpha_2 ln(Digi_t) + \mu_i$ Coefficient	t-statistic	Probability
1	Constant	1.1322	0.492	0.6345
2	$ln(Digi_t)$	0.7585	6.3252	0.0001
3	R-squared	0.8163		
4	Adjusted R-squared	0.796		
5	S.E. of regression	0.1653		
6	Durbin-Watson Statistic	0.4707		
7	F-statistic	40.0077		

The above result shows that Digitalization is highly significant, with a p-value of 0.0001 (p-value <0.05) in the above bivariate model. The slope coefficient α_2 measures the elasticity of Credit Outstanding with respect to Digitalization, i.e., the percentage change in Credit Outstanding for a given percentage change in Digitalization. Thus, it can be said that with 1 unit change in Transaction Value of Digitalization can affect 0.758 unit change in Value of Credit Outstanding. This means that digitalization increases with 1 unit only then the Credit Outstanding will increase by 0.758 units.

Since digitalization has a significant effect on credit outstanding, the Credit demand can be said to have a high-level impact on digitalization with other things remain constant. (Elferink, 2020) in his study also found out the same result as in basic study of this research.

Now, after bivariate analysis, let's take multivariate analysis into account. For this, we are going to show the results of (*v*) equation to know what's the status of variables before stationarity. The equation (*v*) is shown below:

$$\ln(Yd_t) = \alpha_1 + \alpha_2 \ln(X_{1t}) + \alpha_3 \ln(X_{2t}) + \alpha_4 \ln(X_{3t}) + \alpha_5 \ln(X_{4t}) + \alpha_6 \ln(X_{5t}) + \mu_i$$

The regression analysis of the above equation is shown as follows:

Table-4: Ordinary Least Square Regression (Multivariate)[1]

Included observations: 11 Dependent Variable: Credit Outstanding

Sr. No.	Independent Variable	$\ln(Yd_t) = \alpha_1 + \alpha_2 \ln(X_{1t}) + \alpha_3 \ln(X_{2t}) + \alpha_4 \ln(X_{3t}) + \alpha_5 \ln(X_{4t}) + \alpha_6 \ln(X_{5t}) + \mu_i$ Coefficient	t- statistic	Probability
1	Constant	12.8945	8.7069	0.0003
2	L_RTGS	-0.0608	-1.0264	0.3518
3	L_CCIL	-0.0731	-0.8352	0.4417

Sr. No.	Independent Variable	$\ln(Yd_t) = \alpha_1 + \alpha_2 \ln(X_{1t}) + \alpha_3 \ln(X_{2t}) + \alpha_4 \ln(X_{3t}) + \alpha_5 \ln(X_{4t}) + \alpha_6 \ln(X_{5t}) + \mu_i$		
		Coefficient	t- statistic	Probability
4	L_RETAIL	0.3572	6.2520	0.0015
5	L_CARD	-0.01993	-1.6544	0.159
6	L_PPI	-0.0018	-0.3457	0.7437
7	R-squared	0.9978		
8	Adjusted R-squared	0.9957		
9	S.E. of regression	0.0240		
10	Durbin-Watson Statistic	1.5496		
11	F-statistic	461.4421		

Table-4 shows the analysis of the multivariate regression model without stationarity of two variables. The result, thus, shows a significant relationship between Credit Outstanding and Retail Payment in the economy. Their significance level is about 99%, while other variables have no significant effect on the Credit.

There is an elasticity of +0.35 between these two variables showing a positive relationship, while other variables have a negative impact on the dependent variable without any significance.

Table-5: Unit Root Test – Augmented Dickey – Fuller Method Particulars[2]

	At level		1st Difference	
	Dickey-Fuller	P value	Dickey-Fuller	P value
$\ln(Yd_t)$	0.62087	0.99	-1.719	0.6794
$\ln(X_{1t})$	-2.5854	0.3494	-	-
$ln(X_{2t})$	-2.1065	0.5318	-	-
$ln(X_{3t})$	1.1892	0.99	-1.9476	0.5923
$ln(X_{4t})$	-2.936	0.2158	-	-
$ln(X_{5t})$	-2.8313	0.2557	-	-

To test stationarity, we have used the Augmented Dickey-Fuller test in R software. The above result was obtained by running adf. test function in R. This result showed that only two variables were non-stationary, i.e., Log of Credit Outstanding and Log of Retail Payments. And on converting these series on the first difference both the variables become stationary.

To confirm our results, a Phillips-Perron Test on R has been run. The result was as follows:

Table-6: Unit Root Test – Phillips-Perron Method Particulars[3]

	At level		1st Difference	
	Dickey-Fuller Z(alpha)	P value	Dickey-Fuller Z(alpha)	P value
$\ln(Yd_t)$	3.1008	0.99	-11.953	0.3444
$\ln(X_{1t})$	-3.3682	0.9127	-	-
$ln(X_{2t})$	-6.6208	0.7016	-	-
$ln(X_{3t})$	0.025816	0.99	-9.1939	0.5292
$ln(X_{4t})$	-7.4987	0.6428	-	-
$ln(X_{5t})$	-4.76	0.8263	-	-

The above result was obtained by running pp.test function in R. The result shown are the same as the results of the Augmented Dickey-Fuller test, that only two variables were non-stationary, i.e., Log of Credit Outstanding and Log of Retail Payments. And on converting these series on the first difference, both the variables become stationary.

The analysis is made here after making the variables stationary. As we have discussed further, all variables are stationary at level except two variables, i.e., Credit Outstanding (dependent variable) and Retail Payments (one independent variable). So, for making these variables, we have settle them at 1st difference and after that, the results of 1st difference of these variables show stationarity in them. So, the (*vi*) equation is the equation showing that all variables in this equation are stationary. The equation (*vi*) is given below:

$$\ln(Yd_t)^s = \alpha_1 + \alpha_2 \ln(X_{1t})^s + \alpha_3 \ln(X_{2t})^s + \alpha_4 \ln(X_{3t})^s + \alpha_5 \ln(X_{4t})^s + \alpha_6 \ln(X_{5t})^s + \mu_i$$

Table-7: Ordinary Least Square Regression (Stationary)[4]

Included observations: 11 Dependent Variable: Credit Outstanding

Sr. No.	Independent Variable	$\ln(Yd_t)^s = \alpha_1 + \alpha_2 \ln(X_{1t})^s + \alpha_3 \ln(X_{2t})^s + \alpha_4 \ln(X_{3t})^s + \alpha_5 \ln(X_{4t})^s + \alpha_6 \ln(X_{5t})^s + \mu_i$		
		Coefficient	t- statistic	Probability
1	Constant	-1.3778	-0.8077	0.456
2	L_RTGS	0.0968	1.5687	0.1775
3	L_CCIL	-0.0210	-0.2751	0.7943
4	L_RETAIL	0.2733	3.8762	0.0117
5	L_CARD	-0.0024	-0.1829	0.8621
6	L_PPI	0.0020	0.5977	0.5760
7	R-squared	0.8932		
8	Adjusted R-squared	0.7863		
9	S.E. of regression	0.0255		
10	Durbin-Watson Statistic	1.958		
11	F-statistic	8.3602		

In Table-7, the Retail Payment has a p-value of 0.01 (p-value <0.05), which shows that retail payment is highly significant in affecting the Credit Demand. Another variable like RTGS is less significant, but we can say it has some significance in deciding the Credit Demand in the economy, while all other variables have no significance in this model. So, we can say that Credit demand can be affected by only two variables in this model. First is Retail Payment and the Second is RTGS.

Both Retail and RTGS have positive elasticity with the Credit Demand. Retail has an elasticity of 0.27, while RTGS has an elasticity of 0.096. This means if Retail increases by 1 unit, then the Credit demand will increase by 0.2733 units while an increase in 1-unit RTGS has 0.968 units change in Credit Demand.

So, with the above results of both bivariate and multivariate model,it can be said that the null hypothesis is rejected in this study.

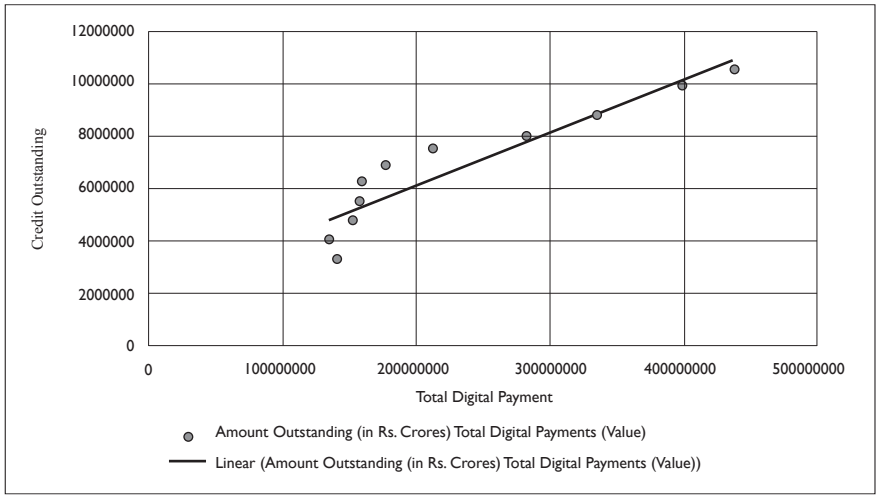
Conclusions

The study interprets that with an increase in the digitalization in the economy the credit demand also increases and it is because of the ease of taking loans from the banks. In this study, it has been found that increasing digitalization through Retail Payments is affecting the Credit Demand more than any other variables of the digital payment used in this study. The growth of systems like UPI, NACH, AePS, RuPay, etc., is affecting the credit in a positive way. The retail is the most significant variable in the multivariate model, whether it is a non-stationary model or the model made after making all variables stationary. So, to further understand this relationship,a scatter plot between credit outstanding and digital payment is made.

A positive relationship exists between credit and digitalization in the economy (Elferink, 2020). In their study (Herwadkar et al., 2019) showed that digitalization is very much required for economic growth and they have shown it with the help of a scatter plot that digitalization is key to increasing the credit growth of the Indian economy with the help of 'Credit to GDP' variable. In this study, a scatter plot was made to show the impact of digitalization on credit with the same approach (Herwadkaret al., 2019).

Chart-3 shows the scatter plot interaction of both the variables. Moreover, it can be seen in this plot that there is a linear relationship between both the variables, which can be proved from the results of our bivariate equation. In their study (Das & Tewari, 2020), they have shown that banks make more profit after digitalization and the study shows why.

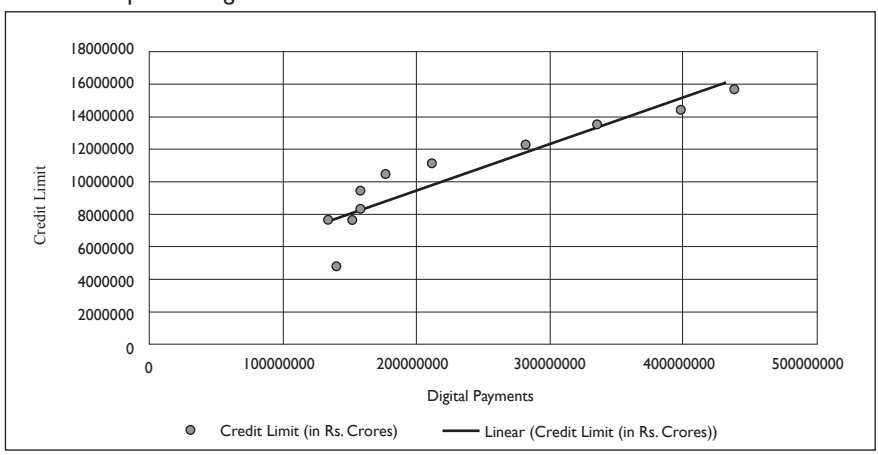
Chart-3: Impact of Digitalization on Credit Outstanding



This study shows that banks can earn more profit because they give more loans to the public. This happens because of the ease of getting loans and the increase in demand for credit due to digitalization. Now, in this study, there is another scatter plot which shows how digitalization is impacting credit supply. At the starting of the study, there is a trend comparison between two credit variables, i.e., Credit Outstanding and Credit Limit, where Credit Outstanding is used as the proxy of Credit Demand and Credit Limit is shown as the Credit Supply in the economy. The variable analysed in this study is Credit Outstanding. However, it cannot be possible to complete this study without showing the effect of digitalization on Credit Supply, which is, proxied by the Credit Limit in this study.

So, there is a scatter plot showing the relationship between Credit Limit and Digitalization.

Chart-3: Impact of Digitalization on Credit Limit



This is also showing an upward trend with the increase of digitalization in the economy, which can be due to the fact that Credit Outstanding is increasing at a faster rate because of the digitalization. As the theories suggest an increase in demand increases the supply.

Likewise, in this case, there is an increase in supply due to an increase in the demand for credit. In the above, when the trend analysis was done, it has shown that the credit outstanding is always less than credit limit which can be due to some imperfection in the Indian Banking Sector. But there is another point that growth rate of credit outstanding is always greater than the growth rate of the credit limit.

Our honourable "Prime Minister of India" urged fellow citizens to go for a 'Cashless Day Out' Experiment. In this he wants people to try and use digital payment throughout the day when they are out for tourism or leisure. Through this, it can be seen how government want digitalization for Economic growth. In their studies, (Herwadkar et al., 2019), (Tet al., 2019) have also shown that how digitalization is important for Economic growth and through this study, it can be said that digitalization is not only required for economic growth, but is also required for credit growth. Through this study, it can be said that RBI has to introduce more systems of digital payments like Wallet in RuPay Card and 'One Nation One Card' Scheme through RuPay. We have to make the UPI system more feasible and accessible for the persons living in backwardness. Aadhar UPI has to be promoted more so that more and more people can use it. 'PM Jan Dhan Yojana' has to be made more connected to Retail payments scheme so that more and more people can join into the banking channel and more facilities can be given to all the citizens. Through this, there could be an emphasis on the fact that this study has shown that Retail is the most important variable of digitalization affecting credit. So, the growth credit in India mostly depends on the Retail Payments and their components.

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Appendices

Appendix-1: Data of Digital Payment's Value of Transaction in India

Value (in 'Crore)

Year	CCIL	RTGS	Retail	Card	PPI	Total Digital Payments
2010	38739582	101169931	596644	88242	0	140594399
2011	38390133	94103933	1194480	1142050	0	134830596
2012	40607118	107979058	2057560	1551078	6201	152201015
2013	50159849	102635005	3188114	1867065	7923	157857956
2014	62156963	90496804	4785629	2215958	8105	159663459
2015	75200042	92933309	6536551	2541527	21342	177232771
2016	80737042	82457801	9132183	39958827	48758	212334610
2017	105617336	98190376	13167260	65828851	83801	282887624
2018	107480202	116712478	19213587	91903500	141634	335451401
2019	116551038	135688187	26615027	119688800	212876	398755928
2020	134150192	131156475	29282565	143481300	215558	438286090

Source:(Reserve Bank of India, Payment System Indicators, 2021)

Appendix-2: Data of Bank's Credit (Annual) in India

Year	Credit Limit (in Rs Crore)	Amount Outstanding (in Rs Crore)
2020	15743447.89	10518811.62
2019	14483881.34	9897595.12
2018	13514104.36	8766972.58
2017	12318881.95	7917868.50
2016	11199273.11	7522644.73
2015	10455451.65	6878472.52
2014	9509444.66	6282082.43
2013	8335783.17	5525317.03
2012	7686604.74	4803266.91
2011	7715531.26	4075647.00
2010	4868696.90	3345169.32

Source: (Reserve Bank of India, Report on Bank Credit of SCBs - Bank Group, Population Group, Occupation (Sector), District Wise, Annual, 2021)

Endnotes

1 The analysis is done before checking and solving stationarity in the variables.

2 Results were obtained using R software.

3 Results were obtained using R software.

4 The analysis is done after checking and solving stationarity in the variables.

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Cropping Pattern and Agricultural Growth: A Region-Wise Analysis of Uttar Pradesh

Sifat Fatima[1]
Md Zulquar Nain[2]

Abstract

Using the share of the agriculture and related activities in the Net State Domestic Product (NSDP) and landuse, this study examines the regional cropping patterns and agricultural growth from 1990-91 to 2020-21 in Uttar Pradesh. We find that despite decreasing trends, food grains have the largest share in total production. There has been a marginal change in land use patterns for different crops. Moreover, there is a wide variation among the regions in terms of land use for different crops and yields. Further, the share of agriculture in the Net State Domestic Product has declined over the sample period.

Keywords: Uttar Pradesh, Net State Domestic Product, Land-Use and Cropping Patterns

Introduction

Uttar Pradesh is a primarily agricultural and economic state in India. It accounts for 7.3 per cent of the country's total land area. Regarding population, Uttar Pradesh is India's largest state, with agriculture providing a living for 59 per cent of the people. Agriculture accounts for nearly 23 per cent of the state's GSDP in 2019-20. Even though agriculture's share of GSDP in Uttar Pradesh is steadily declining, the state remains heavily reliant on agriculture.

Given the size of the state and the rich Indo-Gangetic plains, UP significantly contributes to the nation's food security. Uttar Pradesh is known as the 'granary of the nation' due to its significance as a major agricultural producer. The state contributes approximately 28 per cent of wheat and 12 per cent of rice to total production in the country. Another

1 Research Scholar, Department of Economics, Aligarh Muslim University and can be reached at sifatfatima086@gmail.com or gh8200@myamu.ac.in

2 Assistant Professor, Department of Economics, Aligarh Muslim University and can be reached at zulquar.ec@amu.ac.in

important crop is sugarcane, which accounts for 44 per cent of the country's total output. Given the state's vast size, this paper focuses on four regions: the Western Region, the Eastern Region, the Central Region, and the Bundelkhand Region. In these regions of the state, agricultural performance varies significantly. Regarding its contribution to the economic value of agricultural and related activities, Western Uttar Pradesh is the most advanced region, whereas Bundelkhand lags well behind.

With time, there has been a decreasing trend in acreage and production of major crops in Uttar Pradesh. Since the early 1990s, cropping patterns have gradually shifted in favour of high-value crops such as sugarcane, potatoes, livestock, and fisheries, as opposed to pulses, cereals, and oilseeds (Gulati, 2017).

The introduction of crop diversification in Uttar Pradesh has afforded enormous opportunities for output expansion and income growth among farmers. Horizontal expansion of agricultural land in Uttar Pradesh is unlikely. Therefore, the only way to increase the income and growth of farmers and the agricultural sector is to diversify agricultural farming and intensify land and other inputs.

This paper examines the regional cropping pattern and agricultural growth in Uttar Pradesh from 1990-91 to 2020-21. The article is structured as follows: First, we explain the data and methodology used in the present study. Second, we examine the contribution of agriculture to the net state domestic product of Uttar Pradesh. Then agricultural landholdings in Uttar Pradesh are discussed. This is followed by the analyses of the land-use patterns of India, Uttar Pradesh, and its four regions. The cropping pattern of Uttar Pradesh and its four provinces is examined next. Finally, the paper concludes with a summary of the critical findings.

Data and Methodology

The study is based primarily on secondary data collected from various government publications and reports of India and Uttar Pradesh. The study spans from 1990-91 to 2020-21 to evaluate the agricultural performance in Uttar Pradesh. The study has taken district-level data for 19 major crops from the ICRISAT website. The other sources of data are the websites of the Directorate of Economics and Statistics (DES) of the Government of India, the Ministry of Agriculture and Farmers' Welfare, the Central Statistical Organization (CSO), the Census of India, and the Statistical diary of Uttar Pradesh (various issues).

The district-level data is available only up to 2018-19; therefore, data for 2019-20 and 2020-21 is calculated by taking a five-year moving average of data from 2014 to 2018.

For the analysis to be practical, the study has divided the 75 districts of UP into four regions - Western, Eastern, Central, and Bundelkhand. The western region had 30 districts, the central region had 10, the eastern region had 28, and the Bundelkhand region had 7. These districts are listed in Appendix-5. Furthermore, for better understanding, we have divided the total land area into four categories: Agriculture, Forest, Non-Agriculture, and Waste. The non-agriculture category includes barren and uncultivated land, permanent pastures, and tree crops. Similarly, areas classified as culturable wasteland, current fallow, and fallow other than current fallow land are classified as Waste. Agriculture and forest land have remained unchanged.

To investigate the cropping pattern, we calculated the annual compound growth rates of area, yield and production of significant crops using the following formula:

Annual growth rate $G_t = \left(\left(\frac{V_t}{V_{t-1}}\right) - 1\right) \times 100$

Compound annual growth rate $(CAGR) = \left[\left(\frac{FV}{IV}\right)^{\frac{1}{T}}\right] - 1$

V_t- Value of indicator (like area/production/inputs) in year t.

V_{t-1}- Value of indicator (like area/production/inputs) in year t-1

FV- Final value of the indicator (like area/production/yield)

IV- Initial value of the indicator (like area/production/yield)

T- Number of years for which CAGR is to be estimated.

Share of Agriculture in Net State Domestic Product

First, we examine the performance of agriculture in the state. Table-1 shows that during the thirty years from 1990-91 to 2019-20, Uttar Pradesh's net state domestic product originating from agriculture and related activities recorded a growth rate of 2.38 per cent per annum. The overall growth rate of the state economy was 5 per cent per annum. Agriculture's growth rate was higher from 1990-91 to 1999-00 (3 per cent) before declining significantly from 2000-01 to 2009-10 (1.20 per cent) and then rising again from 2010-11 to 2019-20. (2.93 per cent).

Since 1990s, the size of land holdings in Uttar Pradesh has steadily decreased. The average holding size in the state was 0.86 ha in 1995-96, which was reduced to 0.73 ha in 2015-16 (Agricultural Census, 1995-96 and 2015-16)

Agriculture is an essential aspect of the majority of people's life in Uttar Pradesh. The Situation Assessment of Agricultural Households during

2012-13 estimated that UP is home to approximately 18 million agricultural households, which accounts for 20 per cernt of all agricultural families in rural India.

Table-1: Average Annual Growth Rates of NSDP in Uttar Pradesh (At Constant 2011-12 Prices): 1990-91 to 2019-20

Sector	1990-91 to 1999-00	2000-01 to 2009-10	2010-11 to 2019-20	1990-91 to 2019-20
Agriculture	3.00%	1.20%	2.93%	2.38%
Manufacturing	3.13%	5.15%	11.20%	6.49%
Service	4.10%	6.64%	7.20%	5.98%
Total NSDP	3.60%	5.14%	6.26%	5.00%

Author's calculation by using data available from CSO, MOSPI.

Agricultural Landholdings in UP

Table-2: Percentage Distribution of Operational Holdings and Operated Area According to Size Classes in Uttar Pradesh

Size Classes	1995-96		2000-01		2005-06		2010-11		2015-16	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
Marginal (> 1 ha)	75.4	33.7	76.9	37.0	78.0	38.9	79.5	40.7	80.2	41.8
Small (1-2 ha)	14.6	23.9	14.3	24.3	13.8	24.2	13.0	24.1	12.6	23.9
Semi-Medium (2-4 ha)	7.4	23.3	6.6	21.7	6.2	21.2	5.7	20.6	5.5	20.4
Medium (4-6 ha)	2.5	15.9	2.1	14.4	1.9	13.3	1.7	12.5	1.6	11.9
Large (< 10 ha)	0.2	3.3	0.2	2.7	0.1	2.4	0.1	2.2	0.1	2.0

Number - Units, Area - Hectares

Source: Agriculture Census (various issues), Department of Agriculture & Farmers Welfare

Table-2 shows that the small and marginal farmers had always dominated the land holdings in Uttar Pradesh. The rising population has further led to the fragmentation of land holdings.

Land Use Pattern

The land use pattern has remained constant over the decades at national and state levels. The agriculture sector has dominated the land under total land area at both national and state levels. Figures-1 and 2 show the land use pattern in India and Uttar Pradesh, respectively. In India, the area under the agriculture sector has reduced by 2 per cent from 1990-91 to 2020-21, which has probably added 1 per cent to the forest sector and 1 per cent to the non-agriculture sector. At the same time, the area under the waste category has almost remained constant over the years.

The land use pattern in Uttar Pradesh has also shown a stagnant trend except for the 1990-91 to 2000-01 time period. Over the decades, there has been a massive change in the land category under the agriculture and forest sector. The forest area has declined from 17.3 per cent to approximately 7 per cent, and agricultural land has increased from 58 per cent to 69.5 per cent. Since then, the agricultural land remained highest in Uttar Pradesh. In 2020-21, the forest area was only 7 per cent of the total land, 23 per cent less than the standards for sustaining the region's natural balance. Non-agricultural uses constitute only 16 per cent of the land, and the remaining 8.3 per cent of the land is either degraded or not used for any productive purposes.

Figure-1: Trend in Land Use in India

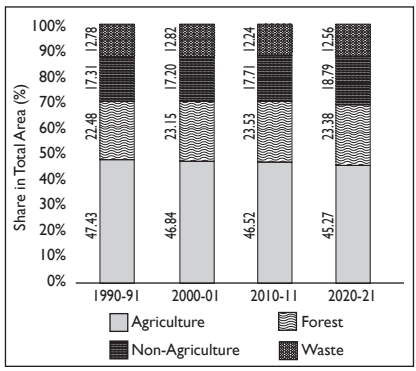
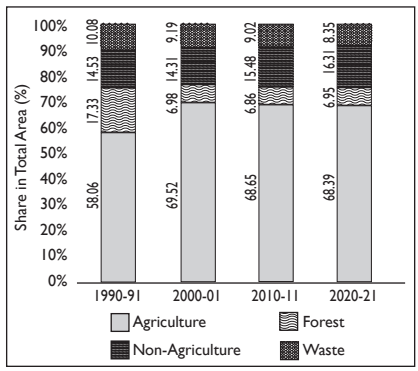


Figure-2: Trend in Land Use in Uttar Pradesh



Source: Directorate of Economics and Statistics, Government of India.

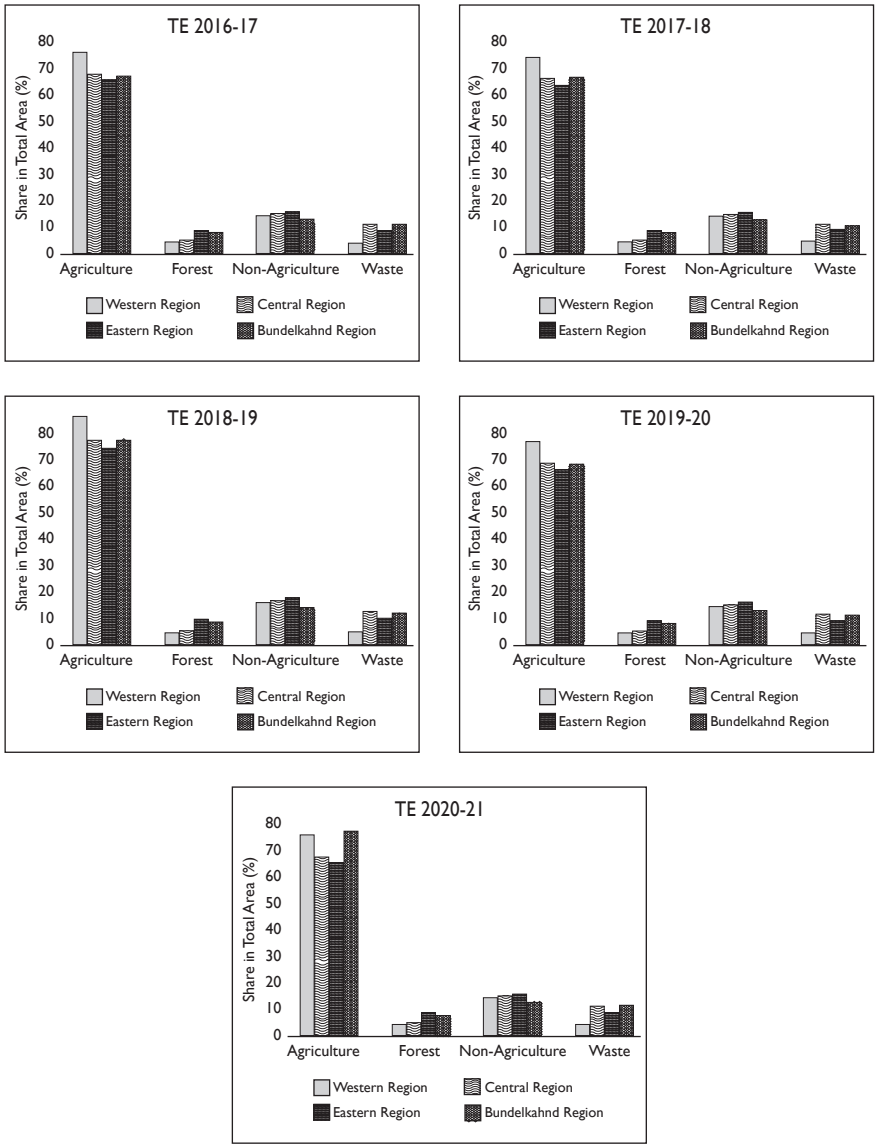
Land Use Pattern in Different Regions

The trend in land use patterns in different regions of Uttar Pradesh has been examined thoroughly from 2016-17 to 2020-21. Agriculture dominates land use patterns in all the regions over the five-year (Figure-3). The share of agriculture in the total land area ranged between 65 per cent to 70 per cent in the Central, Eastern, and Bundelkhand regions. In contrast, it reaches 75 per cent to 76 per cent in the Western region. There is a 1 per cent reduction in agricultural land in the Western region compared to a 1 per cent increment in the same land in the Central and Bundelkhand regions from 2016 to 2020. The forest area ranges from 5 per cent in Western and Central regions to 8 per cent and 9 per cent in Bundelkhand and Eastern regions, respectively. There is no change in area under forest and non-agricultural uses in each region during five years. Similarly, an area under the waste category has remained constant besides slight variations between the years.

The historical land use pattern did not exhibit a considerable movement toward agriculture. Due to increased urbanization and increasing land degradation, the potential for agricultural expansion in the future would be

constrained. Consequently, future agricultural output and expansion may be accomplished primarily by increasing crop yields and expanding land utilization.

Figure-3: Trend In Land Use in Different Regions of Uttar Pradesh



Source: ICRISAT- District Level Data

Cropping Pattern

Uttar Pradesh's location in the fertile Gangetic plains and its extensive agroclimatic diversity allows it to cultivate many crops. It is a leading producer of food grains and sugarcane in India.

Foodgrains

Between 1990 and 2020, the area under food grain crops was limited to 19 to 20 million ha. In 2020-21, this accounted for 73 per cent of the total cropped area in Uttar Pradesh (Table-3). It was significantly more significant than the national average for food grain crops, around 66 per cent during the same period. With changing food consumption patterns, the share of food grains in the gross cropped area has decreased from around 80 per cent to 73 per cent from 1990-91 to 2020-21.

Cereals

The most crucial food grain crops are rice and wheat. In 2020-21, their respective relative share in the gross cropped area (GCA) was approximately 22 per cent and 36 per cent. Uttar Pradesh is the country's leading wheat producer. Uttar Pradesh contributed approximately 31 per cent of total wheat production in India in 2019-20. The state was second only to West Bengal in terms of rice production. Between 1990 and 2020, the wheat area increased by 1.4 million ha, and the rice area increased by 0.4 million ha. During the same period, the area under all coarse cereals decreased by 0.8 million ha. Their marginal share of GCA has also decreased, from 11 per cent in TE 1990-91 to 7 per cent in TE 2000-01.

Pulses

In the TE 2020-21, the relative share of pulses in the GCA was around 8 per cent. Chickpea (gram) and pigeon pea (tur) occupied approximately 36 per cent of the total pulse area during the same period. In the TE 1990-91, their relative share of total pulse area reached 58 per cent. These pulses were replaced mainly by lentils, green gram, black gram, and peas. Between 2000-01 and 2010-11, the GCA's share of these minor pulses increased nearly to 6 per cent but fell back to 5 per cent in 2020-21.

Oilseed Crops

Oilseed crops occupied about 4.3 per cent of the GCA in 2020-21. Their area increased by 100 m ha from 1053.59 m ha in 1990-91 to 1153.69 m ha in 2020-21. Rapeseed and mustard are the most important oilseed crops in the state. In 2020-21, their respective share in the GCA was 2.4 per cent. The 'Technology Mission on Oilseeds' was initiated in 1987 to increase the production of oilseeds in the country, primarily to reduce edible oil imports.

Sugarcane

Another major crop in the state is sugarcane. Its area has increased by 25 per cent, from 1.8 m ha in 1990-91 to 2.3 m ha in 2020-21. With the growth of the irrigated area in the state, sugarcane agriculture flourished. Uttar Pradesh is the largest sugarcane-producing state in the country. In terms of sugar production, however, it was second only to Maharashtra.

Table-3: Cropping Pattern of Uttar Pradesh

Crop	Area ('000 ha)				Share in GCA (%)			
	TE 1990-91	TE 2000-01	TE 2010-11	TE 2020-21	TE 1990-91	TE 2000-01	TE 2010-11	TE 2020-21
Rice	5349.08	5930.22	5831.48	5745.44	22.10	23.44	22.77	21.76
Wheat	8208.68	9285.02	9846.61	9598.05	33.91	36.69	38.44	36.36
Sorghum	526.55	347.43	201.11	163.72	2.18	1.37	0.79	0.62
Pearl Millet	785.13	881.1	940.01	916.56	3.24	3.48	3.67	3.47
Maize	1065.64	922.85	778.12	737.45	4.40	3.65	3.04	2.79
Barley	399.02	287	164.25	147.58	1.65	1.13	0.64	0.56
All Cereals	16334.1	17653.62	17761.58	17308.80	67.48	69.77	69.34	65.57
Chick Pea	1273.37	833.08	588.39	455.64	5.26	3.29	2.30	1.73
Pigeon Pea	466.45	406.65	334.51	283.10	1.93	1.61	1.31	1.07
Minor Pulses	1268.85	1455.57	1525.37	1326.11	5.24	5.75	5.96	5.02
All Pulses	3008.67	2695.3	2448.27	2064.85	12.43	10.65	9.56	7.82
All Foodgrains	19342.77	20348.92	20209.85	19373.65	79.91	80.42	78.90	73.39
Groundnut	151.65	116.97	87.6	94.32	0.63	0.46	0.34	0.36
Sesamum	75.84	108.28	342.65	357.61	0.31	0.43	1.34	1.35
Rapeseed and Mustard	680.01	556.79	594.03	651.81	2.81	2.20	2.32	2.47
Linseed	93.84	55.3	29.19	24.43	0.39	0.22	0.11	0.09
Sunflower	6.75	9.9	3.56	2.40	0.03	0.04	0.01	0.01
Soyabean	8.27	15.76	12.9	23.23	0.03	0.06	0.05	0.09
All Oilseeds	**1053.59**	**863.01**	**1069.94**	**1153.69**	**4.35**	**3.41**	**4.18**	**4.37**
Sugarcane	1804.58	2002.93	2127.06	2258.03	7.46	7.92	8.30	8.55
Cotton	15.64	5.31	3.52	5.77	0.06	0.02	0.01	0.02
Fruits	302.41	320.32	305.95	115.22	1.25	1.27	1.19	0.44
Vegetables	534.08	639.98	790.2	343.38	2.21	2.53	3.08	1.30
All Fruits and Vegetables	836.51	960.22	1096.11	458.60	3.46	3.79	4.28	1.74
Potato	323	394.66	529.4	579.99	1.33	1.56	2.07	2.20
Onion	27.56	24.05	21.69	22.98	0.11	0.10	0.08	0.09

Source: Statistical Diary of UP (various issues).

Potato

The percentage contribution of potatoes to GCA increased from about 1.3 per cent in 1990-91 to 2.2 per cent in 2020-21. Uttar Pradesh is the leading producer of potatoes in the country.

Fruits and Vegetables

The fruits and vegetable area has sharply declined by 45 per cent from 0.83 m ha in 1990-91 to 0.45 m ha in 2020-21. Their relative share in GCA remained only 1.7 per cent from 3.4 per cent between 1990-91 to 2020-21. The area under other crops such as cotton, jute, and onion are minor, and their respective share in GCA is insignificant.

Crop Choices Across Regions

The selection of crops varied greatly between regions. In Table-4, an overview of crop selections in various locations is shown. The primary crops in the Central and Eastern areas are rice and wheat. In the western region, the most important crops are rice, wheat, and sugarcane. In the Bundelkhand region, a considerable portion of agricultural land is allotted to wheat and pulses.

Table-4: Crop Preferences according to Importance in Different Regions of Uttar Pradesh, TE 2020-21

Regions	Crop Preferences				
	High (> 25% of GCA)	**Medium (10-25% of GCA)**	**Low (5-10% of GCA)**	**Least**	**(< 5% of GCA)**
Western	Wheat	Rice, Sugarcane	Pearl Millet	Sorghum, Maize, Barley, Pulses, Oilseeds, Cotton, Fruits and Vegetables	
Central	Wheat	Rice	Sugarcane	Sorghum, Pearl Millet, Maize, Barley, Pulses, Oilseeds, Fruits and Vegetables	
Eastern	Wheat, Rice	-	-	Sorghum, Pearl Millet, Maize, Barley, Pulses, Oilseeds, Sugarcane, Fruits and Vegetables	
Bundel-khand	Wheat	Chick Pea, Minor Pulses	Sesamum	Rice, Sorghum, Pearl Millet, Maize, Barley, Pigeon Pea, Groundnut, Rapeseed and Mustard, Other Oilseeds, Sugarcane, Fruits and Vegetables	

Source: Author's analysis from data.

Table-5: Annual Compound Growth Rates of Area, Production, Yield of Important crops in Uttar Pradesh (%)

Crops	1991-00			2001-10			2011-20		
	Area	**Prod.**	**Yield**	**Area**	**Prod.**	**Yield**	**Area**	**Prod.**	**Yield**
Rice	1.58	3.16	1.12	-0.5	-0.44	0.34	0.01	0.10	0.15
Wheat	1.29	2.96	1.58	0.63	1.98	1.33	0.0	-0.28	-0.26
Sorghum	-3.12	-1.17	2.06	-5.20	-4.45	-1.43	-1.23	-2.92	0.22
Pearl Millet	1.88	5.79	3.53	1.11	5.62	0.64	0.27	0.88	0.04

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Maize	-1.28	3.22	4.19	-1.99	-2.83	-1.34	-0.24	1.46	2.15
Barley	-3.04	-1.95	1.18	-4.75	-4.05	0.99	-1.20	-1.82	-0.13
All Cereals	1.06	2.97	2.04	0.00	1.13	0.41	-0.03	-0.11	0.24
Chick Pea	-3.01	-2.33	0.48	-3.89	-4.45	-0.08	-2.94	-5.65	-3.20
Pigeon Pea	-2.72	-0.91	0.74	-1.88	-4.57	-2.75	0.19	-0.71	-0.94
Minor Pulses	2.04	-1.18	-1.16	0.64	0.66	1.29	-1.42	-2.60	-2.08
All Pulses	-0.54	-1.51	0.11	-0.99	-1.83	-0.64	-1.58	-3.17	-2.14
All Foodgrains	0.83	2.69	1.59	-0.13	0.99	0.19	-0.21	-0.23	-0.22
Groundnut	-0.82	-0.49	-0.88	-2.34	-0.49	0.39	-0.18	-1.71	0.30
Sesamum	3.77	3.71	-0.16	14.30	11.38	-3.04	1.47	3.52	1.70
Rapeseed and Mustard	-4.43	-3.05	1.40	0.51	2.28	1.51	0.86	1.29	0.39
Linseed	-5.30	-6.96	-3.90	-3.55	-2.99	-0.55	-1.99	-1.11	2.33
Sunflower	-5.79	-4.93	0.01	-4.73	-5.78	-4.93	-1.65	-3.73	-2.52
Soyabean	10.40	7.44	-10.04	1.83	8.80	4.17	3.11	-7.41	-7.70
All Oilseeds	-3.18	-1.09	1.51	2.77	2.32	1.08	0.97	1.06	14.93
Sugarcane	0.68	0.20	0.12	0.14	-0.08	-0.13	0.39	2.45	1.46
Cotton	-9.58	-11.33	-1.64	-2.67	-0.43	0.45	7.82	-6.35	-12.51
Potato	1.58	3.08	2.21	3.53	3.96	0.37	0.94	0.61	-0.29
Onion	-2.99	-1.65	-0.16	0.36	3.16	3.00	0.82	1.21	0.28

Source: Author's calculations

Growth Patterns

Compared to the 1990s, Uttar Pradesh's agricultural output since 2010 has been significantly lower (Table-5). The production increase of important crops slowed down between 2011 to 2020. The following points may be observed.

- Annual compound growth rate of food grain production decelerated between 2001-10 (0.99 per cent) and 2011-20 (-0.23 per cent) as compared to 1991-00 (2.69 per cent). The primary causes of these changes were (i) a fall in the yields of rice, wheat, and other cereals and (ii) a sharp decline in the acreage and output of pulses.
- Oilseeds production increased during 2001-10 (2.32 per cent) mainly because of area expansion. Yield demonstrated a slight decline of 0.43 per cent during the same period. However, there was a sharp increase in oilseed yield during the 2011-20 (14.93 per cent) period. This is due to the support given by the government of India to the oilseeds production/ developmental programs and policies.
- Sugarcane production increased during 2011-20 (2.45 per cent) compared to 1991-00 (0.20 per cent). The sugarcane production during 2001-10 showed a negative growth rate (-0.08 per cent).
- Potato production increased during 2001-10 (3.96 per cent) than during 1991-00 (3.08 per cent) along with area expansion from 1.58 per cent to 3.53 per cent during the same period. However, there was a rapid decline in both area and production after 2010, reaching 0.61 per cent and 0.94 per cent, respectively. Similarly, yield levels recorded a negative growth rate during 2011-20 (-0.29 per cent).

Cropping Pattern at Regional Levels

Regional agricultural performance in the state varied significantly. The following are the critical observations regarding the agricultural performance of various regions:

Western Region

The western region of Uttar Pradesh is a significant producer of food and sugar. In 2020-21, the GCA's relative share of food grain production was approximately 66 per cent. During the same time period, sugarcane comprised around 14 per cent of the GCA land area (Appendix-1). In 2020-21, this region contributed around 40 per cent of the state's food grain production and nearly 21 per cent of its sugarcane production.

Rice and wheat are the most important cereal crops. Their performance from 1990 to 2020 has been extremely remarkable. Rice output rose from 2.5 million tonnes in 1990-91 to 4.2 million tonnes in 2020-21. (Table-6). During the same period, wheat production increased from 8.1 million tonnes to 13.8 million tonnes. During 2011-2020, yield growth contributed more to rice output growth than land expansion did during 1991-2000. (Table-7). Wheat output increased during the decades as a result of yield enhancement.

Sugarcane was formerly the most valuable cash crop in the western region. Sugarcane production increased from approximately 7.1 million tonnes in 1990-1991 to 35 million tonnes in 2020-21. From 1991-2000 (-0.28 per cent) to 2011-2020, the yearly compound growth rate of sugarcane production surged (17.32 per cent). The majority of the rise in sugarcane production between 2011 and 2020 is attributable to yield growth, while area expansion during the 1990s and 2000s.

Pearl Millet has also shown an upward trend in the Western region. Pearl millet production increased from 0.6 m tonnes in 1990-91 to 1.5 m tonnes in 2020-21. Other coarse cereals have shown a declining trend during the study period.

In the region, oilseeds production has increased slightly. In contrast, the acreage and production of pulses, especially chickpea and pigeon pea, have decreased. Green gram and black gram partially replaced chickpea and pigeon pea.

Table-7: Annual Compound Growth Rates of Area, Production, Yield of Important crops in Western Region (%)

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Rice	4.36	4.44	0.53	0.09	-0.75	-0.23	-0.23	0.56	2.27
Wheat	1.59	3.35	1.70	0.42	1.36	0.93	-0.06	0.27	2.21
Sorghum	-11.56	-10.20	0.74	-10.20	-9.03	-2.53	2.41	3.54	3.77
Pearl Millet	2.26	6.51	3.52	1.21	6.14	0.85	0.16	0.95	2.85
Maize	-2.26	3.34	3.18	-3.31	-3.52	-0.59	0.40	1.37	3.68

Table-6: Area, Production, and Yield of Different Crops in Western Region

Crops	TE 1990-91			TE 2000-01			TE 2010-11			TE 2020-21		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Rice	1126.25	2516.88	36887.96	1592.84	3436.65	37680.05	1602.67	3385.81	38955.94	1615.90	4224.3	53752.27
Wheat	3126.98	8159.42	46698.14	3629.82	11702.64	57853.65	3729.46	12958.4	62432.77	3649.56	13828.56	80664.16
Sorghum	72.67	60.91	13706.47	21.26	19.18	12971.29	7.13	6.82	10576.31	7.90	8.78	15871.92
Pearl Millet	599.44	671.86	17012.26	714.91	1119.93	25624.69	768.45	1374.29	21814.42	758.09	1569.4	30731.84
Maize	542.73	909.82	23178.31	402.72	842.67	33040.52	315.36	623.86	30931.7	319.10	800.08	47498.26
Barley	168.68	418.34	37217.31	130.77	379.83	45481	62.58	196.89	49815.67	52.14	168.86	62448.31
All Cereals	5636.75	12737.23	174700.5	6492.32	17500.9	212651.2	6485.65	18546.07	214526.8	6402.69	20600.0	290966.8
Chick Pea	158.58	168.55	18496.72	40.47	47.61	17640.94	13.16	19.87	19404.33	10.92	15.4	19939.24
Pigeon Pea	99.46	98.56	16486.82	77.89	72.29	16734.64	55.54	44.3	12427.17	44.79	43.3	18189.22
Minor Pulses	342.21	278	13622.4	187.07	146.31	13947.84	184.83	161.41	15478.08	183.70	166.8	38643.19
All Pulses	600.25	545.11	48605.94	305.43	266.21	48323.42	253.53	225.58	47309.58	239.41	219.0	76771.64
All Foodgrains	6237	13282.34	223306.4	6797.75	17767.11	260974.6	6739.18	18771.65	261836.4	6642.10	20818.9	367738.4
Groundnut	62.94	47.29	17041.64	16.47	15.78	12304.8	15.98	16.43	15860.11	16.05	18.76	19195.33
Sesamum	26.38	2.8	2368.26	21.89	3.11	2650.83	30.89	4.74	2688.14	32.26	4.8	3837.222
Rapeseed and Mustard	457.57	511.24	17339.93	280.85	338.45	19050.19	305.33	438.51	22538.92	343.53	550.9	30007.81
Linseed	1.25	0.49	6148.88	0.31	0.11	2678.56	0.00	0.00	0.00	0.09	0.00	2990.238
Sunflower	4.66	4.58	15818.86	6.94	7.1	16311.84	2.53	4.26	17536.16	1.09	1.5	12506.92
Soyabean	0.16	0.22	8476.19	0.04	0.03	2500	0.4	0.53	5309.47	0.50	0.3	2175.141
All Oilseeds	554.21	567.11	73342.64	326.5	364.58	55496.22	355.13	464.47	63932.8	393.52	576.27	70712.67
Sugarcane	1190.95	7192.24	97433.68	1291.9	7479.01	98855.01	1336.13	7948.24	100972.4	1376.38	35044.9	642073.1
Cotton	15.51	2.76	1343.55	5.3	0.81	1413.42	3.39	0.72	1408.21	5.80	0.7	1347.153

Source: ICRISAT
Note: Area = '000 ha; Production = '000 tonnes; Yield = Kg/ha

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Barley	-2.80	-1.48	0.74	-6.74	-6.65	0.08	-1.74	-2.25	2.88
All Cereals	1.76	3.56	1.62	0.09	0.87	0.09	-0.07	0.40	2.74
Chick Pea	-11.39	-10.43	-0.01	-11.80	-9.25	0.11	-1.22	-2.33	-1.58
Pigeon Pea	-1.95	-4.53	-2.27	-4.19	-5.18	-3.41	0.99	0.90	1.18
Minor Pulses	-4.67	-5.46	-0.66	-1.49	0.79	2.24	-1.46	-1.84	9.55
All Pulses	-5.35	-6.35	-1.03	-3.01	-1.96	-0.36	-1.04	-1.73	3.49
All Foodgrains	1.31	3.31	1.07	-0.05	0.84	0.00	-0.10	0.37	2.89
Groundnut	-9.75	-7.81	-1.39	1.06	2.33	1.77	-0.79	-0.44	2.56
Sesamum	-2.36	-5.81	-2.28	3.11	-3.56	-4.91	1.55	-0.86	0.34
Rapeseed and Mustard	-7.51	-4.94	2.00	0.12	2.16	1.49	1.30	2.82	3.66
Sunflower	-6.82	-6.02	-0.56	-3.17	-2.50	-3.99	-2.66	-4.91	-4.10
Soyabean	-15.39	-19.86	-13.16	16.65	27.39	17.81	29.24	18.55	-0.78
All Oilseeds	-7.38	-5.13	-2.51	0.37	2.05	-0.23	1.23	2.63	1.60
Sugarcane	0.48	-0.28	-0.22	0.10	-0.22	-0.39	0.10	17.32	22.34
Cotton	-9.52	-11.24	-0.20	-3.03	-0.89	-1.36	8.00	0.91	0.27

Source: Author's calculations

Central Region

In 2020-21, foodgrain crops contributed around 75 per cent of the total GCA. It used to be 80 per cent in 1990-91. The region dispensed 18 per cent of all food grains produced in the state in 2020-21.

In 2020-21, rice and wheat, the principal food grain crops, accounted for around 62 per cent of the GCA (Appendix-2). From 1990 to 2020, their output has risen significantly. Rice production increased from 1.9 million tonnes in 1990-91 to 2.7 million tonnes in 2020-21 (Table-8). The rise in yield levels is an essential source of the rice production increase (Table-9). Wheat production has also increased in the region during the past three decades, primarily due to yield enhancement.

In the region, maize is another foodgrain crop that has emerged. Its output increased significantly from 197 thousand tonnes in 1990-91 to 265 thousand tonnes in 2020-21. In 2020-21, the maize output and yield annual compound growth rates were unusually high at 5.8 per cent and 5.4 per cent, respectively.

The area under pulses is decreasing, whereas the area under commercial crops, such as oilseeds and sugarcane, is increasing. Rapeseed and mustard are the most important oilseed crops, and their output grew from 1990 to 2020 due to an increase in area and yield.

Table-9: Annual Compound Growth Rates of Area, Production, Yield of Important crops in Central Region (per cent)

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Rice	1.21	1.76	0.52	-0.68	-0.13	0.69	-0.09	0.73	1.23
Wheat	1.45	2.56	1.15	0.88	2.95	1.98	-0.12	-0.01	0.62
Sorghum	-0.87	-0.78	0.26	-5.86	-4.32	0.66	-1.91	-2.38	0.11

Table-8: Area, Production, and Yield of Different Crops in Central Region

Crops	TE 1990-91			TE 2000-01			TE 2010-11			TE 2020-21		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Rice	1028.71	1903.97	16488.9	1090.96	1893.64	14906.15	1086.48	2277.3	18625.65	1101.82	2781.41	23181.23
Wheat	1442.03	3068.3	18991.24	1666.24	4254.92	22907.16	1816.7	5831.15	28568.02	1786.91	6007.52	31094.46
Sorghum	152.52	175.29	10294.55	118.56	125.15	8649.99	64.21	75.57	9604.92	52.80	63.28	9747.60
Pearl Millet	38.15	35.45	6757.98	33.13	32.51	8405.08	38.74	55.58	10119.18	36.25	60.29	11938.91
Maize	168.58	196.9	9000.03	167.25	234	11447.76	137.08	140.4	8516.38	129.13	265.26	15567.64
Barley	85.4	107.75	11597.59	48.12	82.04	15178.38	22.24	45.6	16893.2	20.33	48.25	21816.38
All Cereals	2915.39	5487.66	73130.29	3124.26	6622.26	81494.52	3165.45	8425.6	92327.35	3127.24	9226.01	113346.22
Chick Pea	212.32	205.87	7347.67	118.42	126.35	8967.36	99.33	123.73	7699.48	89.46	107.30	9034.13
Pigeon Pea	104.32	172.17	12841.45	90.31	141.33	11880.92	57.66	66.92	9072.55	44.17	50.97	9897.34
Minor Pulses	216.31	133.17	5123.26	226.71	149.24	5745.62	232.64	169.42	6642.58	207.97	141.13	10975.28
All Pulses	532.95	511.21	25312.38	435.44	416.92	26593.9	389.63	360.07	23414.61	334.08	293.53	29906.74
All Foodgrains	3448.34	5998.87	98442.67	3559.7	7039.18	108088.4	3555.08	8785.67	115742	3461.31	9519.53	143252.96
Groundnut	57.16	40.4	6653.35	36.79	22.43	6875.28	21.24	16.61	7145.67	26.76	29.35	8085.33
Sesamum	15.36	3.81	1797.96	41.14	6.54	1422.99	67.7	12.33	1694.13	70.16	26.00	3022.04
Rapeseed and Mustard	127.34	109.59	6745.21	152.26	134.34	7463.1	149.69	155.24	8721.83	172.83	175.32	8967.51
Linseed	4.45	1.52	3042.76	1.54	0.57	3069.2	0.32	0.18	3141.83	0.48	0.27	3821.56
Sunflower	1.3	1.16	7483.65	1.97	2.69	9461.73	0.84	1.63	8868.42	0.69	0.93	6454.79
Soyabean	0.24	0.31	5815.79	0.29	0.18	2115.38	0.11	0.15	1363.64	0.04	0.03	1346.90
All Oilseeds	210.3	158.31	34581.48	233.99	166.75	30407.68	239.9	186.14	30935.52	270.96	231.89	31698.13
Sugarcane	279.25	1238.34	43043.95	349.82	1793.78	45021.28	391.77	2112.78	47855	463.38	11466.87	216589.00

Source: ICRISAT
Note: Area = '000 ha; Production = '000 tonnes; Yield = Kg/ha

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Pearl Millet	0.63	1.94	2.98	2.11	6.23	2.24	-0.15	0.94	0.67
Maize	0.03	4.53	4.28	-2.14	-5.61	-3.96	-0.41	5.84	5.46
Barley	-5.29	-3.49	2.98	-6.18	-5.03	0.61	-1.96	-2.04	0.74
All Cereals	1.03	2.21	1.82	-0.06	1.69	0.66	-0.17	0.31	1.28
Chick Pea	-5.35	-1.46	2.55	-1.10	0.06	-1.47	-0.82	-2.48	-2.59
Pigeon Pea	-4.23	-0.96	2.75	-3.58	-7.01	-3.07	-3.82	-4.53	0.08
Minor Pulses	0.74	-3.01	-2.95	-0.26	0.85	1.65	-0.35	-0.47	6.48
All Pulses	-2.36	-1.89	1.16	-1.04	-1.40	-1.38	-1.24	-2.22	0.93
All Foodgrains	0.55	1.92	1.65	-0.17	1.54	0.21	-0.28	0.23	1.20
Groundnut	-3.94	-6.76	-1.07	-3.71	-3.94	-2.43	0.66	3.99	1.11
Sesamum	7.66	4.34	-1.36	5.28	-0.40	-3.99	0.77	8.43	5.65
Rapeseed and Mustard	-0.55	1.13	0.95	0.13	1.96	1.87	1.05	2.02	1.29
Linseed	-11.10	-12.26	-2.06	-14.78	-11.49	-0.07	5.36	8.30	0.78
Sunflower	-3.40	-3.42	-0.40	-6.65	-10.19	-6.78	-3.51	-5.99	-2.90
Soyabean	2.61	-1.70	-9.72	-4.08	2.51	-6.72	-13.19	-18.68	-7.07
All Oilseeds	-0.54	-0.58	-2.67	0.79	0.89	-3.11	0.92	2.76	-0.01
Sugarcane	2.03	3.18	1.54	0.00	0.05	0.55	1.15	18.52	17.41

Source: Author's calculations

Eastern Region

The eastern part of Uttar Pradesh is susceptible to flooding. In this region, poverty is acute. Therefore, the fundamental concern of agricultural households in this region is food security. To ensure family food security, 85 per cent of agricultural land is devoted to producing food grains.

Rice and wheat accounted for 74 per cent of the GCA (Appendix-3). Their production increased remarkably during the last three decades because of rising yields (Table-10 and 11). Rice yields, which were 2.5 t/ha in 1990-91, reached 4.4 t/ha in 2020-21. The corresponding increase in wheat yield is from 2.8 t/ha to 5.8 t/ha.

In this region, chickpea and pigeon pea are the most important pulses. In rice-fallow areas, other pulses, such as lentil and green gram, are increasing in acreage and output. Rapeseed and mustard are the principal oilseed crops. Its output has increased due to the increased area and yield levels.

Table-11: Annual Compound Growth Rates of Area, Production, Yield of Important crops in Eastern Region (per cent)

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Rice	0.52	2.81	1.92	-0.59	-0.37	0.10	0.22	0.38	2.56
Wheat	0.96	2.35	1.34	0.46	2.29	1.86	0.15	0.93	3.16
Sorghum	0.19	3.27	4.33	-4.24	-4.02	-2.21	-0.98	-2.56	1.49
Pearl Millet	0.57	1.72	4.01	-0.46	0.08	-0.34	-0.41	-1.72	0.97
Maize	-0.85	1.35	3.81	-0.90	-1.28	-1.64	-0.64	0.56	3.58
Barley	-3.31	-2.03	2.52	-3.77	-2.03	1.52	-3.56	-2.90	0.21
All Cereals	0.60	2.47	2.66	-0.15	1.04	0.32	0.11	0.67	2.12
Chick Pea	-4.78	-5.39	-0.37	-4.38	-3.62	0.62	-1.54	-1.41	1.66
Pigeon Pea	-2.23	-0.26	1.91	-2.22	-4.04	-1.11	0.78	1.38	2.44

Table-10: Area, Production, and Yield of Different Crops in Eastern Region

Crops	TE 1990-91			TE 2000-01			TE 2010-11			TE 2020-21		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Rice	3098.8	5206.95	25315.46	3148.31	6301.58	29670.43	3079.49	6622.73	32060.37	3140.24	7461.32	44142.65
Wheat	3048.37	5844.6	28654.36	3316.33	8014.06	35944.67	3479.03	9850.99	42179.28	3544.28	11322.71	58773.90
Sorghum	71.81	74.44	16574.83	66.05	66.39	18496.3	43.81	46.12	13229.37	39.77	41.98	16299.84
Pearl Millet	120.15	142.11	15659.29	108.66	102.81	19855.19	101.26	113.32	18512.01	97.78	110.87	23226.58
Maize	326.95	262.8	11999.57	324.71	368.11	20910.23	287.21	349.42	18322.59	269.17	392.03	28158.84
Barley	117.11	158.72	22292.54	78.49	109.09	24574.72	47.84	89.05	33443.81	33.47	70.16	35978.33
All Cereals	6783.19	11689.62	120496.1	7042.55	14962.04	149451.5	7038.64	17071.63	157747.4	7124.69	19399.07	206580.15
Chick Pea	325.45	302.13	14127.4	187.31	172.53	14276.21	90.42	94.03	15184.45	78.30	93.61	21081.99
Pigeon Pea	189.55	203.61	15380.64	185.7	228.33	18367.51	150.18	131.72	13864.8	140.44	135.31	16401.13
Minor Pulses	352.52	295.95	12799.68	393.1	328.47	13166.39	347.13	298.45	13414.66	334.85	322.77	34538.82
All Pulses	867.52	801.69	42307.72	766.11	729.33	45810.11	587.73	524.2	42463.91	539.81	539.64	72021.94
All Foodgrains	7650.71	12491.31	162803.8	7808.66	15691.37	195261.7	7626.37	17595.83	200211.3	7664.51	19938.71	278602.09
Groundnut	12.94	11.79	12659.19	11.69	12.95	11598.71	14.21	17.73	11566.3	13.16	13.09	14507.93
Sesamum	11.61	1.71	2190.75	13.78	2.45	2296.75	12.79	2.44	2823.7	13.27	2.58	4068.86
Rapeseed and Mustard	72.36	42.1	7936.72	103.11	73.78	11878.28	89.7	80.43	14772.48	100.38	87.13	16901.40
Linseed	39.44	12.23	4105.71	28.02	10.45	5403.71	12.68	5.27	5327.43	12.29	5.62	6973.41
Sunflower	0.56	0.36	8097.6	0.89	1.06	12577.6	0.16	0.28	15680.72	3.14	1.93	12941.62
Soyabean	0.03	0.03	3000	0.06	0.03	1166.67	0.05	0.07	1400	0.04	0.03	656.71
All Oilseeds	176.38	80.45	42095.68	157.56	100.72	44921.72	129.59	106.22	51570.63	142.27	110.39	56049.93
Sugarcane	330.49	1619.37	67975.36	353.52	1677.42	71131.78	393.78	2013.93	74621.66	401.48	8920.43	525384.64

Source: ICRISAT
Note: Area = '000 ha; Production = '000 tonnes; Yield = Kg/ha

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Minor Pulses	1.33	1.27	0.03	-1.94	-0.76	1.23	-0.91	-0.49	10.28
All Pulses	-1.38	-1.17	0.61	-2.43	-2.22	0.20	-0.88	-0.47	5.19
All Foodgrains	0.39	2.27	2.14	-0.35	0.92	0.30	0.04	0.63	2.83
Groundnut	-0.52	0.69	-0.04	1.48	4.25	0.18	-0.51	-3.86	2.10
Sesamum	2.37	6.85	2.40	0.02	1.57	-1.22	-0.59	-1.18	3.96
Rapeseed and Mustard	2.54	1.92	2.12	-0.55	2.15	1.94	1.05	1.69	1.94
Linseed	-1.77	-4.18	-2.88	-4.98	-4.32	1.48	-0.13	-0.80	5.59
All Oilseeds	-1.02	-0.72	-2.00	-0.87	1.93	-0.11	0.84	0.77	1.58
Sugarcane	0.12	-0.48	-0.21	0.44	0.40	0.24	0.13	16.89	23.11

Source: Author's calculations

Bundelkhand Region

This region is characterized by low rainfall and dryness with vast marginal lands. This region's sizeable area (78 per cent) is allocated to foodgrain crops. Unlike other regions, pulses occupied a large share (about 38 per cent) in the GCA in 2020-21 (Table-12 and Appendix-4).

Among cereals, wheat is an important crop. However, its share in the GCA has remained static at 30 per cent since 2010. The wheat production has increased from 0.9 m tonnes in 1990-91 to 2.2 m tonnes in 2020-21. This is due to the yield enhancement (Table-13). This region is lagging far behind in the adoption of improved varieties and the application of fertilizers. Irrigation facilities are sparse in the region.

The output of pulses between 1990 and 2020 exhibited little change. Other pulses conspicuously replaced historically significant pulses, such as chickpea and pigeon pea. Lentils and peas have mostly supplanted them. This region's marginal and less fertile areas are also used to cultivate more pulses.

In this region, both the area and production of oilseed crops expanded substantially. The area of oilseed crops expanded dramatically from 112,000 ha in 1990-91 to 370,000 ha in 2020-21. Due to little precipitation and a lack of surface and groundwater, this terrain naturally favours pulses and oilseeds. Introducing enhanced, high-yielding, short-duration pulses and oilseed crop types would significantly increase their productivity and farm profitability.

Table-13: Annual Compound Growth Rates of Area, Production, Yield of Important crops in Bundelkhand Region (per cent)

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Rice	0.83	5.05	3.24	-4.89	-5.13	4.65	-0.55	1.06	2.23
Wheat	0.92	3.23	2.16	1.96	2.23	0.05	-0.28	-0.32	1.73
Sorghum	-3.89	-0.74	3.12	-4.38	-4.05	0.58	-1.88	-3.66	1.16
Pearl Millet	-1.11	1.38	2.67	3.32	2.75	-0.33	0.59	2.12	2.39
Maize	1.74	14.62	13.55	3.56	8.11	1.30	-2.62	-4.23	7.13

Table-12: Area, Production, and Yield of Different Crops in Bundelkhand Region

Crops	TE 1990-91			TE 2000-01			TE 2010-11			TE 2020-21		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Rice	95.32	93.41	3608.4	98.11	96.04	3927.58	62.84	77.7	6148.88	75.41	129.67	7870.59
Wheat	591.3	935.71	6586.59	672.63	1309.88	8070.18	821.42	1962.37	9626.25	841.14	2279.77	12770.60
Sorghum	229.55	182.41	3349.94	141.56	118.8	3397.45	85.96	78.57	4085.31	63.08	57.11	4726.52
Pearl Millet	27.39	25.69	3291.2	24.4	22.16	3713.15	31.56	24.27	3127.31	29.72	31.59	4508.35
Maize	27.38	35.04	5279.81	28.17	52.13	6695.95	38.47	60	4560.39	23.76	23.17	7680.86
Barley	27.83	35.18	5056.7	29.62	33.64	4259.73	31.59	77.75	9885.71	36.97	90.15	11594.12
All Cereals	998.77	1307.44	27172.64	994.49	1632.65	30064.04	1071.84	2280.66	37433.85	1070.09	2611.47	49151.04
Chick Pea	577.02	443.27	3130.62	486.88	356.37	2940.8	385.48	304.81	3535.88	300.24	293.85	4718.50
Pigeon Pea	73.12	102.33	5174.72	52.75	67.79	4908.59	71.13	58.48	3660.57	54.53	53.03	4212.72
Minor Pulses	357.81	347.97	3750.65	648.69	325.75	1961.53	760.77	543.49	2696.83	720.44	613.23	8228.65
All Pulses	1007.95	893.57	12055.99	1188.32	749.91	9810.92	1217.38	906.78	9893.28	1045.29	936.64	17159.87
All Foodgrains	2006.72	2201.01	39228.63	2182.81	2382.56	39874.96	2289.22	3187.44	47327.13	2115.38	3548.11	66310.92
Groundnut	18.61	13.01	2722	52.02	46.49	2995.74	36.17	36.26	2643.73	45.26	34.18	3993.23
Sesamum	22.49	2.88	535.66	31.47	5.41	664.55	231.27	48.49	761.95	238.83	60.42	1169.84
Rapeseed and Mustard	22.74	14.78	2475.12	20.57	10.21	1982.24	49.31	29.26	2369.47	60.78	52.30	3674.10
Linseed	48.7	22.45	1879.92	25.43	8.83	1271.20	16.19	7.51	2030.79	12.76	7.50	2422.60
Sunflower	0.23	0.14	1196.43	0.1	0.11	3166.67	0.03	0.05	1666.67	0.09	0.13	1822.47
Soyabean	7.84	6.78	3354.75	15.37	8.99	2450.83	12.34	16.12	5329.78	21.46	11.93	3166.59
All Oilseeds	112.7	53.24	2027.66	144.96	80.04	1894.28	345.32	137.71	1349.03	379.18	166.45	16248.83
Sugarcane	3.89	13.9	14277.18	7.69	32.83	16618.54	5.38	24.88	17202.09	9.67	111.70	75858.97

Source: ICRISAT
Note: Area = '000 ha; Production = '000 tonnes; Yield = Kg/ha

Crops	1991-00			2001-10			2011-20		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
Barley	1.04	-3.63	-5.31	0.78	5.81	5.62	0.74	0.65	1.45
All Cereals	0.04	2.97	2.44	0.80	1.80	2.17	-0.41	-0.33	2.42
Chick Pea	-0.24	1.11	0.91	-3.97	-5.66	-1.01	-3.19	-4.63	0.06
Pigeon Pea	-2.48	1.24	3.86	4.27	-1.19	-4.96	0.10	-0.89	-0.04
Minor Pulses	6.36	-0.15	-5.60	2.98	1.47	-2.53	-0.28	-1.63	8.13
All Pulses	2.68	0.56	0.36	0.27	-1.69	-3.04	-1.48	-2.88	3.14
All Foodgrains	1.39	2.15	1.89	0.52	0.68	0.83	-0.95	-1.07	2.60
Groundnut	11.63	13.47	-0.33	-3.86	-1.51	-1.80	1.50	-0.71	2.16
Sesamum	6.22	15.75	8.96	28.35	30.72	2.23	1.63	2.20	5.07
Rapeseed and Mustard	-3.07	-5.53	-2.20	8.96	7.31	-1.33	2.21	4.53	3.27
Linseed	-7.38	-8.53	-2.01	-2.00	-1.70	1.46	-3.26	0.30	3.85
Sunflower	-4.41	-4.08	0.15	-7.41	-10.81	-15.99	-10.28	-11.77	0.72
Soyabean	11.08	8.54	-1.45	1.70	8.62	6.94	2.43	-6.40	-4.12
All Oilseeds	1.96	3.74	0.04	11.58	6.52	-5.11	1.54	1.15	30.41
Sugarcane	5.30	4.92	-0.50	-3.32	-4.21	-1.46	3.61	14.77	17.81

Source: Author's calculations

Conclusion

Over the last three decades, Uttar Pradesh's agricultural performance has been dismal. From 1990-2020, agriculture's share of total net state domestic product is only 2.38 per cent, compared to 6.5 per cent and 6 per cent for the manufacturing and service sectors. The situation with landholdings in Uttar Pradesh is also concerning. Small and marginal farmers control most holdings (92 per cent). Despite these circumstances, agriculture continues to be the primary source of income for the vast majority of people in Uttar Pradesh. Uttar Pradesh's land use pattern is also agriculturally dominant. In 2020-21, the net cultivated area in UP was 68 per cent, which is far above the national average of 45 per cent during the same period. The study looked at land-use patterns in four regions of Uttar Pradesh from 2016 to 2020. The western region of Uttar Pradesh has the most agricultural land, followed by Bundelkhand, Central, and Eastern regions. However, the land use pattern has remained consistent over time.

Furthermore, cropping pattern analysis revealed that foodgrains are dominant in the state, despite their decreasing share of total production value. In Uttar Pradesh, there are significant disparities between regions. The western UP performs better than other regions, owing to differences in resource endowment. Except in the Bundelkhand region, the prospects for growth through area expansion are limited due to land constraints. However, there are area fluctuations within regions. As the demand for land for residential and industrial purposes continues to rise, the only way to increase the area's contribution to growth is to intensify land cultivation by expanding irrigation facilities. Another issue that has been identified is the

fluctuating yields in the crop sector. Eastern Uttar Pradesh has the highest stake in yield for agricultural growth, followed by Western Uttar Pradesh, Central Uttar Pradesh, and the Bundelkhand region in that sequence. Increased public investment in rural infrastructure and greater emphasis on agricultural research and development is needed to boost yield levels in the state. Diversification of agriculture toward high-value crops within the crop sector and livestock and fisheries across sectors is also a sustainable source of growth that can provide agriculture with cushioned growth.

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Appendices

Appendix-1: Cropping Pattern of Western Region

Crops	Share in GCA (%)			
	TE 1990-91	TE 2000-01	TE 2010-11	TE 2020-21
Rice	12.32	16.47	16.38	16.14
Wheat	34.20	37.53	38.11	36.44
Sorghum	0.79	0.22	0.07	0.08
Pearl Millet	6.56	7.39	7.85	7.57
Maize	5.94	4.16	3.22	3.19
Barley	1.84	1.35	0.64	0.52
All Cereals	61.65	67.12	66.27	63.93
Chick Pea	1.73	0.42	0.13	0.11
Pigeon Pea	1.09	0.81	0.57	0.45
Minor Pulses	3.74	1.93	1.89	1.83
All Pulses	6.56	3.16	2.59	2.39
All Foodgrains	68.21	70.28	68.86	66.32
Groundnut	0.69	0.17	0.16	0.16
Sesamum	0.29	0.23	0.32	0.32
Rapeseed and Mustard	5.00	2.90	3.12	3.43
Sunflower	0.05	0.07	0.03	0.01
Soyabean	0.00	0.00	0.00	0.01
All Oilseeds	6.03	3.37	3.63	3.93
Sugarcane	13.02	13.36	13.65	13.74
Cotton	0.17	0.05	0.03	0.06
Fruits	1.46	1.58	1.50	0.57
Vegetables	2.97	3.44	4.98	2.21
All Fruits and Vegetables	4.43	5.02	6.48	2.78
Potato	1.78	2.23	3.63	3.99
Onion	0.14	0.08	0.06	0.06

Source: Author's calculations

Appendix-2: Cropping Pattern of Central Region

Crops	Share in GCA (%)			
	TE 1990-91	TE 2000-01	TE 2010-11	TE 2020-21
Rice	24.26	24.26	24.31	23.68
Wheat	34.01	37.06	40.65	38.40

Crops	Share in GCA (%)			
	TE 1990-91	TE 2000-01	TE 2010-11	TE 2020-21
Sorghum	3.60	2.64	1.44	1.13
Pearl Millet	0.90	0.74	0.87	0.78
Maize	3.98	3.72	3.07	2.77
Barley	2.01	1.07	0.50	0.44
All Cereals	68.76	69.49	70.83	67.20
Chick Pea	5.01	2.63	2.22	1.92
Pigeon Pea	2.46	2.01	1.29	0.95
Minor Pulses	5.10	5.04	5.21	4.47
All Pulses	12.57	9.68	8.72	7.18
All Foodgrains	81.33	79.17	79.55	74.38
Groundnut	1.35	0.82	0.48	0.58
Sesamum	0.36	0.92	1.51	1.51
Rapeseed and Mustard	3.00	0.92	3.35	3.71
Linseed	0.10	0.03	0.01	0.01
Sunflower	0.03	0.04	0.02	0.01
Soyabean	0.01	0.01	0.00	0.00
All Oilseeds	4.96	5.20	5.37	5.82
Sugarcane	6.59	7.78	8.77	9.96
Fruits	1.62	1.71	1.75	0.66
Vegetables	2.12	2.48	2.36	1.07
Total Fruits and Vegetables	3.73	4.19	4.11	1.73
Potato	1.27	1.44	1.60	1.65
Onion	0.10	0.10	0.11	0.11

Source: Author's calculations

Appendix-3: Cropping Pattern of Eastern Region

Crops	Share in GCA (%)			
	TE 1990-91	TE 2000-01	TE 2010-11	TE 2020-21
Rice	35.85	35.93	35.57	34.88
Wheat	35.27	37.85	40.19	39.37
Sorghum	0.83	0.75	0.51	0.44
Pearl Millet	1.39	1.24	1.17	1.09
Maize	3.78	3.71	3.32	2.99
Barley	1.35	0.90	0.55	0.37
All Cereals	78.48	80.38	81.30	79.14
Chick Pea	3.77	2.14	1.04	0.87
Pigeon Pea	2.19	2.12	1.73	1.56
Minor Pulses	4.08	4.49	4.01	3.72
All Pulses	10.04	8.74	6.79	6.00
All Foodgrains	88.51	89.12	88.09	85.13
Groundnut	0.15	0.13	0.16	0.15
Sesamum	0.13	0.16	0.15	0.15
Rapeseed and Mustard	0.84	1.18	1.04	1.11
Linseed	0.46	0.32	0.15	0.14
Sunflower	0.01	0.01	0.00	0.03
Soyabean	0.00	0.00	0.00	0.00
All Oilseeds	2.04	1.80	1.50	1.58
Sugarcane	3.82	4.03	4.55	4.46
Fruits	1.15	1.02	0.91	0.32
Vegetables	1.88	2.07	1.98	0.75

Crops	Share in GCA (%)			
	TE 1990-91	TE 2000-01	TE 2010-11	TE 2020-21
Total Fruits and Vegetables	3.02	3.09	2.89	1.06
Potato	1.21	1.29	1.17	1.23
Onion	0.11	0.13	0.12	0.13

Source: Author's calculations

Appendix-4: Cropping Pattern of Bundelkhand Region

Crops	Share in GCA (%)			
	TE 1990-91	TE 2000-01	TE 2010-11	TE 2020-21
Rice	4.38	4.13	2.33	2.77
Wheat	27.15	28.33	30.40	30.84
Sorghum	10.54	5.96	3.18	2.31
Pearl Millet	1.26	1.03	1.17	1.09
Maize	1.26	1.19	1.42	0.87
Barley	1.28	1.25	1.17	1.36
All Cereals	45.86	41.89	39.66	39.24
Chick Pea	26.50	20.51	14.27	11.01
Pigeon Pea	3.36	2.22	2.63	2.00
Minor Pulses	16.43	27.33	28.15	26.42
All Pulses	46.28	50.06	45.05	38.33
All Foodgrains	92.15	91.95	84.72	77.57
Groundnut	0.85	2.19	1.34	1.66
Sesamum	1.03	1.33	8.56	8.76
Rapeseed and Mustard	1.04	0.87	1.82	2.23
Linseed	2.24	1.07	0.60	0.47
Sunflower	0.01	0.00	0.00	0.00
Soyabean	0.36	0.65	0.46	0.79
All Oilseeds	5.18	6.11	12.78	13.90
Sugarcane	0.18	0.32	0.20	0.35
Fruits	0.05	0.04	0.10	0.00
Vegetables	0.48	0.59	0.95	0.32
Total Fruits and Vegetables	0.53	0.62	1.05	0.33
Potato	0.07	0.05	0.07	0.08
Onion	0.03	0.03	0.04	0.04

Source: Author's calculations

Appendix-5: List of Districts in Different Regions of Uttar Pradesh

Region	Districts
Western Region	Agra, Aligarh, Amroha J.B Phule Nagar, Auraiya, Badaun, Bagpath, Bareilly, Bijnor, Bulandshahr, Etah, Etawah, Farrukhabad, Firozabad, G.B Nagar, Ghaziabad, Hapur, Hathras, Kannauj, Kasganj, Mainpuri, Mathura, Meerut, Muradabad, Muzaffarnagar, Pilibhit, Rampur, Saharanpur, Sambhal, Shahjahanpur, Shamli
Central Region	Barabanki, Fatehpur, Hardoi, Kanpur Dehat, Kanpur Nagar, Kheri, Lucknow, Rai Bareli, Sitapur, Unnao
Eastern Region	Allahabad, Ambedkar Nagar, Amethi, Azamgarh, Bahraich, Balarampur, Ballia, Basti, Chandauli, Deoria, Faizabad, Gazipur, Gonda, Gorakhpur, Jaunpur, Kaushambi, Kushinagar, Maharajganj, Mau, Mirzapur, Pratapgarh, Sant Kabir Nagar, Sant Ravi Das Nagar, Shravasti, Siddharthnagar, Sonbhadra, Sultanpur, Varanasi
Bundelkhand Region	Banda, Chitrakut, Hamirpur, Jalaun, Jhansi, Lalitpur, Mohaba

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