Summary and Conclusion
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Present study is an attempt of Spatio-temporal analysis of the modernization of agriculture and its impact on the productivity in Bilaspur district. The aim is to determine the adoption of modern technologies in the different size of operational landholdings and to see the impact they have on the growth and development of agriculture. Bilaspur District is situated in the North-Western part of Chhattisgarh; its Latitudinal extent is from 21˚47’N to 23˚08’N and the Longitudinal extent from 81˚14’E to 83˚15’E. The total area of the district is 8272 sq.km; and the general altitude is 262 meter above sea level. The district comprises of eleven tehsils, namely- Bilaspur, Bilha, Masturi, Takhatpur, Lormi, Pathariya, Kota, Mungeli, Pendra, Marwahi and Gaurella. The district headquarter is Bilaspur city which is 120 km away from the State Capital Raipur. The NH-200 passes through the district and is important in the connecting the district, with the state capital.

Geologically Bilaspur district is a part of the Peninsular Shield and has Chhota-Nagpur Complex, Deccan Trap and Raipur Body as major groups. Physiologically the district can be divided into two broad groups- Northern hills (Pendra plateau, Lormi plateau and Maikal Range Shadow Region) and Southern Plains. On basis of Relief the district can be divided into 3 categories; firstly the Plain region of altitude below 300 meter; it makes up the Southern Bilaspur Plains and is drained by river Seonath and its tributaries. Secondly, the Plateau region of altitude between 300 to 600 meter, it makes up the forest covered Pendra and Lormi plateau. And Thirdly, the Mountain region of altitude above 600 meter, which makes up the Maikal Range Shadow region. There are two Drainage Systems in the district- Mahanadi drainage system (about 90 percent of the district is drained by this river system, Seonath, Arpa and Maniyari are the main rivers of which drain the southern plain) and the Ganga Drainage system (major river is Son which drains the northern part of the district).

Climate is defined as a composite of day to day weather conditions and of the atmospheric elements within a specific area over a long period of time. Climate depends not only on the local weather but also on the location, altitude, slope and distance from sea. It’s an important natural factor which not only influences the physical and economic; but also the social and cultural activities of man. Bilaspur district has an average temperature
of 25.9° C; where May and June are the hottest months, December and January record the 
lowest temperature. Climate in hilly regions are cooler in contrast to the plains giving a 
variation in temperature in the district. The district receives rainfall mainly from the 
southwest monsoon, which sets from third to fourth week of June and continues till mid 
August-September. The heaviest showers are seen in July and August; where nearly 95% 
of the annual rainfall is received during the months of June to September. The average 
annual rainfall for the district is around 1378.98 cm (2013-14); while the highest rainfall 
was seen in Gaurella tehsil (175.46 cm) and the lowest in Pathariya tehsil (100.5 cm). Rain 
water is the main source of irrigation for agricultural activities in the district.

The soil found in the district can be classified broadly into four types- Silty Soil, 
Loamy Soil, Gravely Sandy Soil and Clay Soil. The southern part of the district is covered 
by Silty Soil; especially in the area drained by Seonath, Maniyari and Arpa. This soil is 
made up of alluvial deposits and is very fertile. This region exhibits predominance for 
agriculture due to its favorable characteristics. In the northern part of the district, small 
pockets of silty soil are found in the area drained by Son and its tributaries. Loamy Soil has 
a vast area in the district. Loam is considered as the best soil for agriculture as it contain 
more nutrients, moisture, and humus than sandy soils, have better drainage and infiltration 
of water and air than silty soils, and are easier to till than the clay soils. In the southern part 
of district Loamy soil is found in abundance in Mungeli and Masturi tehsils and in small 
pockets in Kota, Lormi, Takhatpur and Bilaspur. In the north the parts of Marwahi, Pendra 
and Gaurella tehsils which are not under the forest coverage have Loamy soil. Gravely 
Sandy Soil in Bilaspur district is found in the parts under the forest coverage. Thus, is 
found in abundance in Lormi, northern Masturi, Pendra, Gaurella, Marwahi and Kota. Clay 
Soil is found in sparsely scattered form in north-eastern and south-eastern parts of the 
district. It’s seen in small pockets in Marwahi, Pendra, Kota, Bilaspur and Takhatpur 
tehsils. The district is covered by various forests and natural vegetation. Forests are one of 
the important natural renewable resources, as they are not only productive but also as 
Green Gold should be managed and conserved at any cost. Bilaspur district has a total area 
of 2085.99 Sq. km. under forest of which 19.93% is Reserved forest; 65.57% is Protected 
forest and remaining is Unscheduled forest. Maximum concentration of forest is seen in 
Kota, Marwahi, Lormi and Gaurella tehsils and minimum in Bilaspur, Masturi and
Takhatpur tehsils. The prominent trees of these forests are Sal, Kendu, Mahua, Haldi, Khasi, Bija, Tendu, Mango, Teak, etc.

The Total Population of Bilaspur district according to 2011 Census of India Survey is 26,63,629 (twenty-six lakh, sixty-three thousand, six hundred and twenty-nine). Of all the eleven tehsils in the district, Bilaspur tehsil has the highest population in the district mainly owing to the increase in concentration of urban concentration in and around Bilaspur city. Population is highest in Bilaspur tehsil, 24.21% of the district. While Masturi and Takhatpur tehsil ranks second and third respectively. The lowest population is recorded in Pendra tehsil with only 3.21 percent of the Total Population. As per the Census, Village Seepat of Masturi tehsil is the largest village with a population of 11,311 person, whereas Village Chandrapur and Koalari of Mungeli tehsil are the smallest in the district with the population of only 10 persons. The population density of the district is 322 person per sq. km. which was 242 person per sq. km. a decade ago in 2001 Census. Bilaspur tehsil has the highest population density of 1017 person per sq. km. and Marwahi tehsil the lowest, with only 116 person per sq. km. Population Growth was seen highest in Bilha Tehsil (52.7%) for the past decade, while lowest in Marwahi Tehsil (3.9%).

As per the 2011 Census data, of all the age group of 10 to 14 years has the highest share (11.67 %) in the total population and is closely followed by the 5 to 9 (11.48 %) and 0 to 4 (10.66 %) age groups. Whereas, the 75 to 79 age group has the lowest (0.66 %) share in the total population. The average sex-ratio for the whole district is 977 females per thousand males; while Pendra tehsil exhibits the highest sex-ratio (1015 females per thousand males) in district, the lowest is seen in Masturi tehsil (948 females per thousand males). Bilaspur district has an average Literacy Rate of 70.78, where the gender wise male and female literacy are 81.54 and 59.71 respectively; which has increased considerably in the past decade.

Literacy Rate is highest in the Bilaspur Tehsil (82.55) and lowest in Lormi Tehsil (62.61). When calculated for the Male and Female Population respectively; the Literacy Rates were highest for male literates in Bilaspur Tehsil (89.75) and lowest in Gaurella tehsil (73.9). Whereas, in Female literates highest is Bilaspur Tehsil (74.97) and lowest
Lormi Tehsil (49.62). The Working and Non-Working population are 45.17 percent and 54.83 percent respectively as per the 2011 Census of India Survey.

Of the Total Workers the highest concentration is seen in Gaurella Tehsil (53.32 %) and Lowest in Bilaspur Tehsil (36.9 %). While for the Non-workers highest concentration is seen in Bilaspur Tehsil (63.1 %) and lowest in Marwahi Tehsil (45.69 %). The Workers are categorized into Main Workers and Marginal Workers. The highest concentration of Main Workers is seen in the Pathariya Tehsil (36.47%) and the lowest in Gaurella Tehsil (28.4%). Whereas in the Marginal Workers the highest concentration is in Gaurella Tehsil (24.92%) and the lowest in Bilaspur Tehsil (6.5%)

According to the 2011 Census Survey, 20.76 percent of the total population belongs to the Schedule Caste and 18.71 percent in the Schedule Tribes. The Masturi tehsil of the district has the highest concentration (28.96 %) of the Schedule Caste population and Gaurella Tehsil the lowest (4.49%). Whereas, the concentration of Schedule Tribes is highest in Marwahi (59.45%) and Gaurella Tehsils (57.27%); and lowest in Bilaspur Tehsil (6.91%).

There are in total 4,26,414 landholdings in the district which occupy a total area of 389412 ha. Of the total area under landholdings 23.18 percent is under Marginal, 29.38 percent area is under Small land holdings, 23.43 percent under Medium holdings, 20.46 under Semi- Medium and only 3.49 under Large holdings. Landuse in literal terms means the parts of land which are used for different functions based on their quality and capacity. The concept of landuse is related to economic, social and cultural progress of man. So basically landuse reflects the correlation between the economic, physical and social factors in the region. The obtained Landuse data regarding Bilaspur District has been categorized into seven categories; they are- Land not Available for Agriculture (the land put to non-agricultural uses, barren and uncultivable land like mountains, river beds, etc); Other Uncultivable Land Excluding Fallow Land (the permanent pastures, grazing lands, area of miscellaneous tree crops and groves); Land Available for Agriculture (the area of land which can be brought under cultivation but hasn’t been cultivated successfully for more than past consecutive five years at the time of reporting); Fallow Land (it’s the land which has not been under cultivation at the time of reporting but has been in the past years, its
divided into two subdivisions based on the time it has remained uncultivated; current fallow- past two year and old fallow- past two to five years); Forest (the area under forest coverage); and Net Sown Area (it’s the actual area under crops sown at least once in the year of reporting).

Bilaspur District in whole shows decrease of area in percent form in the categories of Land not Available for Cultivation (1.11 percent) and Net Sown Area (3.05 percent) only. Whereas the other categories of Other Uncultivable Land Excluding Fallow Land (0.31 percent), Land Available for Agriculture (0.98 percent), Fallow Land (1.36 percent) and Forest (1.52 percent) show increase in their area.

In the first category of Land not Available for Cultivation, highest increase for past two decades was seen in Bilaspur Tehsil, while the highest decrease was seen in Lormi Tehsil this decrease in the area under this category is mainly due to filling of small ponds and increase in irrigation leading to land reforms. In Other Uncultivable Land Excluding Fallow Land there hasn’t been much variation in the district as a whole. The highest increase was seen in the Pendra and Pathariya Tehsils; and Masturi Tehsil shows highest decrease. Land Available for Agriculture is of three types, firstly the land which can be cultivated immediately; secondly the land which can be cultivated after some mild land reforms; and thirdly the land which can be cultivated after some serious and heavy land reforms. In the past two decades land available for agriculture has shown a slight increase from 2.08 percent in 1990-91 to 3.06 percent in 2013-14 for the whole district.

The highest percent increase for the time period was seen in Bilaspur Tehsil and Masturi Tehsil. The Fallow Land was 3.41 percent in 1990-91 which increased to 4.77 percent in 2013-14. While the highest percent of increase in the time period was seen in Gaurella Tehsil and Marwahi Tehsil, only Kota Tehsil has shown slight decrease in the area of fallow land. Increase in the area of Fallow Land signifies the decrease in the Net Sown Area. The Forest land has increased from 16.09 percent in 1990-91 to 17.61 percent in 2013-14; where the highest increase is seen in the Tehsils of Kota, Gaurella and Masturi; considerable decrease has been found in Tehsils of Pendra, Marwahi and Lormi. The Net Sown Area has decreased from 60.29 percent in 1990-91 to 57.24 percent in 2013-14. It
exhibits increase in the Tehsils of Pendra, Lormi and Pathariya; but has drastically decreased in the Tehsils of Gaurella, Bilha, Bilaspur, Marwahi and Masturi.

In regards to the sample villages Land not Available for Cultivation is seen highest in Village Dumariha (11.94 percent of the Total Geographical Area) and lowest in Village Bharjholri (0.72 percent of the Total Geographical Area). Other Uncultivable Land Excluding Fallow Land is highest in Village Chikhaladabra (36.48 percent of the Total Geographical Area) and lowest in Village Kesla (0.4 percent of the Total Geographical Area). Land Available for Cultivation is highest in Village Dumariha (10.74 percent of the Total Geographical Area) and zero in the Villages of Chorma, Jaitpuri and Chikhaladabra. Fallow Land is highest in the Village Dumariha (12.64 percent of the Total Geographical Area) and lowest in Village Anikdh (1.4 percent of the Total Geographical Area). Forest Area seen in only 29 percent of the Sample Villages in which it is highest in Village Kesla (75.32 percent of the Total Geographical Area). Net Sown Area is highest in the Village Mudpar (84.77 percent of the Total Geographical Area) and lowest in Village Kesla (20.77 percent of the Total Geographical Area).

Agricultural Landuse or more commonly known as Cropping Pattern; describes the crops in Total Crop Area, according to their area, season and type. Total Crop Area in turn is the sum total of Net Sown Area (area sown at least once) and Double Crop Area (area sown more than once). In the district of Bilaspur all crop cereals, oilseeds, pulses, vegetables, spices and a few cash crops are grown in all the three crop season of Kharif, Rabi and Zayed. Kharif season crops are sown in the monsoonal months from July to August and are harvested from November to December; the most prominent crop of this season in the district is Paddy. The Rabi season crops are sown after harvesting of Kharif crops from December to January and are harvested March to April; the main crops in the season are Wheat, Tiwra and Mustard in the district. Zayed crops are mainly fruits and vegetables grown alongside the ponds, in dry riverbeds in the months of May and June. The cropping pattern of all the twenty-two sample villages has been studied to derive that Kharif is the main cropping season and Paddy the main crop. But apart from Paddy other crops like Wheat, Maize, Gram and Tiwra are also gaining importance. The agricultural land under Kharif was 71.75 percent of the total crop area in the district; while it was only
28.25 percent for Rabi crops. The main reason for this is the lack of irrigational facilities and reluctance of farmers to indulge in hardship of generating second crop. Many farmers during the survey told us that they like to sit out the Rabi season or only grow Tiwra as second crop.

Crop concentration was derived for the district to study the Spatio-Temporal variations in the density of crops in the region. The concentration of a crop in an area largely depends on its terrain, temperature, moisture and pedagogical conditions. Paddy was the first crop in six tehsils in the first time period, Bilha, Bilaspur, Masturi Lormi, Kota and Takhatpur; and in only two districts in the second time period, Bilaspur and Bilha. The main reason for this change is increase in number and allotted area of other crops. Maize was the first crop in Gaurella tehsil in the first time period; and it is the first crop in Gaurella and Kota tehsils the second time period. This is mainly due dispersion of area under Paddy into other Cereals. Other than Paddy; Gram, Arhar, Urad, Soybean, Niger or Ramtil and Sugarcane also emerged as First Crops in different tehsils. Regarding the Second Crops Paddy along with Wheat, Maize, Gram, Arhar, Tiwra, Niger or Ramtil, Mustard, Sesame or Til, Groundnut and Flaxseed or Alsi were seen. This was a result of dispersion from basic crops to other variety during the past two decades.

Crop diversification is described as the addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns from value added crops with complementary marketing opportunities. In developing countries such as India, which has been one of the leaders in promoting diversification, the concept is applied both to individual farmers and to different regions. In Bilaspur district tehsils like Bilha and Masturi which have highest Paddy productivity have high Diversification Index for both time periods; while the backward and hilly tehsils Gaurella, Marwahi and Pendra have low Diversification of crops.

Spatio-Temporal Pattern of Agricultural Regions in Bilaspur district were derived using the Crop Combination method and the tehsil of Bilaspur, Bilha, Masturi and Kota remained under the Two crop combination region with the same combination (Paddy-Tiwra) for both the time period. Gaurella tehsil transitioned from a two crop region (Paddy-Maize) to a mono crop region (Paddy).Pendra remained in the two crop zone but
the combination changed from 1990-91 (Paddy-Urad) to 2013-14 (Paddy-Wheat). Marwahi remained in the two crop zone but the combination changed from 1990-91 (Paddy-Urad) to 2013-14 (Paddy-Kodo). Mungeli remained under the Four Crop Combination Region with the same combinations (Paddy-Tiwra-Gram-Wheat) for both the time period. Pathariya was in four crop combination zone (of Paddy-Tiwra-Gram-Wheat) in 1990-91 and changed to three crop combination zone in 2013-14 (Paddy-Tiwra-Wheat). Takhatpur was in three crop combination zone (of Paddy-Tiwra-Tuar) in 1990-91 and changed to two crop combination zone (Paddy-Tiwra). Lormi remained under the three crop region with the same combination (Paddy-Tiwra-Gram) for both the time period.

Agricultural Efficiency is described as an efficient measure of agricultural productivity, where specialization of crops and regional efficiency plays an important role. It was calculated for both time periods and it was found that Bilaspur tehsil which had agricultural efficiency of 105.31 in first time period which decreased to 94.78 in second period (i.e., highest to lowest in the span of two decades). While the tehsils of Lormi and Marwahi have transformed from the lower (Lormi-92.07 and Marwahi-79.37); to higher (Lormi-103.29 and Marwahi-100.26). Carrying capacity of land in simple terms is the supported population for every sq. km. of land regarding calories. Its measurement unit is number of person per sq. km. The per capita per day calorie requirement in Indian context is 2114 and thus, per capita per annum requirement is 772138. This value is known as Standard Nutritional Unit. From the derived values for the district it was found that the Carrying Capacity of Land has shown drastic increase in terms of person per sq.km.; the highest in the first time period was 317 person per sq.km. (Masturi tehsil); the lowest value of 494 person per sq.km (Pathariya tehsil). Thus, we can say on basis of the Spatio-Temporal Variations that there have been positive changes in agriculture of Bilaspur District. Even the backward regions with rough terrain have shown development in the past two decades with the aid modern innovations and technologies for the development of agriculture.

Through Spatio-Temporal analysis of the cropping pattern and Productivity aided by different techniques like Crop Concentration, Diversification, Agricultural Regions,
Agricultural Efficiency and Carrying capacity of Land it can be said that Bilaspur district has shown development in terms of Agricultural development.

The Operational Landholdings in the Sample Village have been categorized into four categories according to their size. First, Marginal Landholdings of area below one hectare. Second, Small Landholdings of area between one to two hectare. Third, Medium Landholdings of area between two to four hectare. And fourth, Large Landholdings of area above four hectare. The marginal landholdings are 25.22 percent of the total sample area, which amounts to one-fourth of the sample area. The farmers of this group have low economic level and their land is in very small parcels of land. They are unable to afford costly machinery, hybrid seeds, chemical fertilizers and pesticides. They mostly work as labours also in their fields with very few hired labours to save money. Indulgence of heavy machinery is difficult due to small land area and thus the production is also quite low. This group does not invest highly in second crop (many of the farmers do even plant Rabi crops). The Small Landholdings occupy 23.98 percent of the sample area, the farmers in this group are of two type – firstly the ones who have ascended from marginal to small by buying more land (they are investing more than they used to do previously) and secondly the ones who have descended from bigger landholdings. This group indulges in second crop of Rabi and the investment is more than marginal farmers. The Medium Landholdings are 22.08 percent of the sample area. This group not has land large enough to apply all the innovations for agricultural development. This group not only indulges in the machinery but also actively engages in all other components like HYVs, Chemical Fertilizers and Pesticides. They hire 32 percent of the total hired labour inspite of usage of machinery in farming. The Large Landholdings occupy 28.67 percent of the sample area, with an average of 18.35 percent of the total HYVs, an average of 11.47 kg/ha of Fertilizers and 5.21 litre/ha of Pesticides; it occupies 65.08 percent of the total irrigated area and 63.69 percent of the total area under mechanized agriculture.

The sample villages constituting the High Level of Agricultural Modernization Index fall under the urban and developed tehsils of Bilaspur, Bilha, Takhatpur, Mungeli and Masturi respectively. They have fertile well irrigated plain land, mechanized modern machinery, and awareness among the farmers which has contributed to development of
agriculture in these villages. The Sample Villages under the Moderate Level of Agricultural Modernization Index have the potential to further development. Sample villages of Mudpar (Masturi tehsil), Nagpur (Bilha tehsil) and Barpali (Bilaspur tehsil) already have all the facilities as the villages in high zone. The sample villages of Pathariya (Mohdi and Podi), Gaurella (Dumariha and Bajarwar), Lormi (Dindori), Pendra (Kesla), Marwahi (Madakot) and Kota (Semri) have comparatively more Marginal and Small Landholdings and less Large Landholdings; which has a great impact on the Index Values and the Agriculture of these Sample Villages. The Sample Villages under the Low Level of Agricultural Modernization Index fall in Pendra, Lormi, Mungeli and Kota tehsils respectively. Here, the sample villages Ganjan, Belsari and Chikhaladabra don’t even have any Large Landholdings in the Sample Survey; this is major reason for their decreased value. Other than it the farmer’s poverty and illiteracy plays a determining role in these villages.

There are a number of determinants which asserted as the main controllable factors affecting the modernization of agriculture in the district. Relief, Rainfall and Soil are the main Physical Determinants which influence the Agricultural modernization in the district. The Southern or Bilaspur Plain has more agricultural land compared to the Northern region, which is mostly hills and plains. The impact of relief and rainfall is more evident in the sample villages of Pendra and Gaurella which have the lowest Agricultural Modernization and also fall in the Maikal Range Shadow Region and Pendra Plateau.

The Socio-Economic determinants constitute of educational status of the head of household, family income, size of operational landholdings, irrigational infrastructure, means of mass communication, awareness of the farmers, storage and marketing of produces and administrative facilities available in Bilaspur District.

Education is the basis of development, as no society can develop or thrive without education. Of the total sample 76.12 percent of the Head of Households are Literate and 23.18 are Illiterate. Whereas in respect to level of Educational Status 15.45 percent are only Literate, 23.24 percent at Primary, 1.74 percent at Middle School, 13.90 at High School, 8.57 at Higher Secondary and 4.21 percent are College pass outs. Moderate positive correlation of +0.35 has been seen between the weightage of Educational Level
and Agricultural Modernization in the Sample Villages. ANOVA was conducted to determine significance between Agricultural Modernization and Educational Level in Sample Villages. There was seen a significant difference in the Agricultural Modernization according to the Educational Level of the Head of Households.

Size of landholding is crux in the modernization of agriculture. In the sample villages of Bilaspur district 29.49 percent of the operational holdings are Marginal, 25.98 percent are Small landholdings, 22.52 percent are Marginal and 21.98 percent are under Large Landholdings. Moderately low positive correlation of +0.28 has been seen between the Agricultural Modernization and Size of Operational Landholdings in the Sample Villages. The correlation of Agricultural Modernization with Large landholdings was moderate positive (+0.44); with Medium Landholdings was moderately high positive (+0.64); with Small Landholdings low positive (+0.13); and very low positive with Marginal Landholdings (+0.07). ANOVA was conducted to determine significance of Size of Operational Landholdings on Agricultural Modernization in the Sample Villages; and significant difference in the Agricultural Modernization according to the weightage of Size of Operational Landholdings was found.

Irrigation is a necessary component for agricultural modernization. In Bilaspur district the sample villages have three sources of irrigation Wells, Canal and Tubewell. Some households take irrigation from multiple sources and some not even from one. Wells provide irrigation to 3.99 percent households, canals to 14.61 percent and tubewells to 66.17 percent. The percent of households having no access to irrigation is 15.22 percent. A positive correlation of +0.19 has been seen between the Agricultural Modernization and Irrigational Sources in the Sample Villages. The relationship was found highest with Tubewells (low positive correlation, +0.16) and lowest with Canals (very low positive correlation, +0.04). ANOVA was conducted to determine significance of Sources of Irrigation on Agricultural Modernization in the Sample Villages; and significant difference in the Agricultural Modernization according to the weightage of Sources was found.

In the Sample Survey the Farmers were asked questions about their awareness in context of agricultural modernization. They were asked about their knowledge of HYVs, Chemical Fertilizer, Pesticides/Insecticides, Modern Machineries and Technologies, Crop
Rotation, Animal Husbandry and Fisheries. Between the Agricultural Modernization and Awareness in Farmers of the Sample Villages, moderate positive correlation of +0.31 has been seen. ANOVA was conducted to determine significance of Awareness in Farmers with Agricultural Modernization in the Sample Villages; and significant difference in the Agricultural Modernization according to the weightage of Awareness in Farmers was found.

Information is the key to development and thus relay of important changes and progress is quite necessary. The farmers need to be updated and told about the different changes and development happening in the field of agriculture. In the sample survey we found that Radio, TV and Newspaper along with Local Announcements along with society meets are the Means of Mass Communication which relay information and updates to the farmers. Between the Agricultural Modernization and Means of Mass Communication in the Sample Villages, moderate positive correlation of +0.39 has been seen. ANOVA was conducted to determine significance of Mass Communication with Agricultural Modernization in the Sample Villages; and significant difference in the Agricultural Modernization according to the weightage of Means of Mass Communication was seen.

The ultimate aim of the farmers is to sell their produces at the best price they can get. In the sample survey the farmers were asked where they sell their produces (in mandi or to merchants) and whether they have access to storage facilities. A low positive correlation of +0.29 has been seen between the Agricultural Modernization and Farmers selling their products to merchants’ and of moderate positive correlation (+0.35) with farmer selling in Mandi. The farmers having access to storage facilities showed a moderate positive correlation of +0.38 with Agricultural Modernization; but a low negative correlation of -0.18 was seen with farmers selling their products (this is because of their inverse relationship as if they sell they would not store). There are various Government Plans active in the district to facilitate and develop agriculture. The farmers were asked about their knowledge of the existing plans in the sample village and whether they are beneficial for them. Of the total farmers, 89 percent of the farmers have the knowledge and found the Government plans beneficial; a moderate positive correlation of +0.31 with Agricultural Modernization was seen in sample villages in the sample villages.
The zest of agricultural development is to benefit in the form of high productivity, more income and employment opportunities which in turn leads to overall development of the society. Yield Index of Crops is high in the sample villages which have High and Moderate Level of Agricultural Modernization Index. The correlation between Modernization Index and Yield Index of sample villages was conducted in three groups in accordance to their Level of Modernization Index. The High Level group shows a high positive correlation of +0.78, while the Moderate Level group shows a moderate positive correlation of +0.48; and a moderate positive correlation of +0.24 is seen in the Low Level group. Thus, it can be stated that the level of agricultural modernization has a positive impact on the yield of the crops in the district.

Agriculture is the basic economic activity in the sample villages, which provide livelihood in many forms. Along with farmers and agricultural labours, it employs skilled labours for driving tractors, threshers and trolleys. Employment is generated for technicians for installing and maintenance of tubewells, pipelines and sprinkler for irrigational purposes. Even transportation of agricultural produces to mandi is a form of employment. In the sample villages 35 percent of the household’s income is derived from the agricultural activities other than farming. The Monthly Family income is considerably high in the sample village Jaitpuri, Nagpura, Akdih, Barpali, Pipra and Mudpar. While its low in sample village Podi, Dumariha, Chikhaladabra, Bahrijhokri and Ganjan. The main factor for disparity is income generated from non-agricultural sources. Thus we can say that the income in the sample villages is of two types- agricultural and non-agricultural. The correlation of monthly family income with income generated through agricultural sources was found to be moderately high positive, +0.65 and with income generated through non-agricultural sources was moderately positive, +0.47. For determination of Rural Development eleven indicators were selected. These indicators represent population dependency, literacy, family unit type, marital status, educational level, health facilities, housing conditions, size of landholdings, income level and income source. These indicators were given weightage and the composite weightage for all the twenty-two sample villages was calculated. The Level of Rural Development was highest in the sample village of Nagpura (Bilha), Motimpur (Mungeli) and Jaitpuri (Mungeli) and lowest in sample village Ganjan (Pendra), Dumariha (Gaurella), Chikhaladabra (Kota) and Bahrijhokri (Marwahi).
Food security is a crucial aspect of life with a complex, multidimensional and complicated concept. It has been visualized at international, national, regional, household and even at individual level. FAO (1984) has defined “Food security as a situation in which all people at all time have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. It’s ironical that in a country self-sufficient in domestic production, India has been witnessing the unmanageably bulging stocks and shortages alternately. In the year 1951 the per capita per day food grain availability for India was 394.9 gram which in 2013 has increased to 401.4 gram. The average per day per capita food security of Bilaspur district is 637.73 grams. The highest per day per capita food security is found in Pathariya tehsil (1066.51 gram) and lowest in Bilaspur tehsil (201.73 gram). Whereas, the per day per capita food security in the sample villages was found to be highest in Pipra (Bilaspur) with 1033.94 gram per day per capita; and lowest in the Chikhaladabra (Kota) 80.88 grams.

Findings

The Size of Operational Landholdings influences the Level of Agricultural Modernization Index; as land is the basic resource for agriculture on which all other inputs are implemented. Of all the modern components in agriculture, mechanized tools and equipments play a very important role, alongside chemical fertilizers, pesticides and insecticides, high yielding variety of seeds and irrigation. The level of agricultural modernization in the sample villages was calculated through ‘Composite Z-Score’ from nine agricultural variables in the sample villages. The correlation of Agricultural Modernization with Large landholdings was moderate positive (+0.44); with Medium Landholdings was moderately high positive (+0.64); with Small Landholdings low positive (+0.13); and very low positive with Marginal Landholdings (+0.07). Significant difference in the Agricultural Modernization of the Sample Villages on basis of their Size of Operational Landholdings was seen at 0.05 significance level.

Agricultural Productivity is found to be high in the sample villages consisting High and Moderate Level of Agricultural Modernization Index. The correlation between Modernization Index and Yield Index of sample villages was conducted according to their Level of Agricultural Modernization Index. The High Level group shows a high positive
correlation of +0.78; the Moderate Level group shows a moderate positive correlation of +0.48 and the Low Level group exhibits a low positive correlation of +0.24. The sample villages Barpali, Pipra, Nagpura, Jaitpuri, Mendra, Motimpur, Akdih which have Higher Agricultural Modernization Level have comparatively higher Crop Yield compared to the sample villages of Kesla, Ganjan, Chikhaladabra, Dumariha, Semri which have Lower Agricultural Modernization Level. Thus, we can say that the implementation of new technologies and machinery has not only raised the productivity but has also facilitated in the spread, growth and upliftment of agriculture in Bilaspur District.