Economic Affairs, Vol. 68, No. 01, pp. 409-415, March 2023
DOI: 10.46852/0424-2513.1.2023.8

AESSRA

Research Paper

Decomposition Analysis of Dynamic Changes in Aggregate Crop Revenue in Kymore Plateau Agro-climatic Zone of Madhya Pradesh

Poonam Chaturvedi*, Gourav Kumar Vani and Ankita Rajput

Department of Agricultural Economics, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

*Corresponding author: 26poonamchaturvedi@gmail.com (**ORCID ID:** 0000-0002-1453-835X)

Received: 19-11-2022 **Revised:** 28-02-2023 **Accepted:** 06-03-2023

ABSTRACT

The study attempted to analyze the dynamic changes in the value of aggregate crop revenue by using Logarithmic Mean Divisia Index (LMDI) decomposition approach. Five districts of the Kymore plateau agro-climatic zone of Madhya Pradesh, i.e. Jabalpur, Katni, Panna, Satna & Sidhi were selected in the study for the period from 2007-08 to 2016-17. In the study the aggregate crop revenue was decomposed into the area, price, cropping pattern and yield effect. The results revealed more inclination of the farmers in Jabalpur district towards cereal crops, while in Panna and Katni districts; more inclination was observed towards oilseeds. Relative change for almost all the crops was negative in the Sidhi district except for wheat, gram and *tur*. The study revealed that in the agro-climatic zone, during the study period yield effect was the predominant factor, followed by price effect except for Jabalpur district, where price effect was dominant, followed by yield effect. Amid the different effects, cropping pattern effect had the most minuscule contribution in the agro-climatic zone.

HIGHLIGHTS

- The paper studies dynamic changes in value of aggregate crop revenue of five districts of Kymore plateau agro-climatic zone of Madhya Pradesh for a period from 2007-08 to 2016-17.
- Logarithmic Mean Divisia Index (LMDI) decomposition approach had been used in the study
- The key components of aggregate crop revenue that emerged in the study were yield and price effects.

Keywords: Agricultural output, Decomposition analysis, area, yield, price, cropping pattern

Agricultural development is an integral part of overall economic development. The Indian economy encompasses various critical sectors, which contribute to the total national product. With a share of 20.2 per cent (2020-21) in the GVA of the country agriculture sector remains an essential contributor to the growth of the Indian economy. According to the reports of periodic labour force survey (PLFS) of government agriculture still employed 45.6 per cent of the labour force in India in 2019-20 (Sharma, Yogima Seth, 2021). So this indicates that even after decades of independence, agriculture, the backbone of our economy, still plays a significant role in the economy's advancement.

Madhya Pradesh is the core of India having a total geographical area of 308 lakh hectares. Agriculture being the primary source of living for the people of Madhya Pradesh constitutes about 60-75 per cent of the rural income. In the year 2015-16 in Madhya Pradesh 54.6 per cent of the total workforce is engaged in agriculture, contributing 40 per cent in the GSDP in TE 2018-19 (Gulati *et al.* 2021). Thus, it is an essential source of income not only in

How to cite this article: Chaturvedi, P., Vani, G.K. and Rajput, A. (2023). Modernization Processes Development in the Implementation of Intellectual Capital in a Crisis. *Econ. Aff.*, **68**(01): 409-415.

Source of Support: None; **Conflict of Interest:** None

Madhya Pradesh but in India. It becomes essential to make efforts in the direction of improving the revenue generation from this sector. In this regard decomposition of the aggregate revenue into its various components and their analysis can prove to be beneficial for the agriculture sector and hence for the state's economy as a whole. An analysis of various revenue components can provide insight into the relative shares of various factors involved and the factors responsible for the growth of the various constraints (Vani *et al.* 2020). It enables the economists/researchers to get wind of the direction in which further research or efforts need to be done and guide the policymakers to pay attention to the factors which need improvement to enhance the returns from the agriculture sector further and increase the aggregate revenue.

LITERATURE REVIEW

Shadmehri (2010) and Rehman *et al.* (2011) decomposed the output growth of major crops in Iran and Pakistan, and concluded that yield effect and area effect were the significant drivers of growth. Birthal *et al.* (2014) analyzed changes in the sources of growth in agriculture for significant states of India from 1980-81 to 2009-10 and found technology and diversification to be the crucial factors for agricultural growth. Pattnaik and Shah (2015) analyzed information on fifteen major crops in Gujarat, and the outcome of decomposition analysis revealed that yield effect substantially contributes to growth as compared to cropping pattern, area and price effect. Bruha and Pisa (2011) conducted a study using LMDI method of decomposition in agricultural sector to analyse the dynamics of the world agricultural production and consumption concluding that intensity effect was more prominent while structural effects were relatively insignificant. It was also observed that scale effect was more significant in agricultural consumption compared to agricultural production.

There are a number of studies on decomposition using LMDI approach in other field especially in energy but in the agriculture sector only limited work had been done using this technique. In case of India and particularly Madhya Pradesh, no study had been carried out based on LMDI technique of decomposition hence there is need for conducting such studies. With the above background, the objectives of the present study are to analyze the changes in cropping patterns in different districts, assess the growth in actual aggregate crop revenue, yields and prices of various crops in different districts, analyse the factors responsible for changes in the absolute value of aggregate crop revenue, determine the contribution of various crops in absolute change in the value of aggregate crop revenue and suggest policy measures based on findings of the study.

METHODOLOGY

The present study was confined to five districts of i.e. Jabalpur and Katni, Sidhi, Satna & Panna Kymore plateau and Satpura hill agro-climatic region of Madhya Pradesh. These districts together accounted for 7.8 and 8.24 per cent of the state's gross and net cropped area, respectively. The study used secondary data from 2007-08 to 2016-17, with 2007-08 as the base year. These years were used in the study since data pertaining to this period was available during the research. The data for farm harvest price was collected from the official website of the Directorate of Economics & Statistics, Ministry of Agriculture and Agmarknet portal. The data for area and yield were collected from the official website of the Commissioner of Land records, Madhya Pradesh and the official website of M.P Krishi. The crops considered in the study were wheat, paddy, maize, jowar, linseed, gram, tur, mustard and sesamum.

LMDI decomposition technique: The LMDI refers to Logarithmic Mean Divisia Index, and it is part of Divisia Indices which was developed by Ang in 1998. The LMDI approach has been adopted in different fields of research, including the manufacturing, textile, and power industries although its use in field of agriculture was minimal. This study provides the extension of LDMI based decomposition scheme to segregate price, area, and cropping pattern and yield effect from the aggregate value of crops (Chaturvedi *et al*. 2021).

Suppose Q is the aggregate value of crop output,

$$Q = A\sum iwiciyi \quad \ldots(1)$$

'T' subscript is used for the t^{th} year and '0' for the base year. The absolute change and relative change can be expressed as follows:

Absolute change = $Q_{TOT} = Q_T - Q_O$ & Relative change = $D_{TOT} = Q_T / Q_O$

1. **Area effect:** The effect of change in area on production of crops while keeping yield, prices and cropping pattern constant at base year values.

$$\Delta Q_{AREA} = \sum_i \Lambda_i \ln (A^T / A^O) \quad \ldots 2$$

2. **Yield effect:** The effect of change in yield of crop/crops upon production or aggregate production while keeping the area under crop(s) constant at base year values.

$$\Delta Q_{YIELD} = \sum_i \Lambda_i \ln (Y_i^T / Y_i^O) \quad \ldots 3$$

3. **Cropping pattern effect:** The effect of change in cropping pattern on aggregate production of crops, while keeping overall area, yield and prices (only if production is measured in monetary terms) constant at base year values.

$$\Delta Q_{STR.} = \sum_i \Lambda_i \ln (C_i^T / C_i^O) \quad \ldots 4$$

4. **Price effect:** The change in the production of crop output due to only change in crop output price, while other things remain the same at the base year value.

$$\Delta Q_{PRICE} = \sum_i \Lambda_i \ln (W_i^T / W_i^O) \quad \ldots 5$$

The additive decomposition scheme can be expressed as follows-

$$\Delta Q_{TOT} = \Delta Q_{AREA} + \Delta Q_{YIELD} + \Delta Q_{STR.} + \Delta Q_{PRICE} \quad \ldots 6$$

$$\Lambda_i = L (Q_i^T, Q_i^O) = (Q_i^T - Q_i^O) / (\ln Q_i^T - \ln Q_i^O) \quad \ldots 7$$

$L (Q^T_i, Q^O_i)$ is the logarithmic mean between Q^t_i and Q^o_i, where,

Q^o_i = Aggregate value of crop output in the base year (2007-08) &

Q^t_i = Aggregate value of crop output in t^{th} year

Coefficient of Variation: The coefficient of variation was used to find out the fluctuations in the growth rate in the various districts of Kymore plateau & Satpura hills agro-climatic zone of Madhya Pradesh.

$$Coefficient\ of\ variation = \frac{\text{Standard deviation}}{\text{Mean}}$$

Compound annual growth rate (CAGR): In the present study, compound growth rates of price and yield was estimated for the selected crops for each period, to study the price growth, and yield of these crops.

$$CAGR = \left(\frac{\text{Current year}}{\text{Base year}} \right)^{1/n} - 1$$

RESULTS AND DISCUSSION

From table 1, it was observed that Jabalpur and Katni were characterized by a larger share of wheat and paddy in the cropping pattern of the district and together accounted for over 70 per cent area. At the same time, Panna, Satna and Sidhi districts were characterized by a higher share of less water-intensive crops like jowar, linseed and gram. In all these five districts, maize, mustard, *tur* and sesamum accounted for less than ten per cent of the area. The total share of these eight crops considered here for analysis ranged from 47 per cent of gross cropped area in the Sidhi district to 96 per cent in the Panna district.

It was observed that the highest relative change was observed for maize in Satna district, with a relative change of 812.52 per cent followed by Jabalpur district with 100 per cent. The highest relative change was observed for *tur* in the case of Satna i.e. 212.65 per cent followed by Panna with 175.21 per cent while Sidhi district had 9.66 per cent relative change which was the lowest among all districts. All the districts showed negative relative change for jowar/linseed except Satna, where the relative share was 36.83 per cent. In Jabalpur district, oilseeds registered negligible relative change over the period. It can be said that farmers in Jabalpur district were more inclined towards cereal crops. While in Katni and Panna district, shift in cropping pattern was more inclined towards oilseeds; the relative change of 190.87 per cent for sesamum and 79.18 per cent for mustard in Katni district and 73.05 per cent and 97.03 per cent relative change respectively for sesamum and mustard in Panna district. In Sidhi district, relative change was observed to be negative in crops except wheat, gram and tur. In

Table 1: Distribution and Relative change of area in various districts of Kymore Plateau agro-climatic zone of Madhya Pradesh for the period 2007-08 to 2016-17

Average share (%^)						Relative change# (%)				
Crop	**Jabalpur**	**Katni**	**Panna**	**Sidhi**	**Satna**	**Jabalpur**	**Katni**	**Panna**	**Sidhi**	**Satna**
Wheat	39.94	34.27	33.45	11.07	23.75	43.95	54.08	1.33	11.01	15.44
Paddy	28.61	40.4	1.19	6.18	0.75	43.93	6.4	7.76	-26.21	24.94
Maize	1.99	1.85	1.94	5.18	0.96	100	72.1	72.69	-6.74	812.52
Jowar /Linseed*	0.62	1.28	22.37	32.06	24.87	-66.66	-35.38	-43.23	-18.43	36.83
Gram	22.78	14.94	25.32	28.61	38.25	-14.92	91.13	-18.6	5.7	5.7
Tur	4.18	3.48	4.94	9.86	8.65	85.71	81.64	175.21	9.66	212.65
Mustard	1.4	1.11	1.88	2.41	0.78	0	79.18	97.03	-11.62	54.29
Sesamum	0.48	2.66	8.9	4.62	2	0	190.87	73.05	-18.78	158.77
Aggregate area (000' ha.)	275.53	230.95	258.23	227.39	380.29	26.96	38.51	4.92	-6.05	27.6
Percentage of gross cropped area	75	74.31	96.03	47.22	83.36					

*^ Average shares out of the aggregate area of eight crops; * Linseed for Katni and jowar crop for other districts; #Relative change of area was calculated between the triennium ending 2009-10 and 2016-17.*

Table 2: Real aggregate crop revenue in various districts of Kymore Plateau agro-climatic zone of Madhya Pradesh for the period 2007-08 to 2016-17 (Unit: ₹ ha^{-1})

Year	Jabalpur	Katni	Panna	Sidhi	Satna	Overall
2007-08	16787	5794	11498	8173	7630	9845
2008-09	14999	7662	14718	7830	7796	10554
2009-10	17393	9388	16402	8302	10636	12759
2010-11	14773	8640	15724	7953	9600	11830
2011-12	21410	16054	17879	12440	16102	17486
2012-13	25351	18849	18363	16282	21298	20596
2013-14	25260	25254	18236	19787	24444	23184
2014-15	22106	18677	19852	18376	27951	22090
2015-16	25039	21087	16859	20017	25034	21996
2016-17	30299	31912	32768	30027	34141	33418
Growth rate (%)	8.33	15.89	7.70	15.10	16.27	12.40
Mean	21342	16332	18230	14919	18463	18376
Standard Deviation	5224	8501	5610	7348	9424	7381
Coefficient of Variation (%)	24.48	52.05	30.78	49.25	51.04	40.17

Satna district relative change for all the crops was positive, the highest in maize and the lowest for gram with 5.70 per cent. Except for Sidhi district, in all other districts of this agro-climatic zone, the aggregate area of these eight crops had increased from 4.92 (Panna) to 38. 51 (Katni) per cent.

Table 2 provides the real aggregate crop revenue per hectare of aggregate crop area for different districts of the Kymore Plateau agro-climatic zone from 2007-08 to 2016-17. The highest growth was observed for district Satna at 16.27 per cent, while the lowest was observed for the Panna district. Convergence among the real aggregate crop revenue was observed; three districts with low values in initial years, namely Katni (₹ 5794), Satna (₹ 7630), and Sidhi (₹ 8173) had good growth rates (above 15 per cent, above average growth in the agro-climatic zone of 12.4 per cent) while districts with high values in initial years namely, Jabalpur (₹ 16787) and Panna (₹ 11498) had low growth rates (below 12.4 per cent). The gap in the later years between real revenue per hectare closed due to convergence effect The districts with higher growth had to experience higher fluctuations (Coefficient of Variation) to achieve higher real aggregate crop revenue per hectare over the year.

Table 3 presents the growth rate of yield of various

crops in various districts of the Kymore plateau and Satpura hills region. Among the various districts, Satna district had the highest growth rate of yield for all the crops. It had the highest growth rate for gram (10.07 per cent), jowar (5.06 per cent), wheat (13.84 per cent) and mustard (8.83 per cent) among all the districts. For Paddy, Satna and Katni districts had shown comparable growth rate with 20.35 and 20.64 per cent, respectively. Among all districts, Jabalpur district had shown the lowest growth rate in yield as compared to other districts, with negative growth rates for tur (-2.18 per cent) and sesamum (-1.03).

Table 3: Growth rate of yield in various districts of Kymore Plateau agro-climatic zone of Madhya Pradesh between TE 2009-10 and 2016-17 (Unit: %)

	Jabalpur	Katni	Panna	Sidhi	Satna
Gram	2.46	6.83	1.07	9.29	10.07
Tur	-2.18	4.55	7.74	8.63	5.5
Maize	7.65	11.1	9.67	4.96	4.21
Jowar / Linseed	3.75	3.71	3.52	2.53	5.06
Paddy	9.81	20.64	15.7	13.92	20.35
Wheat	6.2	10.1	6.71	11.96	13.84
Mustard	4.33	6.31	2.98	3.77	8.83
Sesamum	-1.03	13.73	0.04	-0.26	9.12

Table 4 provides price growth rates in various districts between the triennium ending 2009-10 and 2016-17. From table 4, it can be observed that for gram growth rate in price was nearly identical in Jabalpur, Katni and Panna districts, while it was negative in Satna with -6.85 per cent. For *tur*, the highest growth rate was observed in Sidhi (10.30 per cent), followed by Katni (6.83 per cent) & Panna (6.28 per cent), while Satna again showed the least growth rate of price with 1.03 per cent. Growth rate of the price index number was observed to be the lowest in the Satna district compared to other districts. Among various crops, the lowest growth rate of price was observed for wheat, which had the highest growth rate of 2.85 per cent in Sidhi followed by in Panna with 1.72 per cent. The highest growth rate for Paddy was observed in Katni district (7.68 per cent) followed by Panna district (6.12 per cent). In case of oilseeds Jabalpur had the highest growth rate in the price for both mustard and sesamum with 5.84 and 9.64 per cent, respectively. For mustard, Jabalpur district was followed by Panna district with 5.13 per cent, whereas in case of sesamum, it was followed by Sidhi with growth rate of 8.70 per cent. The dominant share of revenue in all the districts was obtained mainly by three crops, i.e. gram, paddy & wheat.

Table 4: Growth rate of price and the revenue share in various districts of Kymore Plateau agro-climatic zone of Madhya Pradesh between TE 2009-10 and 2016-17 (Unit: %)

	Jabalpur	Katni	Panna	Sidhi	Satna
Gram	7.62 (26.07)	7.38 (18.70)	7.63 (39.01)	5.18 (10.65)	-6.85 (23.80)
Tur	2.23 (5.29)	6.83 (3.19)	6.28 (6.18)	10.30 (10.05)	1.03 (5.17)
Maize	5.35 (1.33)	5.68 (1.38)	2.04 (0.71)	4.92 (3.82)	1.20 (0.34)
Jowar / Linseed	13.05 (0.48)	4.78 (1.25)	8.97 (1.23)	6.26 (3.62)	1.32 (0.60)
Paddy	5.16 (18.23)	7.68 (30.36)	6.12 (16.86)	3.99 (30.55)	1.94 (22.38)
Wheat	1.64 (47.07)	1.38 (41.84)	1.72 (24.04)	2.85 (32.87)	0.87 (46.07)
Mustard	5.84 (1.09)	3.09 (0.95)	5.19 (1.38)	2.69 (2.36)	0.19 (0.41)
Sesamum	9.64 (0.43)	3.71 (2.33)	5.06 (10.58)	8.70 (6.09)	0.84 (1.23)
Overall (in Price Index)	5.18	7.56	8.07	6.38	6.60

Table 5 presents the decomposition of absolute changes in aggregate crop revenue in the Kymore Plateau agro-climatic zone of Madhya Pradesh. From the table, it can be seen that the yield effect emerged as the most dominant among all the effects, followed by the price effect and area effect. The cropping pattern effect had the most negligible share. While all other effects showed an increasing trend over the years cropping pattern effect showed fluctuations throughout the study period with a negative contribution in some years, i.e. 2010-11 & 2016-17. Area effect showed a negative contribution up to the year 2010-11 but following that, it increased throughout the study period considered.

Table 6 shows the contribution of various crops in the aggregate revenue in the Kymore plateau & Satpura hills agro-climatic zone. From the table, it can be seen that among the various crops considered, gram, paddy & wheat emerged as the most significant crops, which together contributed to 80 per cent of the aggregate crop revenue of the agro-climatic zone.

Table 5: Decomposition of absolute changes in aggregate crop revenue in Kymore Plateau agro-climatic zone of Madhya Pradesh for the period 2007-08 to 2016-17 (Unit: ₹ crores) [at constant 2007-08 prices]

Year	Area effect	Cropping pattern effect	Yield effect	Price effect	Total
2008-09	-5.60 (-85.13)	0.39 (5.96)	5.99 (91.07)	5.79 (88.10)	6.58 (100.00)
2009-10	-3.88 (-5.61)	4.59 (6.64)	29.63 (42.88)	38.76 (56.09)	69.10 (100.00)
2010-11	-4.28 (-8.66)	-1.76 (-3.56)	18.91 (38.26)	36.56 (73.96)	49.44 (100.00)
2011-12	7.15 (3.56)	1.40 (0.70)	109.58 (54.54)	82.79 (41.21)	200.92 (100.00)
2012-13	13.83 (5.13)	3.44 (1.28)	165.63 (61.46)	86.58 (32.13)	269.48 (100.00)
2013-14	41.63 (10.09)	3.27 (0.79)	241.12 (58.46)	126.43 (30.65)	412.45 (100.00)
2014-15	22.24 (5.53)	13.63 (3.39)	219.89 (54.69)	146.27 (36.38)	402.02 (100.00)
2015-16	30.43 (6.83)	5.40 (1.21)	235.44 (52.83)	174.39 (39.13)	445.65 (100.00)
2016-17	106.65 (12.22)	-0.68 (-0.08)	516.36 (59.15)	250.59 (28.71)	872.92 (100.00)
Average	23.13 (7.63)	3.3 (1.09)	171.39 (56.53)	105.35 (34.75)	303.17 (100.00)

Note: *Figures within parenthesis are percentage out of row total.*

Table 6: Contribution of various crops in various constituent factors of absolute change in aggregate crop revenue (%)

Crops	Area effect	Cropping pattern effect	Yield effect	Price effect
Gram	32.49	14.13	21.44	22.61
Maize	-1.95	2.92	1.94	1.96
Jowar / Linseed	-2.01	2.22	1.78	1.65
Paddy	28.16	39.47	29.28	28.65
Wheat	39.49	32.44	34.33	34.42
Tur	1.45	4.22	6.60	6.02
Mustard	0.34	1.50	1.32	1.41
Sesamum	2.03	3.10	3.30	3.28
Total	100	100	100	100

Table 7: Share of various components of absolute change in aggregate crop revenue in various districts of Kymore Plateau agro-climatic zone of Madhya Pradesh for the period 2007-08 to 2016-17 (Unit: %)

District	Area effect	Cropping pattern effect	Yield effect	Price effect	Total
Jabalpur	17.71	0.65	34.46	47.19	100.00
Katni	18.31	4.00	53.54	24.15	100.00
Satna	9.96	-0.55	63.67	26.91	100.00
Sidhi	-86.85	3.51	121.82	61.52	100.00
Panna	15.55	0.21	46.68	37.56	100.00
Overall	7.63	1.09	56.53	34.75	100.00

Table 7 provides the share of various components of absolute change in aggregate crop revenue in various districts of the Kymore Plateau agro-climatic zone of Madhya Pradesh. From table 7, it can be observed that yield effect was the predominant factor in all the districts, other than Jabalpur district, where price effect emerged as the dominant factor followed by yield effect. While the area effect had a moderate contribution, the cropping pattern effect emerged as the least contributing factor in aggregate crop revenue of the agro-climatic zone.

CONCLUSION

From the ongoing discussion, it emerged that the shift of cropping pattern in Katni and Panna districts was mainly inclined towards high-value crops compared to cereal crops, whereas in Jabalpur and Satna district shift was inclined towards cereal crops

compared to oilseeds and coarse cereals. In the agro-climatic zone, gram, paddy and wheat emerged as the dominant crops among the various crops considered in both cropping pattern and revenue share, while the other crops had less than 20 per cent share. The significant findings of the study regarding the contribution of various components of aggregate revenue can be summed up as:

(a) Yield effect emerged as the primary contributor in the aggregate value of crop revenue during the study period, followed by price effect, except in Jabalpur where price effect was the dominant component.

(b) Cropping pattern effect was observed to have most minor contribution among the various constituents of aggregate revenue.

The findings of this study conform to the results of Birthal *et al.* (2014) and Kalamkar (2003), where yield effect emerged as the most important source of agricultural growth.

LIMITATIONS AND FUTURE STUDIES

Owing to the rapid growth in population and hence demand for food production is also increasing rapidly, but the prospects for area-led growth are limited. In this study contribution of area in overall change in aggregate revenue was low, which was an indication of a sustainable growth pattern was. In most of the districts of the agro-climatic zone, the yield effect was dominating, which shows that the growth in the zone was sustainable. There is growth potential in the high-value crops, and inclination towards them can help the farmers of the zone in realizing greater revenue. Efforts should be made by the policymakers to encourage farmers towards market-led extension for encouraging shifts towards high-value crops. The contribution of cropping pattern effect needs to be improved and policies directed towards the same need to be emphasized.

REFERENCES

Ang, B.W. 2015. LMDI decomposition approach: A guide for implementation. *Energy Policy*, **86**: 233-238.

Birthal, P.S., Joshi, P.K., Negi, D.S. and Agarwal, S. 2014. *Changing sources of growth in Indian agriculture: Implications for regional priorities for accelerating agricultural growth* (Vol. 1325). *Int. Food Policy Res. Inst.*

Chaturvedi, P., Awasthi, P.K. and Vani, G.K. 2021. Comparative Economic Analysis of Aggregate Crop Revenue in Jabalpur and Katni Districts of Madhya Pradesh. *Int. J. Agric., Environ. and Biotechno.*, **14**(4): 511-519.

Gulati, A., Rajkhowa, P., Roy, R. and Sharma, P. 2021. Performance of Agriculture in Madhya Pradesh. In *Revitalizing Indian Agriculture and Boosting Farmer Incomes* (pp. 145-174). Springer, Singapore.

Kalamkar, S.S. 2003. Agricultural development and sources of output growth in Maharashtra State.

Pıša, V. and Bruha, J. 2011. The Decomposition Model of the World Agricultural Production and Consumption.

Rehman, F.U., Saeed, I. and Salam, A. 2011. Estimating growth rates and decomposition analysis of agriculture production in Pakistan: pre and post sap analysis. *Sarhad J. Agric.*, **27**(1): 125-131.

Shadmehri, M.T.A. 2010. Estimating growth rates and decomposition analysis of agricultural production in Iran (19702000). *Trends in Agril. Econ.*, **3**(2): 107-119.

Sharma, Yogima Seth. 2021. *Share of agriculture sector in employment sees steady increase: CMIE - The Economic Times* [News]. The Economic Times.

Vani, G.K., Mishra P. and Sahu, P.K. 2019. Decomposition Technique in Agricultural Policy Analysis. Jaya Publishing House, New Delhi.