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Comparative analysis of profile characteristics of farmers practicing integrated farming systems (IFSs) in Chhattisgarh and Madhya Pradesh states

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Abstract

This research provided a comparative analysis of integrated farming system practices in Chhattisgarh (CG) and Madhya Pradesh (MP). It examined education levels, family size, farming experience, landholding patterns, irrigated areas, and occupational distribution. CG had a higher percentage of illiterate respondents but better high school completion rates. MP exhibited larger family sizes and slightly higher farming experience. Most landholdings were below 2 ha., with MP having more farmers in the 1-2 ha. category. MP showed a higher percentage of areas with over 75% irrigation. Farming situations revealed a greater proportion of irrigated areas in MP. CG demonstrated higher engagement in agriculture, business, and agricultural labour, whereas MP led in animal husbandry. Income analysis highlighted agriculture as the main source, with CG farmers earning slightly more. However, income from animal husbandry was higher in MP, with significant service sector disparities. Annual family income distribution showed no statistically significant differences, suggesting shared income inequality. This study emphasized the need for targeted interventions to address sectoral disparities and improve income generation in CG and MP.

Keywords: Agricultural profile characteristics, integrated farming system, comparative analysis

Introduction

Integrated Farming Systems (IFSs) have become a crucial strategy in modern agriculture, aiming to enhance productivity, sustainability, and profitability through the integration of various farming components. This approach is increasingly relevant in India, a country where agriculture supports over 50 percent of the population and contributes significantly to the national economy. As the Indian agricultural sector grapples with challenges such as resource depletion, climate variability, and market fluctuations, IFSs offer a promising solution by promoting diversified and resilient farming practices.

Chhattisgarh and Madhya Pradesh states are central Indian states, provide an intriguing context for studying IFSs due to their distinct geographic and socio-economic characteristics. CG, with its predominantly hilly terrain and tropical climate, has a significant proportion of its agricultural land devoted to rice cultivation. According to the Chhattisgarh Economic Survey (2022), the state's agricultural sector is characterized by small and fragmented land holdings, with average landholding size of about 0.86 hectares per household. This fragmented land pattern presents both opportunities and constraints for the implementation of IFSs.

In contrast, MP features a more varied landscape, including

both plains and plateaus, and experiences a range of climatic conditions from semi-arid to humid. The state is a major producer of wheat, rice, and pulses, with an average landholding size of approximately 1.18 hectares per household. This larger average landholding size and diverse Agro-ecological conditions influence the adoption and adaptation of IFS practices in MP.

A comparative analysis of these two states offers valuable insights into how regional factors influence IFS practices. For instance, in CG, the prevalence of rice-based IFSs, including the integration of livestock and minor forest products, reflects the state's agrarian structure and resource availability. Data from the Chhattisgarh State Agriculture Policy (2022) indicates that nearly 45 percent of IFS practitioners in the state incorporate fish farming and poultry into their rice cultivation systems.

Conversely, in Madhya Pradesh, IFS practices are more diversified, with a notable integration of horticulture and agroforestry alongside traditional crop cultivation. The MP State Agro-Economic Survey (2023) highlights that about 55 percent of farmers practicing IFS in the state include crop-livestock integration, with significant investments in horticultural crops such as fruits and vegetables.

This study aims to conduct a comparative analysis of the profile characteristics of farmers engaged in IFSs in CG and

MP, focusing on demographic factors, economic conditions, farm characteristics, and environmental influences. By examining these factors, the research will shed light on the similarities and differences in IFS practices between the two states, providing insights that can inform targeted interventions and policy development to support sustainable agricultural practices across diverse regional contexts.

Objective

To study the profile characteristics of farmers practicing integrated farming system (IFSs) in Chhattisgarh and Madhya Pradesh states.

Methodology

The study was conducted in the central Indian states of CG and MP during the years 2022-24. Both states were purposively selected to represent diverse practices of Integrated Farming Systems (IFSs).

Four districts were chosen purposively: Rajnandgaon and Kawardha from CG, and Balaghat and Mandla from MP. Rajnandgaon, Kawardha and Balaghat are located in the CG plain agro-climatic zone. Mandla, in the Northern Hill Region.

Two blocks from each district were randomly selected, resulting in a total of eight blocks for the study. Thirty-two villages were randomly selected (sixteen from each state) to ensure a representative sample. In each village, ten IFS practicing farmers were chosen, leading to a total of 320 respondents (160 from each state). This sampling approach provided a comprehensive overview of IFS practices across the selected districts.

“Z” test

This technique was used to know the compare the mean difference.

$$Z = \frac{X - \mu^0}{\sigma/\sqrt{n}}$$

Where,

X = Mean of sample

μ^0 = Mean of population

σ = Standard deviation of population

n = No. of observation

Difference in percentage

Percentage difference is used when both values mean the same kind of thing.

$$\text{Difference in percentage} = \frac{(x_1 - x_2)}{x_1} \times 100$$

Where,

x_1 = Mean of first group

x_2 = Mean of second group

Results and Discussion

Education

The data in Table No.1 indicates that the level of education within the integrated farming system practicing farmers in CG and MP states. The study categorized educational levels from illiterate to undergraduate. It was found that 6.25

percent of respondents in CG were illiterate as compared to 8.75 percent in MP. Primary education completion rates were 20.00 percent in CG and 21.25 percent in M.P. Middle school completion was equal in both states at 22.50 percent. High school education completion was slightly higher in CG (23.13%) than in MP (17.50%). Higher secondary education completion rates were 18.13 percent in CG and 18.75 percent in MP. The percentage of undergraduate farmers in CG and MP was 6.88 percent and 6.25 percent. The average years of education were 8.24 years for CG and 8.58 years for MP. These results were also supported by Argade (2014)^[1], Nipane *et al.* (2016)^[6] and Parmar (2018)^[7].

Family Size

In terms of family size. It was observed that 22.50 percent of families in both states had fewer than 4 members. The significant differences existed between CG and MP states. For instance, while the CG showed a high proportion of families with 5 to 6 members (31.25%), the MP exhibited an even higher proportion in the same category (38.75%). Families with 7 to 8 members made up 25.00 percent in CG and 26.87 percent in MP. The percentage of families with more than 8 members was considerably lower, especially in the MP (11.88%). The average family size was 7.00 members in CG and 6.25 members in MP. The finding is similar to Singh *et al.* (2017)^[9] and Deshmukh *et al.* (2020)^[4].

Farming Experience

Farming experience was categorized into six groups, ranging from less than 10 years to more than 50 years. It was found that 10.00 percent of respondents in CG had less than 10 years of farming experience, compared to 11.88 percent in MP. Those with 10 to 20 years of experience constituted 21.88 percent in CG and 18.13 percent in MP. The majority of farmers had 20 to 30 years of experience, with 33.13 percent in CG and 36.88 percent in MP. Farming experience of 30 to 40 years was reported by 18.13 percent in CG and 15.00 percent in MP. Those with 40 to 50 years of experience constituted 12.50 percent in CG and 11.25 percent in MP. More than 50 years of farming experience was reported by 4.38 and 6.88 percent in CG and MP. The average farming experience was 25.50 years in CG and 25.84 years in MP. The result is in line and agreement with the findings of Sharma (2019)^[8].

Land Holding

Depending upon the farm size, the respondents were grouped in to five categories using the criterion adopted by Indian Agricultural Statistics Research Institute, New Delhi (Agricultural Census Report 2010-11). It was found that 33.13 percent of farmers in CG and 26.88 percent in MP had less than 1 ha. land. Those with 1 to 2 ha. constituted 40.62 percent in CG and 51.25 percent in MP. Land holdings of 2 to 4 ha. were reported by 18.75 percent in CG and 19.38 percent in MP. Holdings of 4 to 10 ha. were found in 6.85 percent of farmers in CG and 2.50 percent in MP. More than 10 hectares were reported by 0.65 percent in CG and none in MP. The average land holding was found slightly difference in CG and MP (1.90 ha. and 1.70 ha.). The finding is similar to Kowsalya (2017)^[5], Borade (2021)^[2] and Chandana *et al.* (2021)^[3].

Table 1: Distribution of respondents according to their profile characteristics

Sl. No.	Profile Characteristics	Categories	C.G.		M.P.	
			F	%	F	%
1	Education	Illiterate	10	6.25	14	8.75
		Primary School	32	20.00	34	21.25
		Middle School	36	22.50	36	22.50
		High School	37	23.13	28	17.50
		Higher Secondary	29	18.13	30	18.75
		Under Graduate	11	6.88	10	6.25
Average years of education			8.24		8.58	
2	Family size	< 4 members	36	22.50	36	22.50
		5 to 6 members	50	31.25	62	38.75
		7 to 8 members	40	25.00	43	26.87
		> 8 members	34	21.25	19	11.88
Average family members			7.00		6.25	
3	Farming experience	< 10 Years	16	10.00	19	11.88
		10 to 20 Years	35	21.88	29	18.13
		20 to 30 years	53	33.13	59	36.88
		30 to 40 years	29	18.13	24	15.00
		40 to 50 years	20	12.50	18	11.25
		> 50 years	7	4.38	11	6.88
Average farming experience in years			25.50		25.84	
4	Land holding	< 1 ha.	53	33.13	43	26.88
		1 ha. to 2 ha.	65	40.62	82	51.25
		2 to 4 ha.	30	18.75	31	19.38
		4 to 10 ha.	11	6.85	4	2.50
		>10 ha.	1	0.65	0	0.00
Average land holding in ha.			1.90		1.70	
5	Irrigated area from net cultivated area (NCA)	< 25%	1	0.96	1	0.77
		25-50%	16	15.38	14	10.77
		50-75%	29	27.88	26	20.00
		> 75%	58	55.76	89	68.46
Avg. irrigated area from NCA			51.00		75.91	
6	Farming situation	Irrigated	95.54	33.13	183.84	67.34
		Rainfed	83.66	29.01	45.56	16.69
		Partially irrigated	109.20	37.86	43.60	15.97
Total farming area			288.40		273.00	

*F= Frequency, %= Percentage

Irrigated Area from Net Cultivated Area (NCA)

The irrigated area from NCA was divided into four categories. It was observed that less than 25% of the area was irrigated for 0.96 percent land in CG and 0.77 percent in MP. The 25-50% irrigation area included 15.38 percent land in CG and 10.77 percent in MP. The 50-75% area was reported by 27.88 percent land in CG and 20.00 percent in MP. More than 75% of the area was irrigated for 55.76 percent land in CG and 68.46 percent in MP. The average irrigated area from NCA was observed significant difference in CG and MP (51.00% and 75.91%).

Farming Situation

The farming situation was categorized into irrigated, rainfed, and partially irrigated. It was found that 33.13 percent (95.54 ha.) of the total farming area in CG was irrigated, compared to 67.34 percent (183.84 ha.) in MP. In rainfed farming constituted 29.01 percent (83.66 ha.) in CG and 16.69 percent (45.56 ha.) in MP. Partially irrigated areas made up 37.86 percent (109.20 ha.) in CG and 15.97 percent (43.60 ha.) in MP. The total area regarding farming situation of the farm families in CG was 288.40 ha. and in MP was 277.00 ha. which shows slight difference.

Occupation

Table No. 2 presented the distribution of occupations between CG and MP, along with the percentage change between the two states. The occupations listed included Agriculture, Animal husbandry, Business, Service, Agricultural labour, and Non-Agricultural labour. The data revealed significant variations and trends that could be analyzed to understand the occupational landscape in these regions.

Table 2: Distribution of respondents according to their occupation

Sl. No.	Occupation	CG		MP		Difference (%)
		F	%	F	%	
1	Agriculture	156	97.50	146	91.25	6.41
2	Animal husbandry	82	51.25	151	94.38	-84.15
3	Business	18	11.25	3	1.88	83.33
4	Service	10	6.25	8	5.00	20.00
5	Agricultural labour	30	18.75	4	2.50	86.67
6	Non-Agricultural labour	21	13.13	2	1.25	90.48

*Data are based on multiple response, F = frequency, % = percentage

In terms of Agriculture, CG had 97.50 percent of its population engaged in the agriculture sector, compared to

91.25 percent in MP, indicating a 6.41 percent higher engagement in CG. Agriculture was slightly more predominant in CG, potentially due to more favorable farming conditions or greater agricultural land availability. Animal husbandry showed a significant difference, with only 51.25 percent respondents' engagement in CG compared to 94.38 percent in MP, representing an 84.15 percent decrease. Business activities were notably higher in CG, with 11.25 percent of the population engaged compared to only 1.88 percent in MP, indicating an 83.33 percent increase.

In the service sector, CG had 6.25 percent engagement compared to 5.00 percent in MP, showing a 20 percent increase. Agricultural labor showed a significant difference, with 18.75 percent in CG compared to only 2.50 percent in MP, an 86.67 percent increase. This suggested that more people in CG were involved in agricultural labor, reflecting differences in agricultural practices or labour market conditions. Non-agricultural labour was also significantly higher in CG, with 13.13 percent engagement compared to 1.25 percent in MP, indicating a 90.48 percent increase. Chandana *et al.* (2021)^[3] also reported the similar results.



Fig 1: Occupational Distribution and Percentage change between Chhattisgarh and Madhya Pradesh

Average Annual Income

The figures given in Table No. 3 show that the analysis of income sources for respondents from CG and MP, several notable trends emerged. Agriculture was the predominant source of income for both states, with CG respondents earning an average of ₹1.12 lakh compared to ₹1.01 lakh in MP, indicating a significant difference of 9.82 percent. Animal husbandry, while contributing to income, showed a decline in CG, with an average income of ₹0.34 lakh,

compared to ₹0.48 lakh in MP, resulting in a difference of -41.18 percent. This suggests a potential underutilization or reduced productivity in animal husbandry within CG. In terms of business, CG respondents reported an average income of ₹0.89 lakh, slightly higher than the ₹0.85 lakh in MP, reflecting a minor but positive difference of 4.49%. This could indicate a more robust entrepreneurial environment in CG.

Table 3: Distribution of respondents according to their average annual income

Sl. No.	Sources of income	Total income of respondents (In Lakh)		Average income (In lakh)		Difference (%)
		CG	MP	CG	MP	
		Income	Income			
1	Agriculture	177358	159535	1.12	1.01	9.82
2	Animal husbandry	44674	75018.5	0.34	0.48	-41.18
3	Business	15180	2550	0.89	0.85	4.49
4	Service	14640	27500	1.63	3.44	-111.04
5	Agricultural labour	7060	5630	0.17	0.13	23.53
6	Non- agricultural labour	5970	3380	0.27	0.21	22.22

*Data are based on multiple response

Service income presented a stark contrast, with CG respondents earning an average of ₹1.63 lakh, while MP respondents earned significantly more at ₹3.44 lakh, leading to a negative difference of -111.04 percent. Income from agricultural labour was relatively modest in both states, with CG respondents earning ₹0.17 lakh and MP respondents earning ₹0.13 lakh, which demonstrated a positive

difference of 23.53 percent. Non-agricultural labour also showed similar trends, with CG respondents earning ₹0.27 lakh compared to ₹0.21 lakh in MP, resulting in a positive difference of 22.22 percent.

Overall, the analysis highlighted significant disparities in income sources between the two states, particularly in the service sector. The findings clearly indicate that among all

occupations the maximum average income earned from service, followed by agriculture occupation, etc. It may be due to all selected respondents were farmers and only few of them service men or their family member as service men. They got fixed amount of salary amount which was higher so that they were earning more average income as compared to farmers.

Overall Annual Income

The analysis of overall annual income distributions for respondents in CG and MP revealed distinct patterns in income brackets. The Table No. 4 presented a significant proportion of families in CG reported an annual income of up to ₹1.00 lakh, accounting for 46.25 percent of respondents, while this figure was lower at 30.00 percent for MP. This disparity indicated that a larger segment of the population in CG was situated within the lowest income bracket.

Table 4: Distribution of respondents according to their overall annual income

Sl. No.	Annual family income	CG		MP	
		F	%	F	%
1	Up to Rs. 1.00 lac	74	46.25	48	30
2	Rs. 1.00 to Rs. 2.00 lac	44	27.5	70	43.75
3	Rs. 2.00 to Rs. 4.00 lac	27	16.88	31	19.38
4	Rs. 4.00 to Rs. 6.00 lac	9	5.63	7	4.38
5	More than Rs. 6.00 lac	6	3.75	4	2.5
Average income (Rs.)		1.74 lac		1.83 lac	
Mean difference (Rs.)		0.09 lac			
“Z” Value		-0.49			
P(Z<=z) two-tail		0.62			
Z Critical two-tail		1.95			

In the income range of ₹1.00 to ₹2.00 lakh, 27.50 percent of CG families reported earnings, compared to 43.75 percent in MP. This difference suggested that families in MP were more likely to attain slightly higher income levels than those in CG. Conversely, the income brackets of ₹2.00 to ₹4.00 lakh showed 16.88 percent of families in CG compared to 19.38 percent in MP, indicating a relatively similar distribution in this category.

For higher income brackets, the differences continued to persist. Only 5.63 percent of CG families earned between ₹4.00 to ₹6.00 lakh, while 4.38 percent of MP families fell into this category. The proportion of families earning more than ₹6.00 lakh was slightly higher in CG at 3.75 percent compared to 2.5 percent in MP. The average annual income in CG was reported at ₹1.74 lakh, while MP showed a slightly higher average of ₹1.83 lakh, resulting in a mean difference of ₹0.09 lakh. The Z-value of -0.49 suggested that the difference in income distributions between the two states was not statistically significant, with a two-tailed P(Z<=z) value of 0.62, indicating a high probability that the observed difference could occur by random chance. The Z-critical value of 1.95 confirmed that the findings did not reach the threshold for significance.

Conclusion

In conclusion, the comparative analysis of integrated farming system practices between CG and MP revealed several key insights. The educational levels, family size,

farming experience, landholding patterns, irrigated areas, and farming situations exhibited varying trends across both states. CG showed a slightly higher percentage of illiterate respondents and marginally better completion rates in high school education, while MP had a higher average number of years of education. Family size analysis indicated larger family units in MP. The farming experience was predominantly between 20-30 years for most respondents, with MP having a slightly higher average experience. Landholding sizes were mostly below 2 hectares in both states, though MP had a higher proportion of farmers in the 1-2 ha. category.

Irrigation practices showed MP had a significantly higher percentage of areas with more than 75% irrigation from net cultivated area (NCA). Farming situations indicated a higher proportion of irrigated farming areas in MP compared to CG. Occupational distribution highlighted CG's higher engagement in agriculture, business, and agricultural labor, whereas MP showed a significant lead in animal husbandry. Income analysis revealed agriculture as the predominant income source for both states, with CG respondents earning slightly higher on average. However, CG showed a decline in income from animal husbandry and significant disparities in the service sector compared to MP.

Despite these differences, the overall annual family income distribution analysis indicated that the observed variations between the two states were not statistically significant, suggesting that income inequality remained a common challenge in both regions. This comprehensive analysis underscored the need for targeted interventions to address specific sectoral disparities and enhance income generation opportunities across CG and MP.

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