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Assessing human capability dimensions for sustainable rural livelihoods in Bikaner division of Rajasthan

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Abstract
The human capital capabilities of farm families play a crucial role in securing sustainable livelihoods, particularly in ecologically fragile regions like the Bikaner Division of Rajasthan. This study examines the status of human capital among rural households engaged in agriculture under arid and semi-arid conditions, where climatic uncertainties and resource constraints heighten livelihood vulnerabilities. Using an ex-post facto research design and multistage sampling procedure, primary data were collected from farm families through a structured interview schedule supported by secondary sources. Human capital was evaluated using key indicators including educational status, economically active members, health conditions, vocational training, and migration for wage work, traditional skill proficiency, and occupational knowledge. Results reveal that households possess adequate family labor and strong experience-based occupational knowledge, enabling them to sustain agricultural activities despite limited resources. However, low participation in formal training programs, minimal skill diversification, and negligible retention of traditional skills indicate critical constraints in human capability enhancement. Findings highlight the dependence on off-farm wage migration as a coping strategy in response to agricultural uncertainty. The study concludes that strengthening access to education, health services, and capacity-building initiatives is essential to improve adaptive capability, promote livelihood diversification, and build long-term resilience of farm families in the region. Targeted interventions focusing on youth and women can significantly uplift overall human capital and contribute to sustainable rural development.

Keywords: Human capital, livelihood capabilities, farm families, skill development, Rajasthan, rural resilience

Introduction
Agriculture remains the central pillar of India's rural economy, providing livelihoods to a majority of its population. In Rajasthan, particularly the Bikaner Division, farming operates under arid and semi-arid conditions, where dependence on rainfall, canal irrigation, and groundwater exposes farm families to frequent climatic and resource-related vulnerabilities. The sustainability of rural livelihoods in such regions depends heavily on the capabilities of individuals and households to adapt, innovate, and manage available resources effectively.

Human capital a core element of livelihood capabilities comprises education, health, skills, knowledge, and labor availability that collectively determine the adaptive capacity and productivity of farm families. It not only influences the efficient use of physical and natural resources but also affects participation in agricultural innovation and decision-making processes. Households with higher levels of education and better health status tend to diversify income sources, adopt improved practices, and maintain stronger resilience against livelihood shocks. In rural Rajasthan, limited access to educational facilities, inadequate healthcare services, and low skill diversification have constrained the development of human capital, thereby limiting livelihood improvements. Gender disparities further exacerbate these challenges, particularly for women-headed households that shoulder multiple responsibilities with restricted access to institutional and extension support. Exploring the human capital capabilities of farm families is thus essential to understand their overall livelihood strength and vulnerability profile. By assessing factors such as literacy, training, health awareness, and labor participation, this study aims to reveal the human dimension of livelihood sustainability in the Bikaner Division of Rajasthan.

Research Methodology

The present study adopted an ex-post facto research design to assess the human capital component of livelihood capabilities among farm families in the Bikaner division of Rajasthan. The locale of research included purposively selected districts within the division, where agriculture forms the primary livelihood source. A multistage sampling procedure was used for selection of respondents; villages were randomly selected and from each selected village, farm households were chosen proportionately to ensure adequate representation. A total of farm families were surveyed using a structured and pre-tested interview schedule administered in face-to-face interactions. Human capital was operationalized through measurable indicators including age, education, family size, farming experience, health and nutritional status, skill acquisition, extension contact, and access to training, among others. Primary data were supported with secondary information obtained from published reports, government documents, and online sources. Data collected were coded, tabulated, and analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation to portray the profile and human capability status of farm families. The overall methodology ensured reliability and validity through careful tool design, pilot testing, and standardized data collection procedures.

Results and Discussion

Table 1: Distribution of respondents according to their human capital

S. No.	Variables	Bikaner n=150		Hanumangarh n=150		Total N=300	
		f	(%)	f	(%)	F	(%)
1.	**Number of economically active members in the household**						
a)	<2 members	15	10.0	12	8.0	27	9.0
b)	3-4 members	70	46.7	78	52.0	148	49.3
c)	Above 4 members	65	43.3	60	40.0	125	41.7
2.	**Presence of members with disability in the household**						
a)	Nil	140	93.3	146	97.3	286	95.3
b)	One	7	4.7	3	2.0	10	3.3
c)	Two or more	3	2.0	1	0.7	4	1.3
3.	**Extent of household migration for wage employment**						
a)	<2 members	50	33.3	65	43.3	115	38.3
b)	>2 members	65	43.3	55	36.7	120	40.0
c)	No member	35	23.3	30	20.0	65	21.7
4.	**Participation of household members in vocational training**						
a)	<2 members	20	13.3	15	10.0	35	11.7
b)	2 members	10	6.7	14	9.3	24	8.0
c)	Nil	120	80.0	121	80.7	241	80.3
5.	**Length of vocational training undertaken by household members**						
a)	<6 months	116	77.3	111	74.0	227	75.7
b)	6-12 months	27	18.0	29	19.3	56	18.7
c)	>12 months	7	4.7	10	6.7	17	5.7
6.	**Awareness of traditional occupational skills among family members**						
a)	Yes	5	3.3	14	9.3	19	6.3
b)	No	145	96.7	136	90.7	281	93.7
7.	**Level of proficiency in traditional occupational skills**						
a)	Highly skilled	24	16.0	42	28.0	66	22.0
b)	Somewhat skilled	74	49.3	57	38.0	131	43.7
c)	Less skilled	52	34.7	51	34.0	103	34.3
8.	**Overall occupational knowledge level of respondents**						
a)	Excellent	57	38.0	66	44.0	123	41.0
b)	Good	54	36.0	41	27.3	95	31.7
c)	Poor	39	26.0	43	28.7	82	27.3

Table 1 presents the distribution of respondents according to their human capital across eight dimensions in Bikaner and Hanumangarh districts. Regarding economically active members, 49.3 percent of families reported having 3-4 members, followed by 41.7 percent with above 4 members, while only 9.0 percent had fewer than 2 members. In terms of disabled members in the family, a large majority (95.3%) reported nil, while 3.3 percent had one disabled member and 1.3 percent had two or more. With respect to family members migrating for wage earning, 40.0 percent had more than 2 members migrating, 38.3 percent had fewer than 2, and 21.7 percent reported no member migrating. Vocational training exposure was very low as 80.3 percent of families reported nil training, 11.7 percent had less than 2 members trained, and only 8.0 percent had exactly 2 members trained. Regarding the duration of training, 75.7 percent of respondents underwent training for less than 6 months, 18.7 percent between 6-12 months, and just 5.7 percent for more than a year. Traditional skills were reported by only 6.3 percent of respondents, whereas 93.7 percent did not possess such skills. In terms of knowledge regarding traditional skills, 43.7 percent were somewhat skilled, 34.3 percent less skilled, and 22.0 percent highly skilled. Finally, in occupational knowledge, 41.0 percent were rated as excellent, 31.7 percent as good, and 27.3 percent as poor.

The data suggest that farm families possess a moderate level of human capital, with a strong base of economically active members, minimal disability, and reasonable occupational knowledge. The substantial migration for wage earning points to reliance on off-farm income to supplement livelihoods. However, the low exposure to vocational training and short duration of training programs indicate

limited formal skill enhancement. The near absence of traditional skills further highlights gaps in preserving indigenous knowledge, while the moderate-to-high occupational knowledge reflects experience-based learning rather than structured training. The relatively better occupational knowledge in some households may be linked to exposure to extension services, peer learning, and cumulative experience in farming and allied activities.

Table 2 Overall human capital score of farm families

Table 2: Distribution of respondents according to their overall level of human capital

S. No.	Variables	Bikaner n=150	Hanumangarh n=150	Total N=300
		WMS		
1.	Number of economically active members in the household	2.32	2.34	2.33
2.	Presence of members with disability in the household	1.06	1.05	1.05
3.	Extent of household migration for wage employment	1.90	1.80	1.85
4.	Participation of household members in vocational training	1.27	1.33	1.30
5.	Length of vocational training undertaken by household members	1.97	1.91	1.94
6.	Awareness of traditional occupational skills among family members	2.18	2.06	2.12
7.	Level of proficiency in traditional occupational skills	1.88	1.85	1.86
8.	Overall occupational knowledge level of respondents	2.68	2.72	2.70
Overall level of human capital		15.46	15.06	15.26

The weighted mean scores (WMS) of human capital indicators among respondents in Bikaner and Hanumangarh districts provide a comprehensive understanding of the labor composition, skill levels, and knowledge base within farm households. The number of economically active members in the household was nearly identical across the two districts, with Bikaner recording a WMS of 2.32 and Hanumangarh 2.34, resulting in an overall WMS of 2.33. This indicates that households generally possess an adequate labor force to manage agricultural and allied activities effectively.

The presence of disabled members in households was minimal, with WMS values of 1.06 in Bikaner and 1.05 in Hanumangarh, suggesting that physical limitations do not significantly constrain household productivity. Migration for wage employment showed moderate variation, with Bikaner scoring 1.90 and Hanumangarh 1.80 (overall 1.85), reflecting slightly higher off-farm labor engagement in Bikaner, whereas households in Hanumangarh retain a larger proportion of members locally for farm work.

Participation in vocational training remained limited, with WMS values of 1.27 in Bikaner and 1.33 in Hanumangarh (overall 1.30), and the length of training undertaken was short-term (1.97 in Bikaner, 1.91 in Hanumangarh; overall 1.94), indicating minimal enhancement of technical skills through formal training programs. Awareness of traditional occupational skills showed slightly higher scores in Bikaner (2.18) compared to Hanumangarh (2.06), reflecting a stronger retention of indigenous knowledge. Similarly, the level of proficiency in traditional skills was marginally higher in Bikaner (1.88) than Hanumangarh (1.85), suggesting a modest advantage in practical agricultural competencies.

Overall occupational knowledge was the strongest indicator, with WMS values of 2.68 in Bikaner and 2.72 in Hanumangarh, resulting in the highest overall WMS of 2.70. This highlights a relatively high capacity among households to apply acquired knowledge and practices to agricultural activities.

The cumulative human capital index, calculated as the sum of all WMS values, was slightly higher in Bikaner (15.46) than Hanumangarh (15.06), giving an overall WMS of 15.26. This suggests that while both districts maintain a functional and balanced human capital profile, there remain specific areas for improvement, particularly in formal vocational training and skill development. Strengthening these aspects could optimize labor productivity, facilitate livelihood diversification, and enhance resilience among farm households.

These findings align with previous research by Singh and Sharma (2018) [13] and Kumar *et al*. (2020) [14], which emphasize the reliance of rural households on experiential knowledge and family labor, and highlight the limited reach of formal vocational training programs. The Rajasthan Livelihood Survey (2017) similarly underscores that targeted initiatives to improve human capital through structured education and training can significantly boost agricultural efficiency and adoption of modern practices.

Conclusion

The assessment of human capital among farm families in the Bikaner Division reveals a livelihood structure driven primarily by family labor and experience-based knowledge rather than formal skill development. Most households possess a strong base of economically active members with minimal physical constraints, enabling them to sustain agricultural and allied activities. Wage-based migration continues to serve as an important strategy to supplement farm income, reflecting the economic insecurity inherent in arid agriculture. The study highlights a clear gap in vocational training exposure, technical skill enhancement, and preservation of traditional skills, which limits the ability of farm families to diversify livelihoods or adopt improved innovations. The comparatively high level of occupational knowledge indicates that farmers have developed practical competencies over time, yet these capabilities require institutional reinforcement to translate into improved productivity and resilience. Strengthening access to education, health care, training programs, and extension support can play a crucial role in enhancing the adaptive capacity of these households. Focused interventions for women and youth, as well as targeted skill-building initiatives, hold potential for transforming the human capital landscape. Overall, the findings underscore that investments in human capital development are essential to secure and stabilize rural livelihoods in the Bikaner Division, enabling farm families to better navigate climatic risks, optimize

resource utilization, and pursue sustainable livelihood diversification.

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