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Aims and Scope

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Subject areas include any thematic areas related to sustainable integrated rural development aligned with Sustainable Development Goals (SDGs). The thematic areas are including but not limited to the following:

- Sustainable use of natural resources
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Agricultural Land Rental Arrangements in Nepal: Incidence, Forms, Determinants, and the Current Legal Provisions

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Abstract

Given the fragmented and small size of land holdings in Nepal, the viability of crop production is a pressing concern. Rental or tenancy arrangements, which equalise marginal returns from factors of production across households, offer a solution to this viability crisis. In this context, our study is unique as it not only examines the incidence and forms of tenancy, but also identifies the determinants of the land leasing decision of rural households, and discusses their implications for agrarian development in Nepal. Drawing on primary survey data from 350 households in six districts of plains and hills, we provide evidence of the widespread prevalence of informal tenancy in Nepal. Despite locational variations explained by the location-specific cropping patterns, sharecropping and fixed-rent are found to be the primary forms of tenancy contracts. A Tobit regression analysis identifies certain household level, farm level, and location-specific characteristics as important factors influencing land leasing decisions. Our analysis suggests that the land supply in the land lease market may increase in the future, and therefore, it is pertinent to examine the legal provisions that govern the use of such lands. Hence, we also examine the legal provisions concerning tenancy relations.

Keywords

Tenancy, Nepal, sharecropping, fixed-rent, tenancy reforms

Introduction

Land and labour are the most essential factors of agricultural production. Rural households, however, rarely possess these resources in the right combination. Since the land sale market is thin, and the ownership right usually changes hands

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through inheritance and marriage, rental or tenancy arrangements have historically emerged as a mechanism to alter factor combinations to optimal ones in farm activities (Bliss & Stern, 1982; Himanshu et al., 2018; Khan & Bezbaruah, 2024). Our study aims to delve into the current prevalence of tenancy in Nepal, particularly its forms, determinants, and implications for agrarian development. Through tenancy, households with more land than labour lease out their land to households with more labour than land and vice-versa.

Like in other developing countries, Nepal's land distribution is uneven. There is a predominance of small and marginal holdings, and the incidence of landlessness is high. A recently released report highlights that 26.1% of Nepalese households are landless. The incidence of landlessness is the highest among the Dalit households (AINS et al., 2019). While 36.5% of Dalit households in the hills are landless, the percentage of landless Dalit households in the plains is 41.4% (AINS et al., 2019). Even those households who own land, their holdings are exceedingly small. The average holding size for the entire country is less than 1 hectare and is declining over time (Adhikari, 2019). The preponderance of small and marginal holdings raises a question about the viability of cultivation (Sharma & Malik, 2021). However, access to land through rental arrangements can potentially be a solution to the viability crisis. Another implication of the small size of land holding is that there is now minimal scope for redistributing the ownership right of land (Adhikari, 2019; Central Bureau of Statistics, 2013b; Goswami & Giri, 2022; Zaman, 1973). If transferring full ownership of land is not feasible or politically contested, tenancy arrangements can improve access to land through user-right distribution (Sharma et al., 2014).

Another issue concerning agricultural land in Nepal is fallow land. The increasing trend of migration out of the country has turned a sizeable amount of cultivable land into fallow land (Adhikari & Hobley, 2015; Paudel et al., 2014; Sharma et al., 2014). As per the record of the Ministry of Agriculture and Development, Government of Nepal (2016), an estimated 20%–25% of the country's total cultivable land remains fallow. The share of fallow land, especially those owned by absentee landlords, is rising (Adhikari, 2019, 2022). The presence of rental markets can facilitate the use of the fallow lands. The land rental market can promote occupational mobility, too (NITI Aayog, 2016). Tenancy arrangements allow households that own land but are not interested in agriculture to move from the farm to the non-farm sector. These households can lease their lands and utilise their labour in the non-farm sector.

Given the above-discussed reasons, an analysis of Nepal's agricultural land rental arrangements becomes pertinent. The literature on land use in Nepal covers many aspects, such as landlessness (AINS et al., 2019; Deuja, 2004), fallow land (Adhikari, 2019; Hussain et al., 2016; Jaquet et al., 2015; KC & Race, 2019; Maharjan et al., 2020; Sunam & Adhikari, 2016), land inequality (AINS et al., 2019; Sunam, 2014; Sunam & McCarthy, 2016; Wily et al., 2008) and so on, the issues of tenancy relations have not been adequately explored. The discussion in the prevailing literature regarding tenancy relations centres on Nepal's land reform measures implemented since 1951 wherein the central issue of discussion

is the rights of the sharecroppers (Adhikari, 2019; AINS et al., 2019; Community et al., 2009; Dhakal, 2011; Regmi, 1961; Sharma et al., 2014; Shrestha & Deuja, 2021; Wily et al., 2008; Zaman, 1973). Some other studies, such as Acharya (1993), Acharya and Ekelund (1998), and Aryal and Holden (2011, 2013), explored the economic implications of sharecropping for resource use efficiency in Nepal. Though Nepal's agricultural census revealed the emergence of fixed-rent contracts as a major form of rental arrangement in the country (Central Bureau of Statistics, 2013a), the literature on tenancy relations and land use is yet to explore issues associated with different forms of tenancy arrangements besides sharecropping. There is also a dearth of research on the current nature of tenancy relations and the factors influencing tenancy relations. Because of these limitations of the existing literature, the present study examines certain aspects of Nepal's agricultural land rental markets that have not been explored adequately. Further, the comparative analysis of the tenancy situation across hills and plains of Nepal adds additional value to our study.

Using primary survey data from 350 households collected from six districts of Nepal, the article estimates the incidence of tenancy and identifies various forms of tenancy contracts that prevail therein. Further, an analysis was carried out to identify the factors that affect the land leasing decisions of rural households. We find that tenancy is widely prevalent and informal in Nepal. Notwithstanding locational variations, fixed-rent and sharecropping are the major forms of the tenancy contract. A particular form of tenancy contract in a location is associated with the location-specific cropping pattern. Further, along with other socio-economic variables, we find that the education level of the head of the household and the migration status of the household significantly affect the household's leasing decision. Highly educated households are more likely to lease out land. On the other hand, while recent migrants are likely to lease the land, early migrants are likely to lease out the land. Finally, the desired reforms in tenancy relations have also been discussed.

The study is organised as follows: the second section explains the sampling design and methods used for data analysis. The third section presents the results of the empirical analysis. The fourth section discusses the results. The fifth section concludes the article with the implications of the policy results.

Data and Methodology

Data

The study uses data from a primary survey of 350 households between November 2021 and February 2022. Of the three ecological regions, the study is limited to Nepal's hills and terai (plains). The mountain region is excluded because the share of arable land in the total land area of the mountains is only 8%. The corresponding figures in hills and terai are 56% and 36%, respectively (Timilsina et al., 2019). Further, the incidence of tenancy in mountains is less than in hills and terai (Central Bureau of Statistics 2013).

Following a multi-stage sampling technique, we divide the hill region into three sub-regions (Eastern, Central, and Western) in the first stage. In the second stage, one district from each sub-region is selected. In the third stage, we select four villages from each district. While selecting the districts, we ensure that the agro-climatic conditions of the respective regions are well represented. Further, the villages are selected in a manner so that they represent the socio-economic features and agricultural practices of the districts. At the final stage, we select 10% of the households in a village that either own or/and operate on land by using a simple random sampling technique. A similar process has been followed in the plains to identify the sample households. While Dhankuta, KZavre, and Kaski districts have been selected from the hills, Sunsari, Chitwan, and Dang districts have been selected from the plains. In this way, we have a total of 350 households in our sample that represent the geographical scope of the study. These households have been interviewed using a structured questionnaire. Figure 1 summarises the multi-stage sampling procedure.

Methodology

We begin our analysis by examining the incidence and forms of the tenancy contract at national, regional, and district levels using two indicators of tenancy. These indicators are the percentage of households leasing in the land and the percentage of leased-in area in total operational holding. The key socio-economic characteristics of lessor and lessee households, such as education, ethnicity,

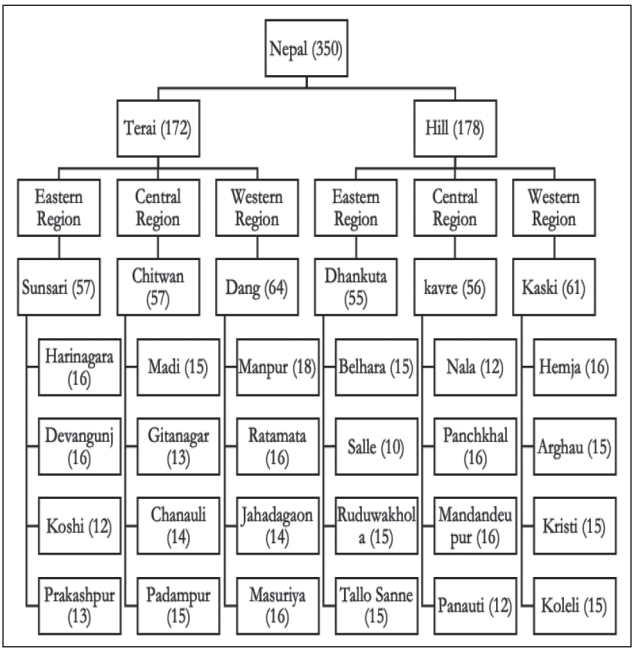

Figure 1. Sample Design.

occupation, and migration status, are then analysed to understand the association of these household characteristics with the land leasing decision. The final part of the analysis involves estimating a both-sided censored Tobit regression model that identifies the factors influencing households' land leasing decisions.

The dependent variable in the regression equation is an index that captures the magnitude and intensity of tenancy. Following Goswami & Bezbaruah (2013) and Goswami (2018), we formulate the index as follows[1]:

The index (Y) is the difference between the operational and ownership holdings divided by their combined total. This index reflects the magnitude and intensity of tenancy by considering both the ownership and operational holdings. It automatically includes information about the owned, leased-in, and leased-out land areas.

$$\text{Magnitude and intensity of tenancy}\left(\text{Y}\right) = \frac{\text{Operational holding}\left(\text{ha}\right) - \text{Ownershiping holding}\left(\text{ha}\right)}{\text{Operational holding}\left(\text{ha}\right) + \text{Ownershiping holding}\left(\text{ha}\right)}$$

where, $\text{Y} \in [-1,1]$

The value of our dependent variable (Y) lies between -1 and 1. For a pure lessor, the value of Y is –1. On the other hand, the value of Y is 1 for pure tenants and 0 for owner-operator households. While the owner-operator-cum lessor households have a value between –1 and 0, the index takes values between 0 and 1 for owner-operator-cum tenants. Given that the dependent variable (Y) is restricted within the range of –1 and 1, using the ordinary least squares method to estimate the model is inappropriate as the predicted values may not lie within the range. Instead, the double-censored Tobit model is considered appropriate in the present context. The double-censored Tobit model handles situations where the dependent variable is constrained within certain limits- in our case, between -1 and 1. This regression model accounts for these bounds by censoring the predictions at the lower and upper limits (Greene, 2003). The double-censored Tobit model uses the latent variable, as in equation 1, which might take any value but cannot be observed.

$$Y_i^* = \beta X_i + U_i \tag{1}$$

where X_i is the set of explanatory variables, and U_i is the random disturbance term.

The observed dependent variable Y_i is linked to the latent variable Y_i^* as per the following configuration:

$$\begin{aligned} Y_i &= -1 \; for \; Y_i^* < -1 \\ &= Y_i^* \; for \; -1 \le Y_i^* \le 1 \\ &= 1 \; for \; Y_i^* > 1 \end{aligned}$$

We use Stata 17 to obtain the maximum likelihood estimates of the parameters. Table 1 lists the set of explanatory variables ($X_i s$) along with their description and expected signs of the coefficients. These variables have been identified

Table 1. List of Explanatory Variables with their Expected Signs.

Explanatory Variables	Description of Variables	Expected Sign
Age	Age of household head (in years)	±
Age (square)	Square of the age of household head	±
Gender	Dummy: 1 if the household head is female, 0 otherwise	–
Education	Years of education as head of household	–
Ethnicity	Ethnicity of household: Categorical variable with Khas/Arya as base category, thus	
	Dummy 1(d1) = Hill Janajati;	+
	Dummy 2 (d2) = Terai Janajati;	+
	Dummy 3 (d3) = Dalit	+
Internal migration status of the household	Year of migration (categorical variable); 0 = non-migrant;	
	Dummy 1(d1) = migrated within the last decade;	+
	Dummy 2 (d2) = migrated between 10–20 years earlier;	–
	Dummy 3 (d3) = migrated between 20 and 30 years earlier;	–
	Dummy 4 (d4) = migrated more than 30 years earlier.	–
Occupation	Primary occupation of the household (categorical variable) 0 = non-farm occupation	
	Dummy 1 (d1) = 1 if farm occupation	+
	Dummy 2 (d2) = 1 if both farm and non-farm occupation	±
Farm workers	No. of adult members primarily engaged in farming	+
Possession of bullock	Dummy: 1 if the Household owns a bullock pair, 0 if otherwise	+
Possession of tilling equipment	Dummy: 1 if the Household owns tilling equipment, 0 if otherwise	+
Access to credit	Dummy: 1 if the household has accessed credit, 0 if otherwise	+
Area under irrigation	Proportion of operational area with irrigation facilities	+
Households receiving remittance income from abroad	Dummy: 1 if the household has at least one member working outside the country and receiving remittance, 0 if otherwise	–
Land inequality	Coefficient of variation of land holding at village level	–
Locational dummies	Dhankuta district is used as a reference category,	
	Dummy 1(d1) = Sunsari district	±
	Dummy 2 (d2) = Chitwan district	±
	Dummy 3 (d3) = Dang district	±
	Dummy 4 (d4) = Kaski district	±
	Dummy 5 (d5) = Kavre district	±

from the existing literature (Goswami, 2018; Goswami & Bezbaruah, 2013; Kuri, 2003). The summary statistics for these variables are in the appendix (Table A1).

Results

Distribution of the Landholdings

Table 2 shows the distribution of land ownership in terms of holdings and area. Overall, landless (11.43%), marginal (16.29%), and small (51.14%) holders constitute 78.86% of the sample households who own less than 40% of the owned area. In contrast, the proportions of medium (14.29%) and large (6.86%) holders are smaller, though these two categories of households own a larger share of the sampled owned land (about 60%). These figures indicate the inequality in land ownership, which is also reflected in the high value of the Gini coefficient (0.57).

However, considerable variations exist in ownership holdings and areas owned across hills and plains, as well as within hills and plains in terms of shares of different land size categories, average size of holding, and inequality of land holding. The inequality in land ownership is higher in terai (Gini coefficient = 0.63) than in hills (Gini coefficient = 0.48). The incidence of landlessness and the average landholding size are also higher in terai than in hills. While 15.73% of the sample households are landless in Terai, the corresponding figure in hills is 6.98%. On the other hand, the average landholding size in Terai is 0.77 ha, which is 0.59 ha in the hills. Although the smallholder category is dominant across plains and hills, the share of this category in hills is much higher than that in plains. This category constitutes 60.47% of the total ownership holdings that own 50.84% of the sampled owned land in the hills. The corresponding figures in plains are 42.13% and 26.32%, respectively. There is a striking difference between hills and plains regarding the share of the large holder category. While the share of the large category in total ownership holdings in Terai is 11.8%, this category constitutes only 1.74% in the hills. The large holders own 49.93% of the sampled area in Terai, whereas the same category owns only 11.28% of the owned areas in the hills.

Table 3 shows the distribution of operational holdings and areas operated in the field study locations. Overall, operational holdings' distribution is similar to ownership holdings. Small and marginal farmers comprise 82.56% of the operational holdings but operate on only 59% of the farmlands. On the other hand, medium and large farmers constitute 24% of the operational holdings and operate on 64% of the sampled land. The Gini coefficient of the distribution of operational holdings is slightly lower (0.55) than that of ownership holdings (0.57), and the average size of operational holdings (0.84 hectares) is slightly higher than that of ownership holdings (0.68 hectares). As in ownership holdings, substantial variations exist across hills and plains and within hills and plains regarding shares of various size categories, average size of operational holdings, and inequality in operational holdings.

Table 2. Distribution of Ownership Holdings and Area Owned (in %).

Locations	Average Holding Size#	Land Size Categories*										Gini Coeff.
		Landless		Marginal		Small		Medium		Large		
		Hold	Area#	Hold	Area	Hold	Area	Hold	Area	Hold	Area	
Dhankuta	0.73	1.82	0	9.09	1.03	60	45.87	29.09	53.10	0	0.00	0.36
Kavre	0.55	3.75	0.04	14.25	3.71	69.64	58.11	10.71	25.04	1.79	13.09	0.44
Kaski	0.49	14.75	0	21.31	4.23	52.46	50.11	8.2	21.08	3.28	24.57	0.59
Hill	**0.59**	**6.98**	**0.01**	**15.12**	**2.80**	**60.47**	**50.84**	**15.7**	**35.07**	**1.74**	**11.28**	**0.48**
Sunsari	1.38	3.51	0	8.77	0.62	35.09	11.80	24.56	22.93	28.07	64.65	0.50
Chitwan	0.63	12.28	0	14.04	2.58	54.39	43.43	14.04	28.64	5.26	25.35	0.53
Dang	0.36	29.69	0	28.13	8.28	37.5	49.41	1.56	4.64	3.13	37.68	0.71
Terai	**0.77**	**15.73**	**0**	**17.42**	**2.41**	**42.13**	**26.32**	**12.92**	**21.33**	**11.8**	**49.93**	**0.63**
Nepal	**0.68**	**11.43**	**0.01**	**16.29**	**2.58**	**51.14**	**36.70**	**14.29**	**27.15**	**6.86**	**33.56**	**0.57**

Source: Authors' estimation based on field survey data.

Notes: Hold: holdings; #area in hectares. *Land size categories: Landless (less than 0.01 hectare); marginal (0.01 to 0.2 hectare); small (0.2 to 1 hectare); Medium (1 to 2 hectare); Large (more than 2 hectare); Bold values are used to highlight the regional and national figures where the regional level data represent an average or the share (%) of sample households belonging to the respective region, while the national level figure reflects the overall sample.

Table 3. Distribution of Operational Holdings and Area Operated (in %).

Locations	Average Holding Size#	Land Size Categories										Gini Coeff.
		Landless$		Marginal		Small		Medium		Large		
		Hold	Area#	Hold	Area	Hold	Area	Hold	Area	Hold	Area	
Dhankuta	0.73	5.45	0	7.27	1.99	65.45	48.12	18.18	33.27	3.64	16.62	0.42
Kavre	0.44	1.79	0	17.86	4.82	75	79.83	5.36	15.35	0	0.00	0.36
Kaski	0.54	6.56	0	13.11	2.63	67.21	47.20	9.84	23.72	3.28	26.44	0.54
Hill	**0.57**	**4.07**	**0**	**13.37**	**2.92**	**69.19**	**55.82**	**11.05**	**25.52**	**2.33**	**15.74**	**0.47**
Sunsari	1.30	8.77	0	3.51	0.41	33.33	12.69	31.58	31.06	22.81	55.85	0.49
Chitwan	1.36	8.77	0	8.77	0.71	54.39	18.82	10.53	9.11	17.54	71.36	0.68
Dang	0.68	9.38	0	4.69	0.46	64.06	53.27	20.31	36.83	1.56	9.44	0.41
Terai	**1.10**	**8.99**	**0**	**5.62**	**0.54**	**51.12**	**24.14**	**20.79**	**23.61**	**13.48**	**51.71**	**0.57**
Nepal	**0.84**	**6.57**	**0**	**9.43**	**1.34**	**60**	**34.72**	**16**	**24.25**	**8**	**39.70**	**0.55**

Source: Authors' estimation based on field survey data.

Notes: Hold: holdings; # area in hectares; $ landless refers to pure lessors; Bold values are used to highlight the regional and national figures where the regional level data represent an average or the share (%) of sample households belonging to the respective region, while the national level figure reflects the overall sample.

Table 4. Distribution of Sample Households by Tenure Status (in%).

Locations	Pure Tenant	Owner Operator Cum Tenant	Owner Operator	Owner Operator Cum Lessor	Pure Lessor
Dhankuta	1.82	30.91	50.91	10.91	5.45
Kavre	1.79	23.21	50	25	0
Kaski	14.75	26.23	37.7	14.75	6.56
Hill	**6.4**	**26.74**	**45.93**	**16.86**	**4.07**
Sunsari	3.51	28.07	47.37	12.28	8.77
Chitwan	12.28	31.58	40.35	7.02	8.77
Dang	29.69	39.06	15.63	6.25	9.38
Terai	**15.73**	**33.15**	**33.71**	**8.43**	**8.99**
Nepal	**11.14**	**30**	**39.71**	**12.57**	**6.57**

Source: Authors' estimation based on field survey data.

Note: Bold values are used to highlight the regional and national figures where the regional level data represent an average or the share (%) of sample households belonging to the respective region, while the national level figure reflects the overall sample.

Table 5. Percentage of Leased-in and Owner-operated Area in Total Operated Area.

Locations	Leased-in Area	Owner-operated Area
Dhankuta	25.75	74.25
Kavre	18.52	81.48
Kaski	38	62
Hill	**28.06**	**71.94**
Sunsari	26.28	73.72
Chitwan	69.49	30.51
Dang	75.89	24.11
Terai	**54.49**	**45.51**
Nepal	45.67	54.33

Source: Authors' estimation based on field survey data.

Note: Bold values are used to highlight the regional and national figures where the regional level data represent an average or the share (%) of sample households belonging to the respective region, while the national level figure reflects the overall sample.

Incidence and Magnitude of Tenancy

Table 4 displays the distribution of sample households based on their tenure status. The households have been categorised into five groups, namely, pure tenant, owner-operator-cum-tenant, owner-operator, owner-operator-cum-lessor, and pure lessor[2]. Overall, the 'owner-operator' is the dominant group (39.71%), followed by 'owner-operator-cum-tenant' (30%), 'owner-operator-cum-lessor' (12.57%), 'pure tenant' (11.14%), and 'pure lessor' (6.57%). Given this categorisation, it is evident that the incidence of tenancy is relatively high. The proportion of sample households that leased in land is 41.14% (pure tenant and the owner-operator cum tenant together). The incidence of tenancy is higher in Terai (48.88%) than in the hills (33.14%).

Among the field study locations, the prevalence of tenancy is the highest in Dang (68.75%), followed by Chitwan, Kaski, Dhankuta, Sunsari, and Kavre.

Table 5 shows the prevalence of tenancy in terms of the share of leased-in areas in total operational area. Overall, though most of the operated area is under owner-operation (54.33%), the share of the leased-in area is also substantial (45.67%). The proportion of leased-in area is higher in terai (54.49%) than in hills (28.06%). Among the field study locations, the proportion of leased-in areas is the highest in Dang (75.89%), followed by Chitwan (69.49%), Kaski (38%), Sunsari (26.28%), Dhankuta (25.75%) and Kavre (18.52%).

Tables 4 and 5 provide evidence of Nepal's wide prevalence of tenancy. While 41.14% of the sample households cultivate on leased-in land, the share of leased-in land in the total operated area is 45.67%. These figures, regarding the shares of tenant households and leased-in areas, suggest that tenancy is more prevalent in terai than in hills. Further, considerable variations in the prevalence of tenancy are visible across the field study locations. Both in terms of the shares of tenant households and leased-in areas, Dang (68.75%) has the highest prevalence of tenancy, followed by Chitwan (43.86%) and Kaski (40.98%).

Forms and Pattern of Tenancy Contracts

Table 6 presents the forms and patterns of tenancy contracts among tenant households. Notwithstanding locational variations, fixed-rent and sharecropping are Nepal's two predominant forms of tenancy contracts. While 45.7% of tenant households leased in land under fixed-rent contracts, 42.38% of such households leased in under sharecropping. The percentages of tenant households leased in land under terms such as mortgage, others, and mixed tenancy are only 4%, 3%, and 5.3%, respectively[3]. Further, Table 6 indicates that within fixed-rent

Table 6. Location-wise Pattern of Tenancy Contract: Tenant Households by Terms of Lease.

	Fixed Rent			Sharecropping					
Locations	Cash	Kind	Total	Cost Sharing	No-cost-sharing	Total	Mortgage	Others	Mixed Tenancy
Dhankuta	30	0	30	5	50	55	10	5	0
Kavre	86.67	0	86.67	0	13.33	13.33	0	0	0
Kaski	48	4	52	12	16	28	8	4	8
Hills	**51.67**	**1.67**	**53.34**	**6.67**	**26.67**	**33.34**	**6.67**	**3.33**	**3.33**
Sunsari	42.86	28.57	71.43	19.05	0	19.05	4.76	0	4.76
Chitwan	61.54	3.85	65.39	3.85	19.23	23.08	3.85	7.69	0
Dang	11.36	0	11.36	75	2.27	77.27	0	0	11.36
Terai	**32.97**	**7.69**	**40.66**	**41.76**	**6.59**	**48.35**	**2.2**	**2.2**	**6.59**
Nepal	**40.4**	**5.3**	**45.7**	**27.81**	**14.57**	**42.38**	**3.97**	**2.65**	**5.3**

Source: Authors' estimation based on field survey data.

Note: Bold values are used to highlight the regional and national figures where the regional level data represent an average or the share (%) of sample households belonging to the respective region, while the national level figure reflects the overall sample.

contracts, the cash payment mode (40.4%) is more dominant than the payment-in-kind (5.3%) mode[4]. On the other hand, within sharecropping contracts, the most prevalent variant is cost-sharing (27.81%), wherein the costs of major inputs such as fertilisers and seeds are shared between the tenant and the lessor.

Table 6 shows substantial variations across field study locations regarding the prevalence of various forms of tenancy contracts. While fixed rent is the predominant form of tenancy contracts in the hills, sharecropping is the major form in Terai. Further, while cost-sharing is the dominant form of sharecropping contract in Terai, no-cost-sharing is the main form in the hills. However, rent in cash is the most preferred form of tenancy contract within fixed rent across hills and terai. The variations in the forms of tenancy contracts can also be found across various field study locations. A fixed rent in cash is the most dominant form of tenancy contract in all but Dhankuta and Dang Districts. While sharecropping with cost-sharing is the major form of tenancy contract in Dang, the no-cost-sharing sharecropping arrangement is widely prevalent in Dhankuta.

Table 7 shows that fixed rent, especially fixed rent in cash, is the major tenancy contract in terms of the area under the lease. Overall, 67.59% of the leased-in area is under fixed rent. The area under sharecropping is only 28.19%. This pattern can be observed across hills and terai. The variations in area under lease across field study locations show a similar pattern as those in tenant households in Table 6.

Although the difference is more significant regarding the area, Tables 6 and 7 show that fixed rent is Nepal's predominant tenancy contract form. About 45.7% of tenant households leased-in land under fixed-rent contracts and operated on 67.59% of the total leased-in land. On the other hand, 42.38% of the tenant households are sharecroppers, and they operate on only 28.19% of the leased-in area. However, the prevalence of tenancy contracts across field study locations is not uniform.

Table 7. Pattern of Tenancy Contract: Area by Terms of the Lease (% of Total Leased-in Area).

	Fixed-rent Tenancy			Sharecropping				
Locations	Cash	Kind	Total	Cost-sharing	No-cost-sharing	Total	Mortgage	Other
Dhankuta	22.99	0.00	22.99	4.36	30.55	34.91	10.16	31.94
Kavre	91.27	0.00	91.27	0.00	8.73	8.73	0.00	0.00
Kaski	74.70	1.19	75.89	9.94	11.18	21.12	2.19	0.80
Hills	**58.03**	**0.55**	**58.58**	**6.18**	**18.05**	**24.24**	**4.82**	**12.37**
Sunsari	53.00	34.82	87.82	10.81	0.00	10.81	1.37	0.00
Chitwan	92.93	0.50	93.43	1.24	4.09	5.33	0.62	0.62
Dang	20.77	0.00	20.77	77.20	2.03	79.23	0.00	0.00
Terai	**63.28**	**6.63**	**69.92**	**26.50**	**2.70**	**29.20**	**0.57**	**0.31**
Nepal	**62.21**	**5.38**	**67.59**	**22.33**	**5.85**	**28.19**	**1.44**	**2.79**

Source: Authors' estimation based on field survey data.

Note: Bold values are used to highlight the regional and national figures where the regional level data represent an average or the share (%) of sample households belonging to the respective region, while the national level figure reflects the overall sample.

Factors Affecting Land Leasing Decision

The regression analysis results that identify the factors affecting the leasing decision of households are presented in Table 8. The estimated results show that duration of internal migration, education of the head of the household, primary occupation, ethnicity, possession of bullock pair, area under irrigation, number of farm workers, access to credit, inequality of land holdings, and locational characteristics have significant impact on the leasing decision of the households. On the other hand, the age and gender of the household's head, possession of tilling equipment, and status of international migration do not impact the leasing decision.

The coefficient of the 'dummy for internal migrant households who migrated to their current residence within the previous decade' is positive and significant at a 10% significance level. However, the dummy for 'internal migrant households who migrated two decades earlier' has a negative and significant coefficient (at a 10% significance level). Thus, these findings suggest that the migration history of the household plays a role in their decision to lease in or lease out land. While recent migrants are more likely to lease land than non-migrants, the early migrants are more likely to lease out land. The results show that the coefficient of 'years of education' is negative and significant at a 1% significance level, indicating that households tend to lease out the land as the education level increases. As for occupation, the dummy for 'farming as the primary occupation' is positive and significant at a 10% level. This suggests that households whose primary occupation is farming are more likely to lease land than those primarily engaged in non-farm activities.

The 'number of agricultural workers' coefficient in a household is positive and significant (at a 5% level), implying that households with more agricultural workers are more likely to lease the land. The coefficient of the 'ownership of the bullock pair' is positive and significant at a 1% level of significance. This indicates that households who own bullock pairs are more likely to lease land compared to those who do not possess bullock pairs. As hypothesised, the coefficient of 'area under irrigation as a proportion of operational holding' is positive and significant at a 1% significance level. This result suggests that households with a higher share of irrigated land in operated areas are likely to lease in land. The dummy coefficient for 'access to credit' is positive and significant, implying that households with access to credit are more likely to lease land compared to those households who do not have access to credit. The estimated result shows that the 'inequality in land holding' coefficient is positive and significant. This implies that a household located in a village where the inequality of land holding is high is more likely to lease in the land than a household located in a village with a relatively even distribution of land holdings.

The coefficients of dummies for 'Terai Janajati' and 'Dalits' are positive and significant, which suggests that households belonging to these ethnic categories are more likely to lease land compared to the base category Khas/Arya households. Finally, the regression results suggest that the 'locational dummies' coefficients are significant only for Kashi and Sunsari districts. While the coefficient of the locational dummy for the Kaski district is positive and significant, it is

Table 8. Tobit Regression Results: Factors Affecting Leasing Decision.

Explanatory Variables	Coefficient	Robust Standard Error
Age of household head (in years)	–0.01	0.01
Square of the age of household head	0.00	0.00
Dummy: 1 if female is a household head, 0 otherwise	0.00	0.08
Years of education as head of household	–0.03***	0.01
Ethnicity dummies (base: Khas/Arya)		
d1 = 1 if Hill Janajati	–0.01	0.09
d2 = 1 if Terai Janajati	0.36***	0.13
d3 = 1 if Dalit	0.55**	0.22
Internal Migration Status of household (Base = non-migrant household)		
d1 = 1 if less than 1 decade	0.35*	0.19
d2 = 1 if 1 to 2 decades	0.05	0.16
d3 = 1 if 2 to 3 decade	–0.21*	0.12
d4 = 1 if more than 3 decades	–0.08	0.12
Primary Occupation of the household dummy (Base = non-farm occupation)		
d1 = 1 if farm occupation	0.19*	0.12
d2 = 1 if both farm and non-farm occupation	0.12	0.12
Adult members engaged in agriculture	0.06**	0.03
Dummy: 1 if Household owns a bullock pair, 0 if otherwise	0.29***	0.08
Dummy: 1 if Household owns tilling equipment, 0 if otherwise	0.10	0.08
Dummy: 1 if household has accessed credit, 0 if otherwise	0.10*	0.06
Proportion of operational area with irrigation facilities	0.09***	0.03
Dummy: 1 if household has at least one member in international migration	0.03	0.06
Coefficient of variation in land holding at village level	0.20**	0.09
District dummies (base = Dhankuta)		
d1 = 1 if Sunsari	–0.19	0.17
d2 = 1 if Chitwan	0.28	0.17
d3 = 1 if Dang	0.15	0.13
d4 = 1 if Kaski	0.33***	0.11
d5 = 1 if Kavre	0.18*	0.10

(Table 8 continued)

(Table 8 continued)

Explanatory Variables	Coefficient	Robust Standard Error
Constant	0.11	0.37
Observations	350	
F	9.09,	
Prob > F	0.0000	
Pseudo R^2	0.3434	

Source: Authors' estimation based on field survey data.

Note: Robust standard errors in parentheses; ***$p < .01$, **$p < .05$, *$p < .1$.

negative and significant for the Sunsari district. In other words, a household in the Kaski district is more likely to lease land than one in the Dhankuta district. The opposite is true in the case of Sunsari district.

Discussion of the Results

The results show that landless, marginal, and smallholders constitute 78.86% of the sample households and own less than 40% of the owned area. In contrast, the relatively small proportion of medium and large holders own a larger share of the sampled owned land (about 60%). These figures indicate a preponderance of smallholders, and Nepal's inequality in land ownership is high (the Gini coefficient is 0.57). A similar pattern can also be observed in the case of operational holdings. Further, substantial variations exist in the distribution and inequality of land ownership and operational holdings across locations.

Tenancy is widely prevalent in Nepal. Our data show that 41% of sample households leased in land, constituting about 46% of the total area under operation. Our findings, though limited to six selected districts, document a much higher incidence of tenancy than what is revealed in the most recent publicly available official report. According to the Agricultural Census 2011, tenant holdings constituted only 15.38% of the total holdings, and leased-in areas accounted for only 11.74% of the total operated area (Central Bureau of Statistics, 2013a). The fact that secondary data underreport the incidence of tenancy has already been illustrated in the literature (Dhakal, 2011). Dhakal (2011) also reported that tenancy was largely informal or concealed. The lessors did not want formal tenancy contracts. They feared that formal disclosure of tenancy (especially sharecropping) might make it legally binding for them to give ownership rights to their tenants (Dhakal, 2011).

This study finds that sharecropping and fixed rent are Nepal's primary tenancy contracts. Here again, contrary to the official statistics, the study finds the fixed rent tenancy predominant. For example, the Agricultural Census 2011 found that about 56% of the tenant households leased in land under sharecropping, and only 19.1% of the leased-in land was under fixed rent contracts (Central Bureau of Statistics, 2013a). The current study shows that about 45% of tenant households

are fixed-rent tenants, and 42.38% are sharecroppers. Regarding the area, our finding shows fixed-rent to be the major contract, with 68% of the total leased-in area under it, and only 28% of the leased-in area is under sharecropping.

The figures in Tables 6 and 7 show that while fixed-rent tenancy is widespread in Chitwan, Kaski, Sunsari, and Kavre districts, sharecropping is predominant in the Dang and Dhankuta districts. We explain the variations in the prevalence of sharecropping and fixed-rent across locations in terms of the location-specific cropping patterns. Table 9 reveals that winter paddy is the most widely cultivated crop across regions in Nepal, covering about one-third of the total cropped area, followed by maize (15.53%), summer vegetables (10.26%), fruits and high-value crops (9.27%), winter vegetables (5.92%), wheat (5.87%), legumes (5.73%), mustard (5.36%), potato (5.36%), and fodder grass (2.69%). Table 9 further reveals that, except for the Sunsari district, the locations with a higher prevalence of fixed-rent tenancy are also the locations where the combined share of cash crops such as summer vegetables, winter vegetables, potatoes, fruits, and other high-value crops is higher than that of cereal crops such as winter paddy, maize, wheat, and others cereals[5]. On the other hand, cereal crops are primarily cultivated in locations where sharecropping is the major form of tenancy. For instance, the share of cash crops in total cropped area is much higher in Kaski (49.11%), Chitwan (46.91%), and Kavre (42.32%) than in that in Dhankuta (23.91%) and Dang (6.12%). In contrast, the share of cereal crops in the total cropped area in Chitwan (41.6%), Kaski (43.78%), and Kavre (51.86%) is significantly lower than that in Dang (77.42%) and Dhankuta (69.51%).

Table 10 features the cropping pattern across tenure status. In conjunction with Table 9, we see in Table 10 that the combined share of cereal crops is much lower in the plots operated under fixed-rented (32.57%) compared to that under sharecropping (62.36%) and owner-operated plots (66.23%). Conversely, the combined share of cash crops is significantly higher in fixed-rent plots (57.17%) than those in owner-operated (23.68%) and sharecropped plots (2.95%). Thus, it becomes clear that while fixed rent is preferred when tenants lease land to cultivate cash crops, sharecropping is the preferred form of tenancy contract when tenants cultivate cereal crops like winter paddy.

The reason for preferring sharecropping for cereal crops and fixed-rent for cash crops, such as vegetables and high-value fruits, and the presence or absence of weather risk is associated with the cultivation of these crops. Winter paddy, the most popular cereal crop among sharecroppers, is planted during the monsoon season and is exposed to weather-related risk and uncertainty (Goswami & Bezbaruah, 2013). Sharecropping allows the tenants to not only share the output but also the production risk. Consequently, the tenants prefer to lease land under sharecropping while cultivating crops like winter paddy. However, this is not the case with cash crops like fruits and vegetables exposed to relatively low weather-related risks (Goswami & Bezbaruah, 2013).

The low level of weather risk incentivises the tenants to cultivate high-yielding varieties and apply purchased inputs like fertilisers, pesticides, and irrigation that further minimise production risk and increase production, productivity, and returns. Under such circumstances, tenants are motivated to grow these crops for

Table 9. Cropping Pattern Across Locations (% of Total Cropped Area Under Different Crops).

Locations	Winter Paddy	Maize	Wheat	Other Cereals	Potato	Mustard	Legumes	Summer Vegetable	Winter Vegetable	Fruits & HVCs	Fodder Grass
Dhankuta	30.49	33.11	0.19	3.15	2.63	2.72	3.94	12.75	4.83	3.70	2.49
Kavre	18.43	29.54	0.25	3.24	27.25	1.70	0.40	11.77	3.00	0.30	4.13
Kaski	28.68	7.45	0.88	6.25	3.74	4.59	0.52	5.88	8.24	31.25	2.52
Hills	**25.88**	**24.06**	**0.42**	**4.13**	**11.25**	**2.95**	**1.70**	**10.32**	**5.26**	**10.99**	**3.05**
Sunsari	41.00	18.78	15.47	0.20	2.24	0.86	2.57	7.92	5.75	5.02	0.20
Chitwan	27.66	6.62	2.08	2.19	2.33	5.12	3.05	19.63	10.55	14.40	6.40
Dang	40.03	8.75	7.57	0.00	0.59	16.22	21.07	0.02	0.71	4.80	0.24
Terai	**35.75**	**11.60**	**8.39**	**0.89**	**1.84**	**6.47**	**7.59**	**10.24**	**6.23**	**8.48**	**2.53**
Nepal	**32.63**	**15.53**	**5.87**	**1.91**	**4.81**	**5.36**	**5.73**	**10.26**	**5.92**	**9.27**	**2.69**

Source: Authors' estimation based on field survey data

Note: HVCs: High-Value crops; Bold values are used to highlight the regional and national figures where the regional level data represent an average or the share (%) of sample households belonging to the respective region, while the national level figure reflects the overall sample.

Table 10. Cropping Pattern and Tenure Status (% of the Total Area Under Different Crop Categories).

Tenure Status	Winter Paddy	Maize	Wheat	Other Cereals	Potato	Mustard	Legumes	Summer Vegetable	Winter Vegetable	Fruits & HVCs	Fodder Grass
Owner operated	33.33	22.64	7.29	2.97	5.98	6.19	2.06	6.88	4.82	6.00	1.85
Sharecropping	49.34	6.91	5.21	1.50	0.74	9.83	23.50	1.20	1.01	0.00	0.74
Fixed rent	22.55	6.41	3.50	0.11	4.69	1.44	3.48	21.49	10.61	20.38	5.34
Nepal	**32.63**	**15.5**	**5.87**	**1.91**	**4.81**	**5.36**	**5.73**	**10.26**	**5.92**	**9.27**	**2.69**

Source: Authors' estimation based on field survey data.

Note: Bold values are used to highlight the regional and national figures where the regional level data represent an average or the share (%) of sample households belonging to the respective region, while the national level figure reflects the overall sample.

markets, and they prefer fixed-rent contracts that allow them to retain the entire return. These crops are perishable, so landlords prefer to receive the rent in cash when leasing land to cultivate such crops. Further, many of these landlords are erstwhile owner-operators who used to cultivate cereal crops. These landlords with prior experience cultivating cereal crops can supervise the work of their tenants if they cultivate cereal crops. However, monitoring the more labour-intensive and complex cultivation process of fruits and vegetables is challenging for them. A fixed-rent contract allows them to avoid the responsibility of monitoring the cultivation of such crops. Goswami and Bezbaruah (2013) also reported similar findings in the context of Assam in India.

It should, however, be noted that winter paddy (22.55%) and other cereal crops (10%) constitute a sizeable portion of the cropped areas under fixed rent. The concern for food security may be the reason for devoting land to cereal crops even under fixed rent. Cultivation of cereal crops is a strategy rural households choose for self-sufficiency as cereals, especially rice, are the staple food of Nepalese households. This strategy enables them to meet their food requirements without relying heavily on external sources. It also provides resilience against natural disasters and market fluctuations (Barlett, 1980; Scott, 1976; Wharton, 1971). Holmelin (2021) documented subsistence farming as a self-sufficiency and shock resilience strategy among Nepal's rural households. The fact that only a few sharecroppers and fixed-rent tenants sold paddy in the market indicates that regardless of the tenancy forms, farmers mainly grow cereal crops to ensure the households' food security. Even the landlords in sharecropping contracts prefer to receive rent as paddy to fulfil their requirements.

The regression analysis shows some interesting results. We find that, among the internal migrants, while the early migrants are likely to lease out, the late migrants are more likely to lease in land. James and Roumasset (1984) found a similar result in their study on the evolution of tenure contracts in Palawana, Philippines. They argued that the early migrants were comparatively in a better position before migrating. They had resources and could afford the risk of migrating to a new place where, whereas the late migrants had fewer resources to start with and were primarily dependent on early migrants to work as wage workers or as tenants. In a study on the Government's land resettlement plans in Nepal's Chitwan and Nawalparasi districts, Shrestha (1989, 2001) documented that the early migrants (who arrived before 1965) were more successful in acquiring larger tracts of land than those who migrated in the latter two decades (1966–1975 and 1976–1988). Shrestha (2001) also noted that those who migrated early were resourceful households who could afford the risks of early settlement. Shrestha (2001, p.181) discussed the 'preemptive advantage' that early migrants could harness due to the abundance of virgin land in the early phases of the resettlement plan. The government provided lands in grants and also allowed to clear forests for settlement and cultivation purposes. However, the pressure on existing land increased as the population grew due to further migration and natural births. The later migrants could acquire land for cultivation through outright purchase or lease. However, the population pressure on land and improvements in land quality resulting from farming by early settlers led to a rise in land prices, making it

impossible for the late migrants to purchase land. Thus, to sustain in their new settlement, late migrant households picked up farming on leased-in land as a primary source of livelihood or as a secondary occupation to diversify their livelihood strategies.

The findings also show that the household head's education (years of education) negatively and significantly affects households' leasing decisions. Households headed by an educated head are likely to lease out land. Existing literature supports our finding that education creates an aversion toward agriculture (Bliss & Stern, 1982; Goswami & Bezbaruah, 2013; Kimura et al., 2011; Kuri, 2003; Zhou & Chi, 2022). Educated households tend to leave farming and engage more in non-farm activities. The regression result also confirms that households primarily engaged in non-farm occupations are likely to lease out land compared to those primarily engaged in farming. This is obvious as households with non-farm as a primary occupation would like to release labour and other resources from agriculture to be utilised more effectively in the non-farm sector (Goswami, 2018).

The regression analysis results show that households with more adult farm workers and bullock pairs are likely to lease in land. The possession of more farm workers and bullock pairs allows the households to expand the scale of operation by leasing the land. Muraoka et al. (2018) and Ayaz and Mughal (2024) also found that having more family labour helped a household to expand the scale of farming activities besides ensuring better utilisation of the existing land and other resources. The estimated results also suggest that households having access to credit and a higher share of irrigated land in the total operated area are more likely to lease in land. Li et al. (2020) also reported that access to credit increased the likelihood of leasing in land in rural China. On the other hand, Mandal et al. (2019), in their study in Uttar Pradesh, India, documented that households with a higher proportion of irrigated land were more likely to lease additional land. Access to irrigation and credit are essential for expanding and intensifying farming. Farmers with access to these inputs can scale up cultivation using better-quality inputs.

As for the implication of the ethnicity of a household for leasing decision, regression results show that Terai Janajati and Dalits are more likely to lease in land compared to the dominant Khas/Arya group. This is a common finding in several works in Nepal and India, where the ethnicity/caste dynamics are more or less similar (Adhikari & Hobley, 2015; Sunam, 2014; Sunam & McCarthy, 2016). Historically, Dalits and other low-caste groups have been marginalised and excluded from land ownership due to the caste system and discriminatory land policies (Sunam, 2014). In the context of our sample, 90% of the landless households belong to Dalits and other lower ethnic strata of the society. These households can only access land for cultivation through rental arrangements.

Locational characteristics are also important determinants of leasing decisions. The results show that a household is likely to lease in land if the inequality of land holding is high at the village level. Inequality of land holdings implies a mismatch in factor endowments. If only a handful of people own land in a village, rental arrangements become the natural way for most rural households to access land for

cultivation. As for the locational dummies, the coefficient of the dummy for the Kaski district is estimated to be positive and significant, which implies that households in the Kaski district are more likely to lease in land than those in the Dhankuta district. Pokhara, a metropolitan city in Kaski, provides a market to the farmers in the neighbouring villages that fetch remunerative prices for agricultural products. Consequently, the small and marginal farmers in these villages find it a profitable livelihood strategy to lease in land. Dhankuta does not offer any such advantage. On the other hand, a negative and significant coefficient of the dummy for Sunsari district indicates that households in Sunsari are more likely to lease out land than their counterparts in the Dhankuta district. The substantially higher concentration of large landowners in the Sunsari district may be the possible reason for such a finding.

Conclusion and Policy Implications

This article explores the existing agricultural land rental arrangements in Nepal and analyses the factors influencing the land leasing decisions of rural households. Using data from a primary survey of 350 households in six districts of Nepal, the study shows that tenancy is widely prevalent in Nepal. While more than 41% of sample households are tenant households (pure tenants and owner-cum-tenants households combined), about 46% of the total operated area is under lease (Refer Table 2). Sharecropping and fixed-rent are two predominant forms of rental arrangements, although the fixed-rent contract has more leased-in areas than sharecropping. While rent in cash is found to be a more dominant arrangement within fixed rent, cost-sharing arrangements between tenants and lessors within sharecropping are more popular. There are, however, substantial variations in the incidence and forms of tenancy arrangements across locations. The variations in the forms of tenancy contracts across locations have been explained in terms of the location-specific cropping patterns.

Compared to non-migrant households, we find that early internal migrants are more likely to lease out land, whereas late internal migrants are more likely to lease in land. This contrasting tendency can be attributed to the preemptive advantage that the early migrants usually enjoy. The early migrants benefitted from the government-supported land resettlement plan. Under the land resettlement plan, early migrants became owners of larger plots, which they eventually leased out to the late migrants. Late migrants, on the other hand, faced challenges in acquiring ownership of land because of population pressure on land and the resulting very high land prices in recent decades. Apart from the status of internal migration, we find other socio-economic factors, namely, education level of the head of the household, ethnicity, primary source of livelihood, number of farm workers, ownership of a bullock pair, access to credit, proportion of operated area under irrigation, unequal land distribution, and locational characteristics to be important determinants of households' leasing decisions.

The findings suggest that if the head of the household has a higher level of education, it increases the likelihood of that household abandoning farming by

leasing out land. This result suggests that with the increase in education among the rural population, there will be more land supply in the land lease market. We also find that households in a village set-up where the inequality of land holding is high are likely to lease in land. Inequality of land holding in Nepal, at least in the context of our study, is high. Because of the high inequality of land holding, more land to lease in is desired. The challenge, however, will be to ensure efficient use of this land.

Nepal's current institutional setup challenges efficiently utilising a substantial portion of arable land. Out of the total arable land area, only approximately 75% is formally registered in the land administration system. The remaining 25% of arable land falls outside the formal cadaster, spreading over an estimated 10 million parcels. The prevailing tenure system on these parcels of land is predominantly non-statutory or informal (Government of Nepal et al., 2018). This implies that a substantial portion of the population resides or cultivates on land parcels that lack spatial recognition and have no security of tenure. Without legal protection, families with informal land tenure constantly face the threat of eviction. The informal land tenure system not only prevents the formal transfer of land titles but also poses obstacles to agricultural investments, accessing credit facilities and government assistance at times of disaster, and complicates the functioning of the land lease market.

The Land Act of 1964 is a major legal framework influencing Nepal's tenancy relationship terms. The fourth amendment of this act in 1997 wanted to grant the registered sharecroppers, who have cultivated leased-in land for at least an agricultural year, an entitlement of 50% of the land under the tenancy. All tenancy relationships were to be registered within a time frame of six months after the amendment. The aim was to eliminate the dual ownership of land under sharecropping within two years from the date of the fourth amendment. However, only 10% of 4,70,000 registered sharecroppers could secure their share of the land by the end of 2019 (Deuja, 2019). Since dual ownership persists, landlords and tenants face difficulties exercising their property rights over the land, using land as collateral to access credit, transferring ownership title, or utilising their share of the land as they desire (Deuja, 2019, 2023). The Land Use Policy 2019 also aims to end dual land ownership.

Although the legal provision of sharing the ownership rights of leased-in land is not applicable in the case of a sharecropping contract that has been agreed upon after the fourth amendment, a large section of contemporary landlords remains hesitant to engage in a written contract and get it registered in the local bodies (Adhikari, 2019, 2022; Wily et al., 2008). Despite the legal protection, the fear of losing land looms large among the landlords due to political reasons. During the decade-long civil war (1996–2006), the rebel group promised to ensure that the tenants get their rights, including land ownership. This sentiment may not have withered away yet. The election manifestos of the major political parties and their leaders continue to advocate for 'scientific land reform', akin to the classical land reform measure of transferring ownership rights (Adhikari, 2022; Dhakal, 2011, 2018). Consequently, those who lease out land are reluctant to register the tenancy contracts for fear of losing the ownership of their land (Wily et al., 2008). In other

words, tenancy relations have become largely informal or concealed[6]. Further, owing to the same issue, a lessor does not want to lease out land for an extended period to the same tenant (Wily et al., 2008)[7]. The shortening of the duration of tenancy contracts and concealed tenancy are two unwarranted outcomes of the perceived narrative around land tenancy.

While concealed tenancy makes it impossible for sharecroppers to claim protection under the law that regulates rent and forced eviction, short contract duration discourages investment in soil productivity and health by tenants. Even the fixed-rent contracts are mostly verbal, and those few written ones are not registered. A written and registered contract protects the landlord and tenant's interests. Furthermore, a registered and written tenancy contract facilitates tenants' access to credit, crop insurance, and government-sponsored grants for agriculture (Wily et al., 2008). It may be mentioned here that although sharecropping is illegal, a sharecropper does not get the same recognition as a registered fixed-rent tenant. While a registered fixed rent tenant can access credit and other benefits from the government using the contract document, the same does not apply in the case of a sharecropper. It is imperative to rectify this disparity. Given these complexities, this study emphasises the urgent need to address the issues associated with informality in landholding, efficiently and effectively eliminate dual ownership of land, and foster a political consensus for implementing the existing tenancy laws. Policymakers should focus on facilitating the smooth functioning of the land rental market, which will improve the access of land-scarce households to land. The Nepal government's 2020–2021 fiscal budget, which includes creating a land bank to facilitate user rights distribution, is a positive step in that direction.

Annex:

Table A1. Descriptive Statistics of the Explanatory Variables Used in Regression Analysis.

Description of Variables	Observations	Mean	Stan. dev.	Minimum	Maximum
Age of household head (in years)	350	55.27	13.71	26	92
Square of the age of household head	350	3242.16	1585.26	676	8464
Dummy: 1 if the household head is female, 0 otherwise	350	0.11	0.31	0	1
Years of education as head of household	350	5.73	5.11	0	17
No. of adult members primarily engaged in farming	350	1.88	1.25	1	8
Dummy: 1 if the Household owns a bullock pair, 0 if otherwise	350	0.19	0.40	0	1

(Table A1 continued)

(Table A1 continued)

Description of Variables	Observations	Mean	Stan. dev.	Minimum	Maximum
Dummy: 1 if the Household owns tilling equipment, 0 if otherwise	350	0.14	0.34	0	1
Dummy: 1 if the household has accessed credit, 0 if otherwise	350	0.19	0.40	0	1
Proportion of operational area with irrigation	350	0.71	1.29	0	13.40
Dummy: 1 if the household receives remittance, 0 if otherwise	350	0.22	0.42	0	1
Coefficient of variation of landholding at village	350	0.84	0.36	0.40	2.04

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Notes

1. Many studies use the size of the household's leased-in area as a measure of tenancy. While such a measure can capture the magnitude of tenancy in the absolute sense, it cannot capture the intensity of the leasing decision. Consider two households that own 5 and 2 hectares of land, respectively. Suppose the household that owns 5 hectares of land leases in 2 hectares of land, and the other household leases in 1 hectare. In terms of the absolute amount of land leased in, the household with larger landholding also leases more land. However, in terms of intensity, the opposite is the case. The intensity of land leasing in is higher in households with lower land holdings. The same argument can be provided in case land being leased out. The problem can be avoided if we standardise the leased-in or leased-out area as a proportion of the areas under operational holding or ownership holding. However, using only one operational holding or ownership holding as a standardising factor cannot capture the magnitude and intensity of the leasing decision of all households. For instance, the proportion of leased-in area to area under ownership holding cannot be defined for pure lessee households. Consequently, we formulate the index by incorporating ownership and operational holdings to overcome these limitations.
2. Pure tenants are landless households who cultivate only on leased-in land. Owner-Operator-Cum-Tenant households operate both on owned and leased-in land.

Owner-Operators cultivate on their owned land and do not lease in or out. Owner-Operator-Cum-Lessor households operate on a portion of their land and lease out the rest. Pure lessors do not operate on any land and only lease out their land.

3. Those tenant households who leased in land under the term 'others' did not pay any rent to the land owners. On the other hand, mixed tenancy refers to a situation where a household leases land under fixed rent and sharecropping.
4. Under the fixed rent in kind, the rent involves the tenant's payment of a pre-agreed-upon quantity of harvested paddy to the lessor.
5. Table 7 reveals that fixed-rent tenancy is the predominant form of tenancy arrangement in Sunsari district. Although fixed rent is the major form of tenancy in the Chitwan, Kavre, and Kaski districts, Sunsari differs in one significant aspect from others. Winter paddy constitutes a significant portion of the cropped area in Sunsari. In contrast, cash crops are more important in cropped areas where fixed rent is predominant in the other three locations. This naturally begs an explanation as to why fixed rent is widespread in Sunsari despite winter paddy being the major crop in this district. The prevalence of paddy cultivation in Sunsari can be attributed to an extensive canal irrigation system that results in a higher paddy yield compared to other districts where fixed-rent tenancy is common. For example, Sunsari boasts a paddy yield of 4.09 metric tonnes per hectare, while Chitwan, Kavre, and Kaski report yields of 3.98 mt/ha, 3.92 mt/ha, and 3.82 mt/ha, respectively (Government of Nepal Ministry of Agriculture and Livestock Development, 2022). Sunsari and its neighbouring districts, Jhapa and Morang, have a historical reputation for reporting very high areas and yields of paddy cultivation across Nepal (Government of Nepal Ministry of Agriculture and Livestock Development, 2022). The well-developed canal irrigation system, established paddy supply chains, and government depots offering a minimum support price may have reduced paddy cultivation's production and price risks. Additionally, Sunsari's proximity to the paddy region of North Bihar in India, along the border, may have facilitated farmers' access to fertilisers, seeds, and other inputs and opportunities for paddy exports.
6. None of the sharecropping contracts in our study is written and registered. Though some of the fixed-rent contracts are written contracts, only 10% of these contracts are formally registered.
7. The average duration of a fixed-rent contract is five years while sharecropping contracts are renewed yearly through verbal understanding.

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Article

Risk Perception, Management Strategies, Determinants of Adoption and Sustainability in Sri Lanka's Layer Chicken Farming Industry: Navigating Crisis

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Abstract

The layer chicken farming industry in Sri Lanka has faced significant challenges due to the COVID-19 pandemic and broader economic downturn. In response to risks such as critical input shortages, price escalations, retail regulations and reduced demand, some farmers exit while others persevere with risk management strategies. A study was conducted to evaluate farmers' risk perception and risk attitude and identify risk management strategies they adopted and the determinants of the adoption. The study found that farmers identified institutional risks as the most significant, followed by marketing risks. However, the adoption of targeted risk management strategies for these concerns remains limited. The multivariate probit analysis showed that risk-averse farmers are more likely to leave the industry, while small-scale farmers tend to reduce household expenditure to survive the crisis. Ensuring the industry's long-term sustainability requires targeted interventions supporting small and medium-scale farmers (SMEs), who play a crucial role in the industry's resilience and longevity. One effective strategy

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is facilitating partnerships between SMEs and larger entrepreneurial farms willing to share risks for a defined period. Additionally, enhancing the resilience capacity of SMEs to navigate risks is crucial for industry resilience and longevity.

Keywords

Poultry farming, probit model, risk attitude, risk perception, risk management strategies

Introduction

Agriculture is known for its inherent challenges and unpredictability (Adnan et al., 2021; Harwood et al., 1999; Moschini & Hennessy, 2001). Risks in agriculture stem from many sources, including weather changes, pest and disease outbreaks, price volatility and more. These risks can be categorised into five primary types: production risks, institutional risks, market risks, personal/human risks and financial risks (Aimin, 2010; Harwood et al., 1999). If not effectively managed, these risks can lead to adverse outcomes, resulting in reduced farm returns (Komarek et al., 2020). Mismanagement of risks can also lead to suboptimal resource allocation and hinder business growth and industry development (Aimin, 2010; Moscardi & Janvry, 1977). Additionally, the consequences of risks in agriculture can extend to broader welfare implications, such as food security and farmers' mental well-being (Mârza et al., 2015). In fact, in developing countries, excessive risk and the inability to cope with it have even resulted in severe outcomes, including farmer suicides (Den Besten et al., 2016; Mishra, 2006).

Like other agricultural sectors, the layer chicken industry faces various risks, including disease outbreaks, climate-related risks and price volatility. Among these risks, production risk has gained disproportionately greater attention from researchers due to the potential high impact of the risk and the cascading effects they have on other risks, such as marketing risks. However, as the risk landscape continues to evolve (Komarek et al., 2020), with marketing risks becoming increasingly prominent (Sattar et al., 2021), there is a need to delve into the nature of these risks and farmers' preparedness for these specific risks that enable the development of strategies to manage these risks in the poultry industry effectively (Duong et al., 2019).

The interplay of COVID-19–induced disruptions in the supply chain, alongside the recent political and economic crises, has introduced a myriad of intricate challenges for poultry farmers in Sri Lanka. These multifaceted obstacles have unleashed an unprecedented wave of uncertainty and risk upon what was once the fastest-growing livestock subsector in the country. In 2021, this subsector contributed USD 4,013.7 million to the GDP, which is equal to 65% of the livestock share of the GDP (DAPH, 2022).

The layer chicken industry in Sri Lanka has recently faced a series of challenges, starting with the Easter bombing attack in 2019. The attack significantly impacted the country's tourism industry, leading to a drop in demand for layer products. The COVID-19 pandemic followed this blow to the poultry

industry in 2020. The pandemic exacerbated the decline in demand for layer products as travel restrictions and a decrease in people's income resulted in reduced consumption. Additionally, the pandemic disrupted supply chains, leading to substantial post-harvest losses in the poultry industry.

Furthermore, the Sri Lankan economy started experiencing symptoms of an economic crisis in 2020, characterised by twin deficits (Bhowmick, 2022). Thus, the government banned maize imports in the same year to address foreign reserve shortages (Madies, 2020). This ban had unintended consequences, creating a scarcity of poultry feed in the local market. The situation worsened when the importation of chemical fertilisers was banned in 2021, negatively impacting local maize production, a key ingredient in poultry feed. The feed shortage subsequently increased animal feed prices, further burdening the poultry industry (DAPH, 2022).

To address the rising input costs, the government imposed a maximum retail price on eggs to prevent the transmission of input price hikes to the output market. However, this measure proved to be ineffective in mitigating the adverse effects. Against this background, this study assesses risk perception, risk attitude and risk management strategies adopted by layer chicken farmers in Sri Lanka and identifies the determinants of these strategies.

Literature Review

In response to anticipated or exposed risks, farmers adopt both ex-ante (precautionary) and ex-post (coping) risk management strategies to reduce risk to an acceptable level or mitigate its impact (Bishu et al., 2018). The interconnectedness between different types of risks and their outcomes often necessitates implementing multiple risk management strategies. These strategies include changes in business and farming practices, diversification of crops and animals, drawing from savings and reducing household consumption. In the poultry industry, common ex-ante risk management strategies include implementing biosecurity measures, diversifying crops and animals, monitoring and preventing pests and diseases, engaging in off-farm income activities, participating in contract farming, and obtaining insurance (Adnan et al., 2020). The less adopted strategies include collaboration with fellow farmers, utilising extension services, receiving training and education, embracing new technologies, and focusing on cost-effective production (Duong et al., 2019).

The risk-coping strategies (ex-post risk management strategies) employed by farmers occur in two stages: income-smoothing measures and consumption-smoothing strategies. Farmers commonly employ ex-post risk-coping strategies, including income-smoothing measures such as conservative production choices and economic diversification in response to income fluctuations arising from risks. When income-smoothing measures are inadequate to shield against potential income shock, farmers adopt consumption-smoothing measures involving reducing household consumption, dissaving, asset depletion, selling productive assets (destocking of animals) and adjusting labour supply. The aim is to protect

households from adverse income shocks and minimise the volatility of consumption patterns (Morduch, 1995; Senapati, 2020).

The choice of risk management strategy is influenced by a combination of factors, including the socio-demographic characteristics of farmers, *viz.*: gender, education, age, farming experience, household size, farm characteristics, exposure to risk, and the cost-benefit analysis of different strategies (Adeyonu et al., 2021; Duong et al., 2019; Meuwissen et al., 2001). Farm size and ownership also affect risk management behaviour. When the business's value increases, risk management strategies are more likely to be used to avoid the loss on a huge investment (Adeyonu et al., 2021). Research also revealed that farmers with personal ownership tend to consider extension and collaboration and strategies for disease management as risk-minimising strategies compared with other types of farm ownership (Rahman et al., 2021).

Risk perception, which refers to individuals' subjective evaluation of risk, also significantly determines their response to risk. (Duong et al., 2019; Khan et al., 2020; Meuwissen et al., 2001; Ranasinghe et al., 2023). Farmers' responses to risks are often based on their perception of the frequency and severity of the risk rather than the actual risk itself. Different individuals may interpret risks differently, leading to diverse risk perceptions (Van Winsen et al., 2016), which, in turn, contribute to various responses to risks (Gao et al., 2019).

Another influential determinant is risk attitude, which represents an individual's inclination to take or avoid risks. Farmers are risk averse, particularly in developing farm settings (Binswanger, 1980; Senapati, 2020; Sulewski & Kłoczko-Gajewska, 2014). Risk-seekers are more likely to adopt ex-ante risk management strategies. In contrast, risk-averse farmers tend to focus on coping with the consequences and mitigating their effects through ex-post strategies. Risk-averse farmers may choose passive approaches, such as downsizing production and saving, rather than investing. Risk-seekers may adopt proactive measures like farm and income diversification and market optimisation for production and profit (Rahman et al., 2021).

Methodology

The study was conducted in four divisional secretariat divisions located in the Kurunegala district of Sri Lanka, namely Panduwasnuwara, Kuliyapitiya-East, Bingiriya and Kobeigane, during September 2022 and October 2022. The Kurunegala district boasts a robust agricultural economy. It has the highest recorded chicken population (Figure 1) in Sri Lanka, with a staggering count of 6,299,510 in 2022. The Department of Census and Statistics reported in 2022 that there are 727 medium and large-scale farms and 1,545 small-scale farms within the district.

Sample and Data Collection

The study population of interest is the small- and medium-scale layer farmers in the study area. There was no established sampling framework, so the Snowball

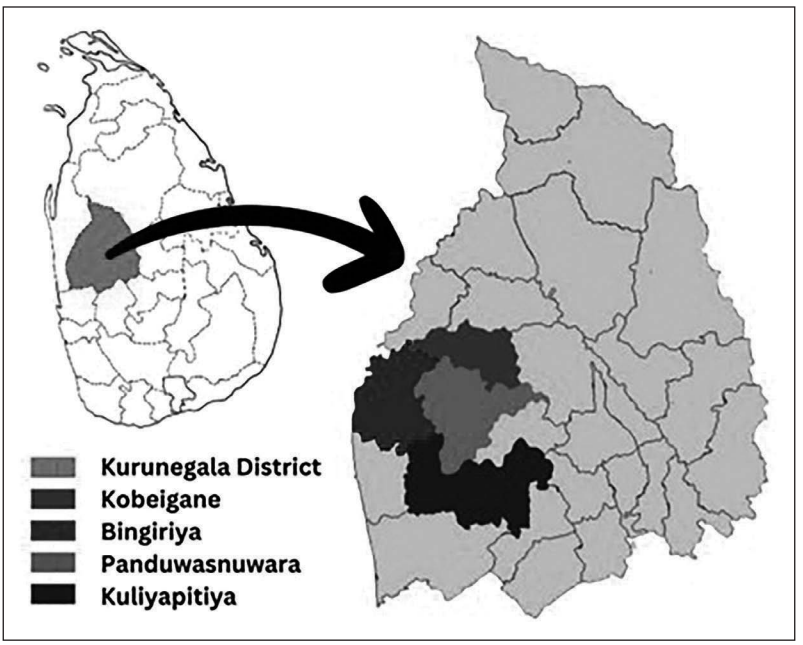

Figure 1. Study Area.

sampling technique was utilised to recruit 68 farmers for the study. The study conducted face-to-face interviews with farmers using a pre-tested questionnaire. The questionnaire comprised six sections, covering various aspects of the farmers and their operations. These sections included:

1. Background and socio-economic characteristics of farmers: This section collected information about the farmers' demographic characteristics, such as age, gender, education, household size and farming experience. It also included socio-economic factors such as income level and access to resources.
2. Farm features: This section focused on gathering data about the farm's features, including size, ownership, breed, marketing arrangements and feed management strategies by the farmer.
3. Risks and risk perception: In this section, farmers were asked to identify and rank risks based on their perceived severity. The questionnaire aimed to understand the farmers' perceptions of various risks, including production risks, institutional risks, marketing risks, personal/human risks and financial risks.
4. Risk attitudes: This section assessed the farmers' risk attitudes, specifically whether they were risk-averse or risk-seeking.
5. Risk management strategies: This section explored the risk management strategies adopted by the farmers. It included questions about the specific strategies implemented by the farmers to mitigate and cope with risks.

6. Perception of layer chicken farmers towards the future of the industry: This section aimed to gather insights into the farmers' perceptions of the prospects of the layer chicken industry.

Face-to-face interviews were conducted with the layer chicken farmers to ensure accurate completion of the questionnaire. The following sections describe measurements and data analysing techniques used in the study.

Risk Perception

Farmers' risk perception was assessed by asking them to indicate the severity of risks in five major categories: production, marketing, institutional, human and financial. The specific risks covered under each category are outlined below:

- Production risks: Heavy rain/flood, drought, disease outbreak, post-harvest losses, animal damage, power outage, input shortage
- Market risks: Increased input prices, decreased output price, reduced demand for eggs, Easter bomb attack in Sri Lanka, transport difficulties due to shortage of gasoline, specifically in early 2022
- Institutional risks: Maize import ban, fertiliser import ban, declaration of maximum retail price on egg
- Human risks: Theft, the inefficiency of workers, illness/death of farmer or family member, labour shortage
- Financial risks: Low access to credit facilities, high-interest rate of loans

To assess farmers' agreement regarding the severity of these risks, Kendall's coefficient of concordance (W) was calculated (Equation 1). Kendall's W is a statistical measure that indicates respondents' agreement level. A value of 1 indicates perfect agreement, while 0 reflects perfect disagreement.

$$\text{Kendall's}\, W = \frac{12\Sigma_{i=1}^{m}\left(R_i - \bar{R}\right)}{n^2\left(m^3 - m\right)}, \tag{1}$$

where n is the number of respondents in the sample. m is the number of risks considered. R_i is the rank given to the ith risk. $\bar{R}$ is the average rank of all risks considered.

Risk Attitude

To assess the risk attitude of farmers, the study employed six statements, which were adapted from previous research conducted by Bardhan et al. (2006) and Van Winsen et al. (2016). The statements used in the study are as follows:

- I like to make risky decisions concerning my farm.
- I only postpone investments once they need to be done.
- I am not afraid to borrow money to make investments that enhance profitability.

- I have always been one of the first producers in my area to adopt new technology.
- I do not rely heavily on market information (for example, government reports and private market news services) in making my marketing decisions.
- I like to experiment with things, though they are risky.

Using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), each respondent was asked to rate their agreement or disagreement with the above statements. The respondent's average risk attitude was then computed. Based on their average total score, they were categorised into three groups. Those who scored between 1 and 2.5 were classified as risk averse, those who scored above 2.5 and below 3.5 were classified as risk neutral, and those who scored between 3.5 and 5 were classified as risk-seeking.

Adaptation of Risk Management Strategies

In identifying the risk management practices adopted by farmers, they were presented with a list of possible ex-ante and ex-post risk management approaches that can be adapted to the risk they face. The list was developed in consultation with experts and literature. This list included risk preventive, mitigating and coping strategies (Table 1). This strategy is also included if the farmers adopt a risk management strategy outside the list.

Table 1. Risk Preventive, Mitigating and Coping Strategies.

Risk Preventive Strategies	Risk Mitigating Strategies	Risk-coping Strategies
Use a disinfectant foot bath before entering the poultry shed	Use of modern production techniques for the farm (battery cage system and automation of feeding and watering)	Cut back household spending/expenditure
Cleaning and disinfecting the farm	Proper and timely medication/ vaccination	Off-farm income
Avoid the visitor's entry		Cancelled or postponed plans to expand the business
Buying birds from reputable sources		Temporary closure of the farm
Pre-purchase of inputs		Layoffs/redundancies of staff
Providing proper housing facilities to animals		Selling non-productive farm assets and family assets
		Selling productive assets (animals)
		Providing a low-cost but nutritious diet to animals

Determinants of Risk Management Strategies

The study estimated a multivariate probit model to identify the determinants of three risk management strategies commonly adopted to navigate marketing risks. Three risk management strategies deliberately chosen for this study are seeking off-farm income, temporary farm closure and reducing household expenditure. While the study acknowledges the importance of biosecurity measures in the poultry industry, their widespread adoption among farmers minimises the value of identifying their determinants for intervention. Therefore, the focus was placed on examining the determinants of other strategies that may require further attention.

The multivariate probit model can simultaneously model the influence of exogenous factors on adopting multiple strategies while accounting for the correlation between the error terms of each strategy. This approach helps avoid biased estimates and accurately represents the relationships between the strategies and their determinants.

The model's exogenous variables include the farmers' socio-demographic characteristics, farm-specific variables, risk perception, risk attitudes, access to resources, institutional support and other relevant factors (Equation 2).

$$y_i = 1 \text{ if } '\beta_i x^{|} \Big| \varepsilon_i > 0$$
$$y_i = 0 \text{ if } '\beta_i x^{|} \Big| \varepsilon_i \leq 0 \quad i = 1,2,3 \tag{2}$$

where x is a vector of the explanatory variables, and β_i are coefficients of parameters. ε_1 is random error distributed as a multivariate normal distribution with zero mean values.

The model includes years of experience, religion, training, extension contacts (1 = yes), full-time/part-time, number of birds before the crisis, marketing strategy, feed type, financial risk perception and risk attitude.

Results and Discussion

Socio-economic Characteristics of Respondents

Respondents have varying socio-economic characteristics (Table 2). Most farmers were male (90%) and married (87%). Two-thirds of the sample respondents (66.18%) were under 45. Most farmers (89.7%) have less than six members in the family. All the farmers in the sample had access to school education but at different levels. More than 70% of farmers (73.53%) worked as full-time farmers. On average, farmers have 11 years of experience in the layer industry. The average share of layer farming to a household's monthly income is 87%. About 84%, 68% and 9% of farmers had no training on poultry husbandry extension or veterinary access.

Characteristics of Farms

According to Table 3, the farms have specific characteristics. The layer farm has an average flock size of 2,470. Most farmers (75%) raise white-type commercial

Table 2. Socio-economic Characteristics of the Layer Chicken Farmers.

Variable	Percentage
Age (years)	
<30	14.71
31–45	51.47
46–60	25.00
>60	8.82
Gender	
Female	10.29
Male	89.71
Religion	
Buddhist	83.82
Christian	7.35
Islam	8.82
Household size	
1–5	90.18
6–10	8.82
Marital status	
Married	86.76
Single	7.00
Widowed	1.47
Separated	1.47
Education level	
Secondary education	86.76
Tertiary education	13.24
Full-time/Part-time	
Full-time	73.53
Part-time	26.47
Extension access	
Yes	32.35
No	67.65
Training	
Yes	16.17
No	83.82
Veterinary access	
Yes	8.82
No	91.18

Table 3. Descriptive Statistics of Farm Characteristics.

Variable	Percentage	Mean
Number of birds before the crisis		5,054
Number of birds at the time of the survey.		2,470
Labours		
Hired labour		2
Family labour		2
Daily production of eggs		2,155
Type of commercial strains		
White layers	75.00	
Brown layers	5.88	
Both white and brown layers	19.12	
Batch system		
Single batch	23.53	
Multiple batches	76.47	
Feed type		
Self-mixed feed	51.47	
Commercial feed	38.24	
Acquaintance's feed mix	10.29	
Marketing strategy		
Selling to wholesalers only	61.76	
Selling to retailers only	1.47	
Wholesalers and selling at own farm outlet	19.12	
Selling to wholesalers and selling to retailers	10.29	
Selling to wholesalers, selling to retailers and selling at own farm outlet	7.35	

strain layer birds, the remaining 5.88% raise brown-type commercial strain layer birds and 19.12% raise a mix of both. Considering the feeding practice, 52% of the farms use self-mixed feeds, 38% use commercial feeds and 10% use acquaintance feed mix (purchasing mixed feed from nearby farmers). Farmers use various marketing channels to sell eggs, the most prominent being selling to wholesalers (62%). Additionally, 19.2% of farmers sell their products at their farm outlets and sell to wholesalers. Only a small percentage of farmers (1.47%) sell their products directly to retailers.

Risk Perception

Kendall's coefficient of concordance (W) was found to be 0.77, which indicates a significant level of agreement over the severity of the risk sources ($p < .001$). Based

on the rankings derived from the average severity scores, the study identified institutional risk as the most severe risk faced by the farmers. These institutional risks are highly correlated with marketing risks. It was followed by marketing, production, financial and human risks in descending order of severity. Following a similar pattern, the recent systematic review of farmers' perception of agricultural risks also indicated that agricultural market risk is prominent (Duong et al., 2019).

Within the major risk categories, the study identified specific individual risks deemed most significant by the farmers. The top three risks in terms of importance were associated with institutional factors and policy changes. They are

Table 4. Descriptive Statistics of Farmers' Perception of Risks.

Risk	Mean	Percentage of High-risk Perception
Institutional risks	4.69	
Maize importation ban		95.59
Maximum retail price on egg		94.83
Chemical fertiliser ban		92.65
Marketing risks	4.29	
Increased input prices		100.00
Decreased egg price		86.77
Reduced consumption of egg		82.81
COVID-19 pandemic		80.88
Fuel shortage		74.63
Easter bomb attack		72.06
Production risks	3.10	
Input shortage		83.83
Pest damage		48.53
Power outage		47.76
Disease outbreak		44.12
Post-harvest losses		42.65
Rain/flooding		14.71
Drought		10.29
Financial risks	2.04	
High-interest rate on loans		30.89
Low availability of credit facility		17.64
Human risks	1.35	
Inefficiency of labours		7.35
Farmer's or family member's health issue		4.41
Unavailability of labours		2.94
Theft		2.94

risks ‘feed shortage arising due to maize importation ban’, ‘imposition of retail price ceiling on eggs’, and ‘chemical fertilizer ban’ (Table 4). These institutional risks received a score above 4.5, indicating their higher potential to have a negative impact. The policy changes associated with these risks directly affect the egg industry's production and marketing aspects. The feed shortage resulting from the maize importation ban significantly impacted the availability of essential inputs for layer chicken farming. The imposition of a retail price ceiling on eggs might affect farmers' profitability and economic viability. At the same time, the ban on chemical fertilisers may have negative implications on crop yields and the overall availability of raw materials from plant-based feed that is locally produced.

The study reveals that most farmers, surpassing 70% of participants, have expressed grave concerns about the country's alarming decline in egg demand. This decline can be attributed to multiple factors, primarily the escalating prices of eggs and the overall inflation in the food market. Furthermore, the shortage of liquid petroleum gas (cooking fuel) has directly impacted the hotel and restaurant industry, leading to a further decrease in the demand for eggs. Additionally, the Easter bomb attack in 2019, which had a detrimental impact on the tourism industry, was identified as a significant risk that reduced demand for eggs.

Nearly 50% of the farmers surveyed have identified various production risks as significant concerns within the layer farming industry. These risks encompass a range of challenges, including post-harvest losses, pest damage, disease outbreaks and power outages, all of which can disrupt operations and impact profitability.

The respondents highlighted that post-harvest losses, a prominent risk factor, can be attributed to several underlying causes. Factors such as dietary calcium deficiencies, worker mishandling, cannibalism and high occurrence of damaged eggs from old flocks were identified as key contributors to these losses. Such losses significantly affect the overall profitability and sustainability of the business. Farmers also expressed concerns regarding predators, such as bandicoots, lynxes, snakes, dogs and palm civets, significantly threatening their farming operations. These predators have increasingly impacted the industry, mainly due to the planned daily power outages lasting 2–3 hours across Sri Lanka in 2022, specifically in the surveyed area of Kurunegala district. The power outages create vulnerabilities within the farming premises, providing opportunities for predators to infiltrate and further intensify the production risks associated with the business.

Interestingly, the farmers' risk perception of the potential impact of extreme weather events, such as droughts and floods, was comparatively low. This could be attributed to the location of the study area in the Kurunegala district, which is situated in an intermediate climatic zone. The area experiences fewer extreme weather events than other regions, leading to a relatively lower risk perception among the farmers surveyed. Moreover, as the chicken is being reared in intensive poultry houses where environmental effects can be regulated, farmers may have a comparatively lower risk perception of extreme weather events.

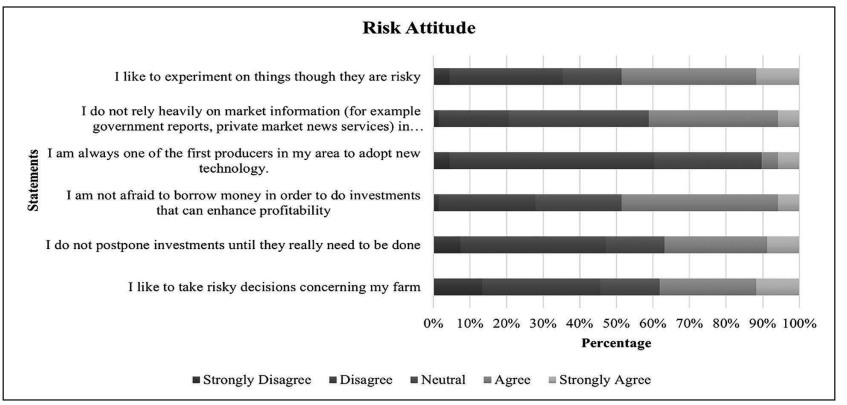

Figure 2. Risk Attitudes of Farmers.

Risk Attitude

Figure 2 presents the study's findings regarding farmers' attitudes towards risk. One-third of the farmers in our sample were risk averse (35%), while 38% were risk neutral (38%). Only 27% of farmers were risk lovers. It can be observed that less than 50% of the farmers expressed a willingness to experiment with risky endeavours and, hence, make risky decisions concerning their farms. Additionally, only a tiny proportion, less than 10% of the farmers, indicated that they would be the first to adopt new technology in their farming practices. This conservative approach taken by a significant portion of farmers to embrace risk and adopt new technologies is potentially influenced by the financial and technical constraints they face.

Risk Management Strategies Adapted by Farmers

Farmers have employed various risk management strategies to mitigate their risks (Table 5). More than 90% of the farmers have implemented preventive measures, including biosecurity measures, timely medication for poultry diseases, sourcing birds from reputable suppliers, and providing appropriate housing facilities to reduce the risk of disease outbreaks (Figure 3). The high percentage of farmers adopting standard biosecurity measures reflects farmers' awareness and proactive approach to managing risks associated with disease outbreaks.

Despite price fluctuations being a common risk in the poultry layer business, they have yet to diversify their enterprise, engage in contract farming or take measures to reduce the cost of production, making them less resilient to these risks. The only risk management strategy that farmers use to protect them from input price fluctuation is the pre-purchase of inputs, with only 54% of the respondents adopting this approach. As a healthy risk-coping measure, 51% of the farmers have an off-farm income. This off-farm income enhances the farmers' capacity to bear risks by providing additional financial security.

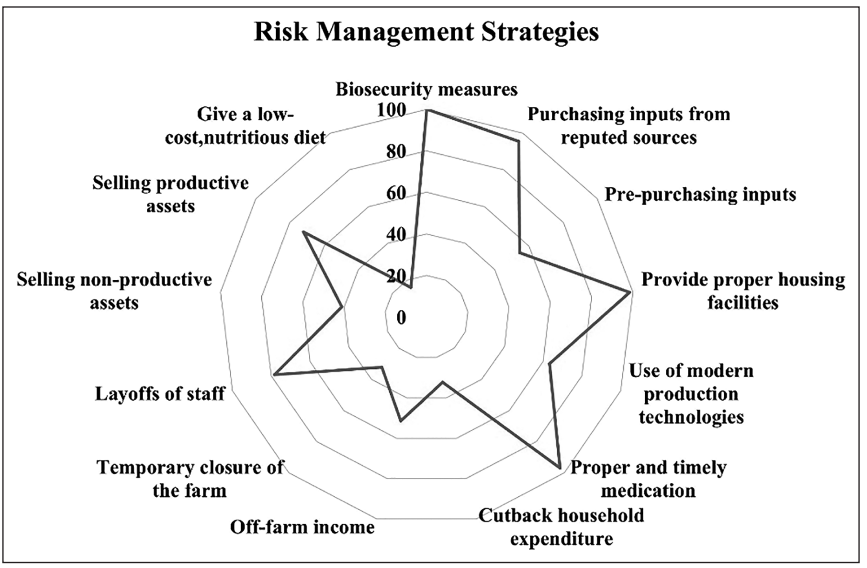

Figure 3. Risk Management Strategies Adopted by Farmers.

Table 5. Usage of Different Risk Management Strategies.

Strategies	Used Percentage
Preventive strategies	
Biosecurity measures	100.00
Purchasing input from reputed sources	95.59
Pre-purchasing inputs	54.47
Provide proper housing facilities	98.53
Mitigating strategies	
Use of modern production technologies	63.24
Proper and timely medication	97.06
Coping strategies	
Cutback household expenditure	32.35
Off-farm income	51.47
Temporary closure of the farm	32.35
Layoffs of staff	78.38
Selling non-productive assets	41.17
Selling productive assets	72.05
Give a low-cost, nutritious diet	16.17

In response to recent risks faced by farmers, such as feed shortage, high feed prices and reduced demand for eggs, most farmers primarily relied on risk-coping strategies rather than risk management strategies. Closer to 17% of farmers shifted to low-cost but well-balanced diets in response to the unavailability and high cost of commercial feed in the wake of feed shortage. The low adaptation rate of these shifted diets can be attributed to poor knowledge of feed formulation, an unreliable supply of alternative maize and soybean meal feed ingredients, and inadequate storage facilities. Similarly, 83.83% postponed investment until the condition improved and hired labour (78.38%) was reduced to reduce the operational cost of the farm.

Apart from these, some farmers rely on income-smoothing risk-coping strategies, such as cutting down their household spending (32.35%) and selling non-productive assets (41.17%), such as household items and jewellery. Since the economic crisis has affected food and non-food prices, with the challenged livelihood of layer chicken farming, these farmers find it difficult to fulfil their basic needs, including food. Hence, they are looking for buyers for non-productive assets.

Alarmingly, one-third have sold their layer birds and temporarily closed poultry farms, while the rest (72.05%) have partially destocked the herd. They have started by selling older batches of birds (over 70 weeks), and as the situation worsens, they proceed to sell younger birds. It is worth mentioning that the birds from these farms are typically sold to the meat market, as the layer industry was no longer attractive to new investments. From the farmers' perspective, temporary closure allows them to reduce the operational costs of their farms and mitigate losses. Since farmers have already invested in their businesses, they may prefer to resume operations once the situation improves. However, the uncertainty surrounding the crisis raises the possibility that some of these farms may be unable to resume operations even the situation is resolved.

Determinants of Risk Management Strategies

Table 6 reports the results of the multivariate probit regression estimated to identify the determinants of the adoption of three risk management/coping strategies: off-farm income, temporary closure of the farm and curtailing of household expenditure. As revealed by the analysis, the decision to adopt risk management/coping strategies is influenced by the farmer's socio-economic characteristics, the farm's features, the perception of risk and the attitude towards risk.

The decision of farmers to pursue an off-farm income as a risk management strategy is influenced by several factors, including their marketing strategy, financial risk perception, risk attitude and religion. Farmers who sell their products to wholesalers are more inclined to engage in off-farm activities than those using alternative marketing methods. This preference may stem from their time availability, as they avoid the responsibility of direct selling. Farmers who perceive higher financial risks are also more likely to seek off-farm opportunities to diversify their income. Additionally, risk attitude plays a role in their decision to diversify income sources. Risk-loving farmers tend to engage in off-farm activities and

Table 6. Determinants of Risk Management Strategies.

Independent Variables	Off-farm Income	Temporary Closure of the Farm	Cutback Household Expenditure
Years of experience	–0.026	–0.036	–0.020
	(0.034)	(0.029)	(0.025)
Religion (1 = Buddhist)	–1.637**	–0.072	–0.596
	(0.719)	(0.525)	(0.476)
Training (1 = yes)	1.031	0.171	0.623
	(0.826)	(0.562)	(0.497)
Extension contacts (1 = yes)	–0.567	0.161	0.475
	(0.597)	(0.423)	(0.392)
Full-time/part-time (1 = full-time)	–8.418	0.414	–1.071***
	(0.347)	(0.428)	(0.406)
Number of birds (1 = > 5,000 birds before crisis)	–0.218	–0.259	1.049**
	(0.576)	(0.467)	(0.451)
Marketing strategy (1 = selling to wholesalers only)	1.266**	0.130	0.521
	(0.593)	(0.372)	(0.377)
Feed type (1 = self-mixing)	0.004	0.429	–0.109
	(0.516)	(0.441)	(0.401)
Financial risk perception	0.595***	–0.254*	0.090
	(0.223)	(0.147)	(0.132)
Risk attitude	0.876**	–0.845***	–0.281
	(0.409)	(0.277)	(0.248)
Chi² value = 12.6855			

Note: Likelihood ratio test of rho21 = rho31 = rho32 = 0: chi²(3) = 12.644 Prob > chi² = 0.0055. Figures in parentheses are robust standard errors. * $p < .1$; ** $p < .05$; *** $p < .01$.

pursue multiple livelihood activities. Similar findings have been reported in previous studies conducted by Asravor (2018) and Rahman et al. (2021). However, Van Winsen et al. (2016) study suggests that risk-averse farmers passively manage risk by maintaining a financial buffer and ensuring off-farm income or expenditures during challenging times.

Similarly, the choice to destock the farm entirely is also affected by risk attitude, whereas risk-averse farmers exhibit a higher inclination to adopt this approach. On the other hand, farmers who perceive higher levels of financial risk are less likely to choose destocking as a risk-coping strategy. Interestingly, while the regression coefficient of herd size suggests a negative relationship between farm size and destocking, the relationship is not statistically significant, indicating that farm size does not play an important role in the decision to destock.

Two key variables that have been found to influence the decision to cut down household expenditures are farm size (scale of operation) and commitment (full-time/part-time). Farmers with more than 5,000 birds exhibit a higher

tendency to cut back on their household expenses compared to those with less than 5,000 birds. This can be attributed to the fact that larger farms, which have made substantial investments in their operations, strive to sustain their business despite the risks they face. By reducing household expenditure, they can allocate additional funds to cover the costs associated with the farm. Large farms have more flexibility to adjust their household food consumption, as their current consumption level is above the subsistence level. Similarly, part-time layer chicken farmers included in the sample also cut back on household expenditure to allocate more resources to their business. This behaviour stems from their ability to adapt their household spending. The flexibility afforded by part-time farming allows them to prioritise and redirect funds towards supporting their agricultural endeavours.

Conclusion and Recommendation

The economic crisis in Sri Lanka has posed significant challenges for poultry farmers, threatening the survival of the farmers and, hence, the industry. A study assessed the risk perception, attitude and management strategies adopted by small-scale and medium-scale poultry farmers during this crisis. The study's findings indicate that poultry farmers perceive policy changes, such as the ban on fertiliser and maize importation and government intervention in the retail market, as critical risks to their business. These risks originate from institutional factors, leading to new marketing and production risks. However, farmers and the industry have yet to develop effective risk management strategies to mitigate the negative impacts of these risks. The uncertainty regarding the industry's future adds to the challenges farmers face. The study highlights the influence of risk attitude, perception and flock size on selecting risk management and coping strategies. It also reveals farmers' limited access to training and extension services, indicating a need for institutional support during crises. Knowledge dissemination, access to credit facilities and improved storage facilities at the farm level are essential in reducing the impact of risks. Maintaining a two- to three-month inventory of inputs can help farmers protect themselves from adverse price fluctuations.

To safeguard small and medium-scale layer chicken farmers during the crisis, the study recommends fostering cooperation between these farmers and large-scale farmers. This collaboration can lead to economies of scale and support small-scale farmers during challenging times. Additionally, promoting unity among layer chicken farmers to advocate against ad hoc policy changes is crucial. Further research is needed to explore low-cost alternative feed ingredients to replace expensive conventional feed sources such as maize and soybean meal in poultry diets as a potential solution.

Declaration of Conflicting of Interests

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Article

Crop Diversification in India (1990–2016): Implications for the Eastern and Northeastern States

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Abstract

This study utilises data from the Agriculture Census for 1990–1991, 2005–2006 and 2015–2016, employing the Herfindahl-Hirschman Index (HHI) to assess crop diversification in Indian states. The overall HHI declined from 1990–1991 to 2015–2016, indicating increased crop diversification nationally. However, the proportion of states exceeding the overall average HHI significantly decreased, indicating a shift towards specialisation or monoculture in some states. The analysis notes a decrease in the gross cropped area (GCA) under total food crops (TFC) and an increase in total non-food crops (TNFC). Despite the overall decline in TFC, high-value crops like horticultural produce, sugar crops, spices, and condiments have seen improvement. Focusing on the Eastern region (ER) and the Northeastern region (NER), the study reveals diversification in NER due to higher allocation of land to high-value crops, while economically disadvantaged states in the ER, such as Bihar and Odisha, show a trend towards crop specialisation, potentially affecting overall food security in the region. The study emphasises the need for government support to address persistent vulnerabilities in poverty, unemployment, and low yields in cereals, pulses, and oilseeds in these regions, recommending inputs, infrastructure development, insurance, and market linkages for perishable items to enhance food security.

Keywords

Crop diversification, food security, Indian agriculture, smallholders, non-food crops

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Introduction

Crop diversification in developing countries, particularly in India, is a practice with immense potential. It is a key strategy that can significantly impact economic and social development. This shift from traditional staple crops to high-value crops is driven by the increasing demand for nutritious food and the implementation of policy reforms. The changing preference for nutritious foods such as fruits, vegetables, milk, meat, and fish is rapidly increasing in domestic and international markets, necessitating agricultural diversification. The Green Revolution's focus on primary staple crops for food security overlooked the potential of high-value crops, hindering farmers' income, employment prospects, and environmental sustainability. However, post-reform agricultural policies emphasise crop diversification to counter economic, social, and ecological degradation caused by the dominance of paddy-wheat cultivation. High-value crops, with their better financial returns, play a crucial role in this and can help address these challenges, providing a ray of hope for the economic and social development of Indian agriculture. The potential benefits of crop diversification are significant, as it meets the changing food demand and enhances farmers' income, employment prospects, and environmental sustainability. Although the demand for cereals seems manageable in India, economic growth, per capita income, and rapid urbanisation hasten the need for high-value crops and pose significant challenges.

Crop diversification, the cultivation of a broader range of crops within a specific area, is a crucial strategy in Indian agriculture. It signifies a shift from cultivating traditionally grown, less economically remunerative crops to high-value crops offering better financial returns. This strategic shift aims to enhance agricultural productivity and economic sustainability. Therefore, a comprehensive understanding of current agricultural trends, particularly in crop diversification, is not just important but essential for ensuring food and nutrition security, poverty alleviation, and effective policy formulation. This understanding is even more critical in agrarian countries like India, where a significant proportion of the population resides in rural areas and relies on agriculture and allied activities for livelihoods. In particular, the Eastern region (ER) and the Northeastern region (NER), which are dominated by smallholder farmers, lag behind the rest of India regarding economic and social development. Diversification through high-value crops could be one of the several ways of agricultural and economic development in this region. However, cultivating high-value crops is often labour-intensive, requiring substantial capital, advanced technology, high-quality inputs, and proper management and farm services. The lack of agricultural public support poses significant challenges to smallholders' access to farm services (Birthal et al., 2007; Jha et al., 2009). Furthermore, agriculture in India is regionally imbalanced due to agroecological conditions and policy support. Therefore, a thorough understanding of current agricultural trends, particularly in crop diversification, is crucial for ensuring food and nutrition security, poverty alleviation, and effective policy formulation, especially in economically disadvantaged regions like ER and NER India.

Eastern and Northeastern States

The transformative impact of the Green Revolution on Indian agriculture has been regionally imbalanced, with ER and NER states significantly trailing behind. A substantial proportion of these states in both regions continue to grapple with elevated poverty rates, surpassing the national average (Figure 1a). Unemployment is another pressing concern for these regions. Rise in unemployment rates have been registered across selected NER and ER states (Figure 1b). Most of the NER and ER states exhibited higher unemployment rates than the national average during 2011–2012 and 2019–2020. In addition, agricultural development in the ER and NER regions, particularly yield rates, lags significantly behind the national average. The most recent data (as shown in Table 1) for the 2017–2018 season illustrates the dismal state of cereals, pulses, and oilseeds yield rates in this region. Compared to the national average, the yield rates for cereals, pulses, and oilseeds are consistently lower. Among the 11 selected states in this region, eight states fail to meet the national average yield, indicating a widespread agricultural deficiency. The situation is particularly dire for oilseeds, where all states in the region fall below the national average yield.

While pulses' performance is relatively better, with only three states having a lower yield rate than the national average, overall agricultural productivity in NER and ER states remains poor. This study underscores the need for special attention and intervention when considering the region's poor performance in poverty alleviation, unemployment, and agricultural yield. These factors encourage us to give special attention to this region in the article.

Agriculture Diversification in India

Indian agriculture has witnessed several phases of short-run growth and long periods of stagnation since independence. The Green Revolution of the 1960s transformed India into a self-sufficient country from a position of growth stagnation and food deficiency (Pingali et al., 2019; Ramakumar, 2022). Agriculture in India has passed through four major phases. The first is the pre-Green Revolution,

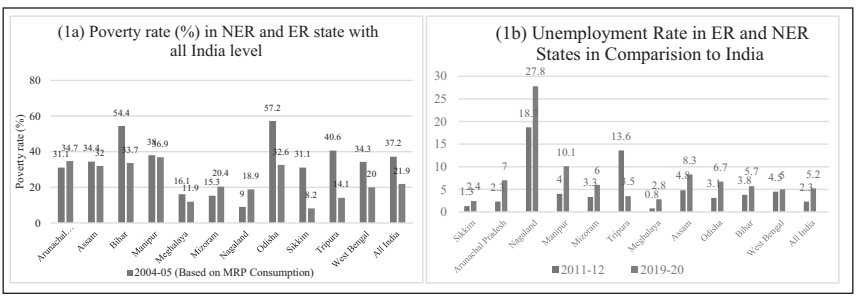

Figure 1. Poverty Rates (2004–2005 to 2011–2012) and Unemployment Rates (2012 & 20).

Source: (1a) National Sample Survey Organisation and NITI Aayog. (1b) Bordoloi and Bedamatta, 2022, NSS-EUS, 2011–2012 and PLFS-2019–20.

Table 1. The State-wise Yield of Cereals, Pulses, and Oilseeds (Kg/ha.) for 2017–2018.

State	Cereals	Pulses	Oilseeds
Arunachal Pradesh	1619	1020	1040
Assam	2174	748	638
Bihar	2714	954	1208
Manipur	2544	965	870
Meghalaya	2637	1439	1057
Mizoram	1641	1544	1113
Nagaland	1706	1159	1050
Odisha	1727	556	625
Sikkim	1740	954	924
Tripura	2869	710	780
West Bengal	2995	969	1198
All India	**2657**	**853**	**1284**

Source: Pocketbook of Agriculture Statistics 2019.

which emphasised expanding areas under agriculture using traditional methods. The Green Revolution era changed agriculture by adapting new technology, high-yielding seeds, and the use of inputs. The post-green revolution phase focused on infrastructural and management issues and linkages in markets, trade, and institution building. The final stage involves liberalisation and withdrawal of public expenditure from agriculture and encouraging the private sector.

Over the past decades, agriculture area, production, and cropping patterns have changed remarkably in India. Although the success of agriculture growth during the Green Revolution has been regionally imbalanced, the overall cropping pattern is significantly shifting towards high-value crops and commodities, transitioning from traditional subsistence cropping to commercial agriculture. Several studies have highlighted this shift, demonstrating a move from food to non-food crops over the years (Banu & Sheereen, 2015).

While some states like Bihar, Jharkhand, Odisha and West Bengal have witnessed a gradual shift towards high-value crops (Kumar et al., 2012), others such as Himachal Pradesh have seen a transition from cereals to high-value crops, particularly vegetables, although with a decline in oilseeds and pulses (Devi & Prasher, 2018). The trend of diversification has been driven by various factors, including market liberalisation, post-WTO dynamics, and increased agricultural output following economic reforms (Bhalla & Singh, 2009; De Roy, 2017; Thamarajakshi, 1999). In some states like Punjab, the government has encouraged private sector participation through contract farming to promote diversification (Sharma & Singh, 2013; Singh, 2000, 2004, 2005). Diversification has also been influenced by the availability of family labour, with labour-intensive crops like fruits and vegetables becoming prevalent (Birthal et al., 2006). Additionally, studies have indicated that diversification has led to cultivating livestock and fishery alongside high-value crops (Chand et al., 2016).

At the state level, the growth and transformation in agriculture have been highly inequitable (Pingali et al., 2019). Moreover, smallholder farmers, who comprise most of the farming community, face challenges in this transformation. Issues such as limited access to infrastructure, including roads and cold storage facilities, and a lack of functionalised markets for perishable or semi-perishable crops hinder their ability to shift towards high-value crops (Chhatre et al., 2016). Despite government emphasis on agriculture diversification to enhance nutrition security, farmers' income, and environmental sustainability, there is a need for improved infrastructure development and increased public support for farm services, especially for smallholders. Closed observation of recent agriculture policy and market reforms suggests that the government has focused on centralising policies (Farm Bills 2020, e-NAM, Contract farming) designed to liberalise and deregulate the agriculture markets, which has received criticism from different stakeholders. Agriculture diversification has also been emphasised through specific initiatives[1] primarily for high-value crops such as fruits and vegetables.

Previous studies have primarily examined crop patterns at the national or state level, lacking detailed information on emerging crop groups or crops responsible for diversification at the state level. Recognising this gap, the current article aims to calculate the crop diversification of India at the state level after reforms. By considering regional patterns and identifying emerging crops, the article emphasises the importance of making crop-specific implications in policy measures to promote further and sustain agricultural diversification. This article aims to understand the trends and recent patterns of crop diversification, considering it a potential means to improve food and nutrition security, income, and employment opportunities, especially for smallholders in India. The focus is on identifying specific crop groups and leading crops in diversification or specialisation at the state level. Particular emphasis is placed on India's eastern and north-eastern states.

Data and Methods

The data utilised in this study regarding the gross cropped area (GCA) of various crops were sourced from the Agriculture Census Report spanning 1990–1991, 2005–2006 and 2015–2016. The Agriculture Census is the principal reservoir of information encompassing various agricultural parameters, meticulously detailing the number and extent of operational holdings, their dimensions, distribution according to size, land usage, tenancy patterns, and cropping preferences, among other vital metrics. Substantial agricultural data is obtained through a nationwide agricultural census every five years, supplemented by a corresponding survey focused on agricultural holdings. The agricultural census data proved to be the most suitable and rigorous data source for the current study, endeavouring to explore crop diversification at state and union territory (UT) levels. We have applied this dataset to measure the extent of diversification within the agricultural landscape.

The Herfindahl-Hirschman Index (HHI) is one of the most cited methods that measure the extent of crop diversification applied by many scholars (see, e.g., Auffhammer & Carleton, 2018; Bharati et al., 2015; Chen et al., 2018; Dakpo et al., 2019; Devi & Prasher, 2018; Gebeltová et al., 2020; Kumar et al., 2012; Kurdyś-Kujawska et al., 2021; Madhumitha et al., 2021; Mulwa & Visser, 2020; Singh et al., 2020; Tisdell et al., 2019). We use the same method to extract crop diversification for the present article. This index solely quantifies the extent of diversification without delving into its specifics or trends. The HHI index ranges from zero (indicating complete diversification) to 1 (representing complete specialisation). A value nearing '1' signifies a highly specialised agricultural focus, while a value nearing '0' indicates significant diversification. States falling within the diversified category possess a balanced distribution of GCA among various crops. Conversely, states falling under specialisation denote a predominant practice of mono-crop cultivation.

Formula : $(\mathrm{HHI} = \Sigma\ P_i^2)$ Where $P_{i=}$Ai / ΣA_i $\mathbf{P_i}$ = proportion of area under i-th crop, and $\mathbf{A_i}$ = Actual area under i-th crop.

Traditionally, studies exploring the relationship between crop diversification and nutrition primarily focus on food crops. However, our analysis incorporates both food and non-food crops. This approach is essential because nutrition is directly linked to the quality of food consumption. However, income also significantly influences access and affordability of food. Non-food crops, often called cash crops, provide farmers with better financial returns. Hence, we comprehensively considered both food and non-food crops in our estimation. We categorised crops into three groups: total food grains (TFG), other food grains (OFG), and total non-food crops (TNFC) to measure crop diversification (See Figure 2).

Results and Discussion

Level of Crop Diversification and Pattern 1990–2016

We divide the diversification value into four groups based on the equal interval (Table A1). The result shows a state-level diversification transformation during the study period (Figure 3). The regional pattern shows considerable changes across states, where some states shifted towards diversification and specialisation (Table 2).

The HHI value presents the concentration of crops in a state or country. A high HHI value indicates either a concentrated crop production or a more evenly distributed share of different crop groups. States in the specialisation zone predominantly practice monocropping or have larger areas dedicated to specific crops. Figure 3 visually depicts the spatial shifts in crop diversification across India from 1990 to 2016. The data reveals a polarisation among states concerning crop diversification: some states are moving towards diversification, while others are transitioning into specialisation zones (Figure 4). Table 2 elaborates on state diversification values and the nature of GCA for various crop groups. The national

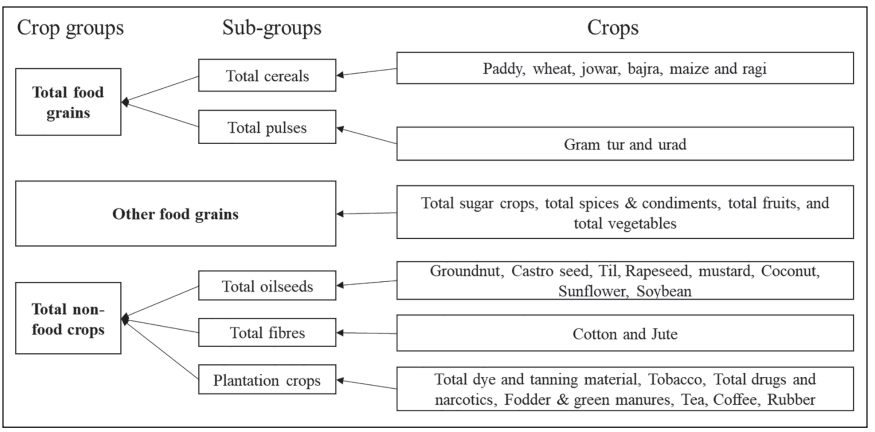

Figure 2. Types of Crops Categories and Crops.

average HHI decreased from 0.63 in 1990–1991 to 0.52 in 2015–2016 (as shown in Table A1), indicating enhanced diversification and shifting from monocropping or uneven distribution to multi-cropping or equal distribution. This improvement does not guarantee a shift from food to high-value crops (OFG or NFC). The prevalence of food crops in Indian agriculture and the declining HHI values at the national level collectively suggest a shift from food grain cultivation.

Figure 4 illustrates the percentage of states in different diversification zones over three periods, indicating a national trend towards increased diversification from 1990 to 2016. The proportion of states categorised as highly diversified, moderately diversified, and specialised increased. In contrast, the percentage of states in the less diversified zone decreased, signifying a shift towards diversification at the national level. However, at the state level, there were both movements towards diversification and specialisation. Notably, states in the NER and Eastern ER regions outperformed the rest of the nation in diversification, with the number of highly and moderately diversified states increasing from four to eight between the 1990–1991 and 2015–2016 census periods (refer to Table A1). This observation raised two vital questions. First, which specific crops drive specialisation and diversification trends? Second, what key crops contribute to the significant diversification changes in NER and ER states? So, in the impending discussion, we focus on identifying crop groups and leading crops in states responsible for the diversification, followed by a particular focus on the NER and ER region states.

Emerging Crop Groups and Crops in Diversification

In the context of agricultural practices in India, there has been a notable shift towards crop diversification; however, certain states have either exhibited minimal changes or transitioned towards specialisation. This section examines specific crop groups and individual crops that have experienced more share gain in the GCA during the study period. As illustrated in Table 3, at the national level,

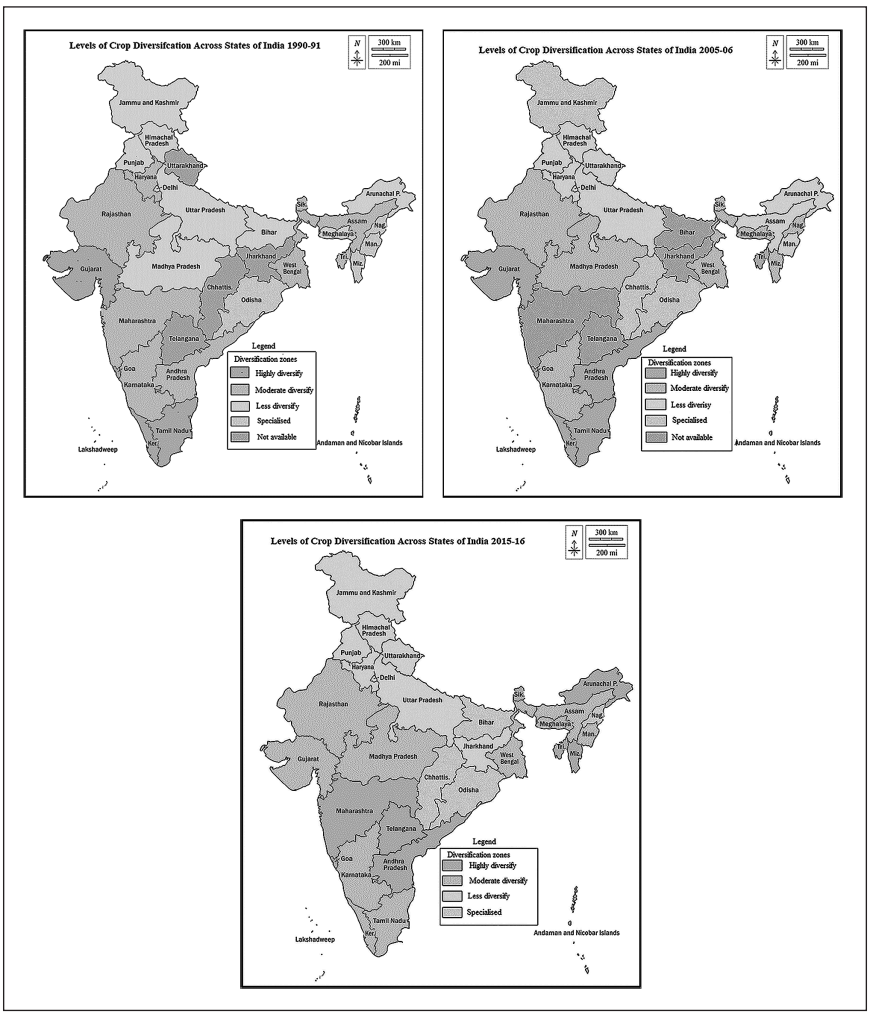

Figure 3. Levels of Crop Diversification Across State/UTs of India 1990–2016.

Source: Data compiled from agricultural census for 1990–1991, 2005–2006, and 2015–2016 *NB*: Except for Delhi, other UTs are not included in the maps as the size is too small to represent the diversification index.

the GCA percentage for total food crops (TFC) has decreased from 77.31% to 75.10% throughout the study period. Despite this decline in the GCA share dedicated to TFC, there is a concurrent increase in the GCA under OFG. Concurrently, there is a growing GCA for TNFC from 22.69% to 24.90% during the same timeframe. These alterations indicate a nationwide agricultural shift towards high-value and commercial crops, signifying crop diversification trends.

Due to the unavailability of GCA data for individual crops at the state level for all states in the 1990–1991 period, we analyse the changes between 2005–06 and 2015–2016 instead. Considering the changes at the national level in

Table 2. Changes in Crop Diversification at State/UTs during 1990–2016.

Year	Zone (HHI)	State/UTs	Characteristics
1990–1991	Highly diversified (0.45 & below)	Gujrat, Kerala, Tamil Nadu, Andaman & Nicobar Island, Goa	In these states, the crop area is relatively balanced between OFG and TNFC. The data indicates a shift towards cultivating high-value and non-food crops. Goa stands out, with an almost equal distribution of GCA between TFC and OFG. Additionally, noteworthy areas are dedicated to high-value crops like fruits and vegetables. However, in Andaman and Nicobar Islands, OFG and TNFC collectively occupy less area than TFG, indicating a different agricultural pattern.
	Moderate diversified (0.46–0.60)	Andhra Pradesh, Assam, Haryana, Karnataka, Maharashtra, Rajasthan, Sikkim, Tripura, West Bengal, Chandigarh, Pondicherry, Daman & Diu	In most states, except for Sikkim and West Bengal, there is a notable trend of TNFC occupying a larger proportion of the agricultural area than OFG despite both being evenly distributed. This suggests moderately diversified states prioritise cultivating non-food or cash crops over high-value crops
	Less diversified (0.61–0.80)	Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Meghalaya, Punjab, Uttar Pradesh, Arunachal Pradesh, Dadra & Nagar Haveli, Delhi, Lakshadweep	In the third group of states, a distinct pattern emerges. Bihar, Himachal Pradesh, Jammu & Kashmir, Uttar Pradesh, and Arunachal Pradesh allocate a smaller area to TNFC than OFG. Conversely, states like Madhya Pradesh, Meghalaya, Punjab, Dadar & Nagar Haveli, and Delhi devote more agricultural area to OFG, specifically vegetables and fruits, than TNFC. This distribution pattern shows a greater disparity compared to the previous two groups
	Specialised (0.81 & above)	Manipur, Nagaland, Odisha, Mizoram	Remarkably, all four states in this specific group are in India's NER and ER regions. State-level data highlights a high GCA for these states under TFG. Mizoram, Manipur, and Nagaland exhibit considerably lower agricultural areas under TNFC. Conversely, Odisha balances TNFC and OFG better. These states predominantly engage in monoculture, allocating a significant portion of their agricultural land to TFG

(Table 2 continued)

(Table 2 continued)

Year	Zone (HHI)	State/UTs	Characteristics
2005–2006	Highly diversified (0.45 & below)	Andaman & Nicobar Island, Andhra Pradesh, Chandigarh, Gujrat, Goa, Kerala, Tamil Nadu, Tripura	In this period, a significant change occurred in the distribution of OFG and TNFC across states. The number of states in this category expanded from five to eight, indicating a trend toward diversification. Tamil Nadu, Kerala, and Tripura allocate more area to TNFC than OFG, while Gujarat's allocation is more balanced and almost equal to TFG. However, Andaman & Nicobar Islands and Goa exhibit a pattern where the TNFC area is smaller than OFG, signifying a different agricultural approach in these regions.
	Moderate diversified (0.46–0.60)	Karnataka, Madhya Pradesh, Meghalaya, Mizoram, Nagaland, Pondicherry, Rajasthan, Sikkim, West Bengal	The number of states in this category decreased from 12 to 9. The distribution pattern between TNFC and OFG remained consistent with the previous census, with the TNFC area consistently surpassing OFG's. A significant shift occurred as Nagaland and Mizoram, formerly classified in the specialised zone, transitioned into this category due to rapid expansion in the cultivation area for both OFG and TNFC crops
	Less diversify (0.61–0.80)	Arunachal Pradesh, Assam, Daman & Diu, Delhi, Haryana, Himachal Pradesh, Manipur, Punjab, Uttar Pradesh, Uttarakhand	Significant state-level changes were observed in this category compared to the previous period. Jammu & Kashmir, and Lakshadweep transitioned into the specialised zone, indicating a shift in their agricultural focus. Conversely, Madhya Pradesh and Meghalaya moved to the moderate zone, signifying a change in their cultivation practices. Notable shifts occurred as Assam and Haryana moved from the moderate zone into this category. Additionally, Manipur shifted from the specialised zone to this category, reflecting alterations in their agricultural strategies
	Specialised	Chhattisgarh, Dadar and Nagar Haveli, Jammu & Kashmir, Lakshadweep, Odisha	In this category, Odisha remains consistent, with Chhattisgarh newly included. Conversely, Dadar & Nagar Haveli, Jammu & Kashmir, and Lakshadweep have shifted to this zone. Upon entering this category, all three UTs experienced a decrease in total GCA. Dadar & Nagar Haveli decreased in the TNFC area, while Jammu & Kashmir and Lakshadweep witnessed reductions in both OFG and TNFC areas. In Odisha, the area under TFG significantly outweighs that of OFG and TNFC, indicating a notable difference in cultivation practices.

(Table 2 continued)

(Table 2 continued)

Year	Zone (HHI)	State/UTs	Characteristics
2015–2016	Highly diversified (0.45 & below)	Andhra Pradesh, Arunachala Pradesh, Goa, Maharashtra, Mizoram, Sikkim, Telangana, Tripura, Andaman & Nicobar Island	Notably, Arunachal Pradesh has made significant advancements, transitioning to this zone from a less diversified category. This progress is attributed to a substantial expansion in the cultivation area of OFG. Similarly, Mizoram and Sikkim have shown improvement from the previous census when they were classified in the moderate zone, indicating positive shifts in their agricultural diversification strategies.
	Moderate diversified (0.46–0.60)	Assam, Gujrat, Karnataka, Kerala, Madhya Pradesh, Manipur, Meghalaya, Rajasthan, Tamil Nadu, West Bengal, Chandigarh, Puducherry	Assam and Manipur transitioned from the third zone to this category. Conversely, four states—Gujarat, Kerala, Tamil Nadu, and Chandigarh—have experienced a decline in diversification since the previous census despite being in a highly diversified zone earlier
	Less diversified (0.61–0.80)	Haryana, Himachal Pradesh, J & K, Jharkhand, Punjab, Uttar Pradesh, Uttarakhand, Daman & Diu, Delhi	During this period, the newly formed state of Jharkhand entered this zone, while Jammu & Kashmir moved up from the fourth zone compared to the previous census. Uttar Pradesh and Punjab, both significant agricultural states, maintained their positions consistently throughout the study period
	Specialised (0.81 & above)	Bihar, Chhattisgarh, Nagaland, Odisha, D & NH, Lakshadweep	Chhattisgarh, Odisha, Dadar & Nagar Haveli, and Lakshadweep retained their positions from the previous census. Unexpectedly, Nagaland experienced a substantial decrease in diversification and shifted from the moderate zone to this category

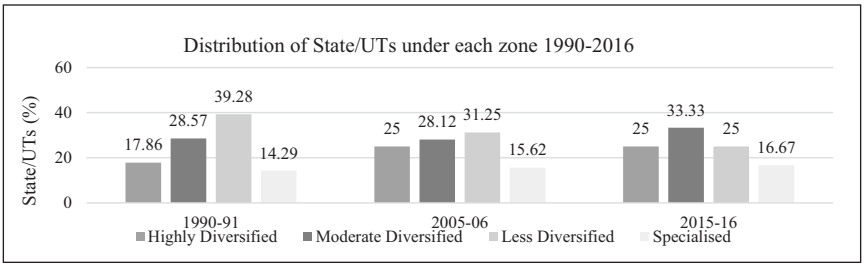

Figure 4. Share of State/UTs Under each Diversification Zone (%).

Table 3. Changes in the Gross Cropped Area Across Crop Groups (%).

		Major Crop Group				
Year	TFG	OFG	TFC (TGG+OFG)	TFC (TGG+OFG)	TNFC	Total Crops
1990–1991	92.05	7.95	100	77.31	22.69	100
2005–2006	90.20	9.80	100	75.88	24.12	100
2015–2016	89.28	10.72	100	75.10	24.90	100

Source: Calculation from Agricultural Census Report 1990–1991, 2005–2006, 2015–2016.

OFG and TNFC, as shown in Table 3, our focus has narrowed to these specific crop groups, indicating diversification or specialisation trends. Consequently, we identify the top five states that experienced the most significant gains or losses in the area dedicated to OFG and TNFC, as detailed in Table 4.

Other Food Grains

Four distinct sub-crop groups, namely total sugar, total spices and condiments, total fruits, and total vegetables fall under the category of OFG. While the national GCA for OFG has experienced a noticeable increase, this trend is not uniform across all four sub-groups. At the national level, the GCA for total sugar has decreased among these sub-groups. In contrast, the other three categories have shown an increase. Despite the overall rise in GCA under OFG at the national level, this phenomenon is inconsistent across all states. Furthermore, if a particular crop witnesses a reduction in its GCA share, this change is not uniformly observed across all states.

The decline in GCA for total sugar shows notable reductions in states such as Uttar Pradesh, Andhra Pradesh, Haryana, Gujarat, and Tamil Nadu. Conversely, despite the national decline in GCA for total sugar, states like Karnataka, Chhattisgarh, Madhya Pradesh, Rajasthan, and Manipur have experienced an increase. Regarding spices and condiments, which saw an increase nationally, significant contributions come from states like Rajasthan, Gujarat, Karnataka,

Table 4. Changes in Gross Cropped Area Under State (2005–2006 to 2015–2016).

Crop Group		Sub-group	Maximum Changes in GCA under Crops					
Other Food Grains (OFG)		Sugar	Increase	Karnataka (1677)	*Chhattisgarh* (183)	Madhya Pradesh (98)	Rajasthan (21)	Manipur (15)
			Decrease	Uttar Pradesh (2954)	Andhra Pradesh (1385)	Haryana (635)	Gujarat (484)	Tamil Nadu (370)
		Spices & condiments	Increase	Rajasthan (5356)	Gujarat (2290)	Karnataka (1346)	Meghalaya (364)	Assam (258)
			Decrease	Kerala (444)	West Bengal (298)	Tamil Nadu (126)	Nagaland (119)	Andhra Pradesh (101)
		Fruits	Increase	Karnataka (921)	West Bengal (701)	Gujarat (440)	Jammu & Kashmir (425)	Tamil Nadu (309)
			Decrease	Andhra Pradesh (977)	Uttar Pradesh (900)	Odisha (495)	Madhya Pradesh (314)	Kerala (151)
		Vegetables	Increase	West Bengal (3440)	Rajasthan (1608)	Karnataka (1133)	Andhra Pradesh (443)	Chhattisgarh (408)
			Decrease	Uttar Pradesh (3541)	Odisha (245)	Nagaland (179)	Tamil Nadu (163)	Haryana (145)
Total Non-food Crops (TNFC)	Plantation crop	Tea	Increase	Assam (257)	Arunachal Pradesh (47)	Karnataka (19)	Nagaland (13)	Meghalaya (1)
			Decrease	West Bengal (350)	Tamil Nadu (144)	Kerala (76)	Tripura (52)	Uttar Pradesh (11)
		Coffee	Increase	Karnataka (350)	Assam (65)	Andhra Pradesh (22)	Manipur (1)	Meghalaya, Tripura (1)
			Decrease	Kerala (41)	Tamil Nadu (13)	Gujarat (1)	Uttar Pradesh (1)	
		Rubber	Increase	Tripura (554)	Karnataka (94)	Kerala (87)	Mizoram (31)	Nagaland, Assam (23)
			Decrease	Andama & Nicobar (1)				
	Fibre & oilseeds	Jute	Increase	Gujarat (104)	Karnataka (56)	Telangana (11)	Meghalaya (5)	Tamil Nadu (5)
			Decrease	West Bengal (998)	Assam (110)	Haryana (49)	Odisha (44)	Tripura (7)
		Cotton	Increase	Gujarat (5325)	Karnataka (3497)	Tamil Nadu (489)	Uttar Pradesh (75)	Odisha (70)
			Decrease	Andhra Pradesh (4468)	Madhya Pradesh (4211)	Punjab (3247)	Haryana (1173)	Rajasthan (69)
		Oilseeds	Increase	Madhya Pradesh (10525)	Gujarat (958)	Uttar Pradesh (826)	West Bengal (520)	Assam (250)
			Decrease	Andhra Pradesh (17148)	Karnataka (8222)	Rajasthan (1657)	Odisha (918)	Haryana (913)

Source: Calculation from Agricultural Census Report 2005–2006, 2015–2016 NB-value with state indicates the change in area in '00' ha.

GCA in '00' ha.

Meghalaya, and Assam. Conversely, GCA for spices & condiments has notably decreased in Kerala, West Bengal, Tamil Nadu, Nagaland, and Andhra Pradesh.

The GCA for fruits has increased nationally, reflecting diversification efforts, with prominent contributions from states like Karnataka, West Bengal, Gujarat, Jammu & Kashmir, and Tamil Nadu. However, despite the national increase, states such as Andhra Pradesh, Uttar Pradesh, Odisha, and Kerala have declined. Similarly, the sub-crop group of vegetables has seen a national increase, leading to diversification. West Bengal, Rajasthan, Karnataka, Andhra Pradesh, and Chhattisgarh have gained the most in GCA. In contrast, GCA for vegetables has decreased in Uttar Pradesh, Odisha, Nagaland, Tamil Nadu, and Haryana during the same period.

Total Non-food Crops

The TNFC category comprises two sub-groups, namely plantation crops and fibres and oilseeds, each consisting of specific crops. The GCA for plantation crops has shown an increase. The GCA for fibres has also risen nationally, with a decline noted specifically in jute cultivation while cotton cultivation has increased. Similarly, the GCA for oilseeds has experienced a slight national rise. Consequently, at the national level, diversification within TNFC has been primarily influenced by the growth in plantation crops (excluding tea), oilseeds, and fibres (excluding jute).

Plantation Crops

In the case of plantation crops, a nationwide increase has been observed. While the GCA for plantation crops, including rubber and coffee, has risen, it has declined for tea cultivation. Assam, Arunachal Pradesh, Karnataka, Nagaland, and Meghalaya have experienced gains in tea cultivation. In contrast, West Bengal, Tamil Nadu, Kerala, Tripura, and Uttar Pradesh have witnessed declines. Coffee cultivation has flourished in states like Karnataka, Assam, Andhra Pradesh, Manipur, Meghalaya, and Tripura. At the same time, Kerala, Tamil Nadu, Gujarat, and Uttar Pradesh have seen reductions. Rubber cultivation has increased nationally, with declines noted only in Andaman and Nicobar Island. Tripura, Karnataka, Kerala, Mizoram, Nagaland, and Assam have significantly contributed to the national increase in rubber cultivation.

Fibres and Oilseeds

In the fibres group, jute cultivation has declined, while cotton cultivation has expanded nationally. Despite the decline in jute cultivation, states like Gujarat, Karnataka, Telangana, Meghalaya, and Tamil Nadu have managed to maintain their cultivation. On the other hand, West Bengal, Assam, Haryana, Odisha, and Tripura have witnessed substantial declines in jute cultivation. Cotton cultivation has notably increased in Gujarat, Karnataka, Tamil Nadu, Uttar Pradesh, and Odisha, while Andhra Pradesh, Madhya Pradesh, Punjab, Haryana, and Rajasthan have experienced reductions.

The OFG and TNFC have significantly contributed to diversification at the national level. This section outlines the five leading states that have experienced

the most substantial diversification and the highest declines under these two crop groups. This evidence sheds light on India's evolving crop preferences and choices between 2005 and 2016, offering insights into the nature of cropping patterns and performance in diversification or specialisation among leading states. Table 4 illustrates West Bengal's shift in cultivation areas, with significant gains in vegetables, the most substantial increase at the national level. Conversely, cultivation areas for spices, condiments, tea, and jute have experienced the most significant declines. This transformation highlights West Bengal's focus on high-value crops like vegetables and fruits, underscoring the need for enhanced infrastructure due to the perishable nature of these items. Policymakers should consider these evolving crop patterns while formulating crop-specific policy frameworks at the state level.

Implication of Crop Diversification for NER and ER States

Our analysis reveals three significant trends during the study period. Notably, all NER states, except Assam, have undergone substantial shifts towards diversification in their agricultural practices. Conversely, Assam and West Bengal have exhibited relatively minor movements towards diversification over the same period. In contrast, other ER states, namely Bihar and Odisha, have experienced a shift towards specialisation. The changes directly influence the movement to diversify levels in the GCA of various crops. Most NER and ER states have transitioned their cropping patterns from TFG to OFG and TNFG, except for Nagaland, Odisha, and Bihar. Nagaland has significantly expanded GCA under TFG, followed by Bihar and Odisha. Notably, OFG has been pivotal in driving this shift in cultivation patterns across these states from 2005–2006 to 2015–2016. This transformation underscores the substantial diversification witnessed in the NER and ER regions, primarily attributed to the cultivation of OFG. We have identified specific crops responsible for specialisation and diversification in each state within this region (detailed in Table A2). The following discussion highlights the major crops for each state.

- *Arunachal Pradesh:* The state has shifted its cropping pattern towards OFG. The decrease in the share of TFG and increase in OFG have resulted in a significant increase in vegetable cultivation, followed by spices & condiments, and fruits. From 2005–2006 to 2015–2016, GCA under TFG declined from 81.13% to 53.13%.
- *Assam:* The state predominantly cultivates TFG with limited diversification. Growth in vegetable, spices & condiments, and fruit cultivation contributes to diversification. We observed that GCA for vegetables (32000 ha.), total spices & condiments (25800 ha.), and fruits (24300 ha.) had the most significant gain.
- *Manipur:* The state transitioned from TFG dominance to OFG and TNFG. During this period, OFG has increased by more than 50%, owing primarily to the increased share of vegetables (17900 ha.) and total spices & condiments (3800 ha.), followed by total sugar (1500 ha.) and fruits (1200 ha.).

- *Meghalaya:* OFG Surpassing TFG, we observed a shift from TFG to OFG, particularly spices & condiments, fruits, and vegetables. Pulses, other cereals under TFG, and oilseeds in TNFG contribute to diversification. It is fair to say that total spices & condiments and fruit cultivation have significantly contributed to steady diversification.
- *Mizoram:* The state scored the best in crop diversification (HHI 0.36) in 2015–2016. Its transition from a highly mono-crop TFG cultivate state to dominance in OFG and TNFC has resulted in its diversification parameter. Significant cultivation of spices and condiments, fruits, and vegetables drives diversification.
- *Nagaland:* Nagaland continues to be dominated by TFG with limited diversification. The state dominated under the area of TFG (89.33%) is the third-highest among the selected NER and ER states after Bihar (95.60%) and Odisha (94.30%). Increase in other cereals and paddy cultivation, decline in pulses and oilseeds. Between 2005–2006 and 2015–2016, the GCA of spices & condiments (11900 ha.) and vegetables decreased (17900 ha.).
- *Tripura:* The state maintains balanced diversification with significant TFG, OFG, and TNFG shares. The share of OFG shows a slight decline, but GCA for fruits (252), vegetables (71), and total spices and condiments (1300) have expanded. With the most significant share by TNFG, GCA further improved most by rubber (55400 ha.) and oilseeds (8700 ha.) and declined in tea (5200 ha.) and jute (700 ha.).
- *Sikkim:* The state witnessed the transition from TFG to OFG, focusing on fruits and vegetables. This state has the second-largest share of OFG (44.05%) after Meghalaya (48.56%). The state has significantly changed its cropping pattern from TFG toward OFG. Fruits and vegetables contribute significantly to diversification.
- *Odisha:* Odisha is heavily dominated by TFG with limited diversification. Decreased cultivation of fruits, vegetables, sugar crops, and spices & condiments led to limited diversification. Odisha is one of the states that has not only lagged the national average in HHI over the study period, but the gap has widened. The second-largest state in this region, with a large share of the TFG area (94.30%) after Bihar (95.60%). During the study period, the state gained the GCA for TFG by 2.39%. The state has lost its cultivable area due to extreme weather and climatic conditions.
- *Bihar:* Since the 2005–2006 census information is unavailable for Bihar, we could not measure the changes in the cropping pattern. The largest share of TFG impacts the state diversification value and remains specialised. From 2005–2006 to 2015–2016, the share of TFG increased from 88.26% to 95.60%.
- *West Bengal:* There has been a significant increase in OFG cultivation, especially vegetables and fruits. Other cereals have grown, paddy has declined, and oilseeds have increased significantly. There has been a shift towards vegetable cultivation on a large scale. West Bengal has shifted a

large area under the cultivation of vegetables (334000 ha.), the maximum in the country.

The story of NER and ER states shows diverse cropping patterns and trends. Meghalaya and Mizoram have shifted crop area most towards cultivating spices & condiments compared to fruits and vegetables. Arunachal Pradesh, Manipur, Assam, Sikkim, and West Bengal experienced extensive diversification towards cultivating vegetables and fruits rather than other high-value and commercial crops. In Nagaland, the area has declined mostly under spices & condiments, and vegetables. In Odisha and Bihar, crop cultivation shifted towards monocrop, which was dominated mainly by TFG. These two states lost most of GCA under most OFG crops, leading to specialisation.

Conclusion

This article identifies specific crop groups leading to crop diversification or specialisation that are important for crop-specific policy support. We emphasise crop diversification and identify crops leading to diversification or specialisation for NER and ER states. The demand for high-value crops is rapidly growing more than staple crops. Crop diversification towards high-value crops can potentially increase farm income, especially in India, where smallholders dominate the farming community. There is a long-standing debate on the ability of smallholders' dominant subsistence agriculture economy to shift toward high-value crops, which reveals a pro-smallholder bias (Birthal et al., 2007). The high-value primary fruits and vegetables are perishable and need urgent management and farm support. So, the performance of smallholders in changing high-value crops would depend on the availability of farm services, including high-yield seeds, fertilisers, irrigation, transport, cold storage, market, and capital support.

The NER and ER states rapidly shifted crop patterns towards cultivating high-value crops. With the changing cropping pattern and demand-driven agriculture practice, smallholders' participation in high-value crops will be crucial for agriculture development in India, where smallholders are expected to grow with fragmentation. The NER and ER states are already facing acute agriculture disadvantages, where the land allocation for high-value crops, predominantly fruits and vegetables, is rapidly growing, raising concerns about smallholders' performance. Smallholders are resource-poor in cultivating high-value crops, and this region lacks advanced farm services. Public investment in supply chain and farm service development will be crucial for future agriculture development. Recently, the government of India (GoI) has launched an initiative, namely the 'One District One Product (ODOP)' approach, to acquire the advantages of economies of scale to access inputs, common services, and marketing of produce (MoFPI). This policy has focused on the NER region, which may keep the cropping pattern in mind. This scheme includes crops, primarily fruits and vegetables;

however, more investment in the value chain development is needed as the production of fruits and vegetables is projected to be grown rapidly in India and the NER region.

Although the country has improved in nutrition indicators, it still has a large percentage of the population deprived of nutrition (Gopalan, 2013; Gulati & Roy, 2021). While nutrition outcomes depend not only on the availability of diverse food or crop diversification, other factors like income, education, health facilities, etc., also matter. We further explored crop diversification and found positive relations between income (value of crop output) and traditional nutrition indicators (stunting, wasting, and underweight). States with a better position in crop diversification have better conditions in crop income and nutrition indicators (see Table A3 and Figure A1). Considering rural and agricultural households that primarily depend on crop production, diversification can improve their economic and nutrition conditions. Policy focuses on improving nutrition and must also consider this situation of agricultural diversification. Considering the dominance of smallholder farmers in the NER and ER regions, with the changing cropping patterns towards high-value crops, policy needs to be designed to support through infrastructural development and farm services, giving regional priorities in cropping patterns rather than designing a centralised framework. Moreover, the movement of cropping patterns towards specialisation in Odisha and Bihar raises concerns about the ER region's nutrition security and economic development.

Since West Bengal has shifted most GCA under vegetables led by potatoes, we were eager to see how smallholders gain under contract farming as the recent government is promoting corporate-friendly policies in the name of agricultural development. A recent article (Barik & Bedamatta, 2023) highlights that contract farming fails to provide better returns to potato farmers at production loss and price movements. So, policy focus must be given regional priorities, and smallholders' interests must be protected. Nowadays, the government promotes those practices and is expected to encourage private sector participation in agriculture to boost smallholders' income and production, particularly in ER and NER states where smallholders dominate. The benefits and performance of smallholders under contract farming and FPOs need to be examined for this region.

Appendix

Figure 1 shows the relationship between diversification and the value of output from crops. States geared towards specialisation show that the value of crop output, the major income source for agricultural households, has declined. The second graph shows that the percentage of the population in stunting is increasing towards specialisation. Similarly, wasting and underweight percentage of the population at the state level has increased where states are in specialisation or closed to it.

Table A1. Diversification (HHI) at State/UTs During 1990–1991 to 2015–2016.

Sl. No.	State/UTs	HHI 1990–1991	HHI 2005–2006	HHI 2015–2016
1	Andhra Pradesh	0.44	0.44	0.43
2	Arunachal Pradesh	0.66	0.68	0.43
3	Assam	0.60	0.63	0.58
4	Bihar	0.79	NA	0.92
5	Chhattisgarh	NA	0.94	0.91
6	Goa	0.39	0.35	0.40
7	Gujrat	0.45	0.45	0.46
8	Haryana	0.60	0.63	0.71
9	Himachal Pradesh	0.79	0.73	0.68
10	J & K	0.66	0.81	0.75
11	Jharkhand	NA	NA	0.79
12	Karnataka	0.49	0.50	0.47
13	Kerala	0.39	0.45	0.47
14	Madhya Pradesh	0.62	0.49	0.53
15	Maharashtra	0.55	NA	0.42
16	Manipur	0.95	0.74	0.57
17	Meghalaya	0.72	0.50	0.46
18	Mizoram	0.89	0.56	0.36
19	Nagaland	0.92	0.58	0.81
20	Odisha	0.90	0.85	0.89
21	Punjab	0.65	0.69	0.78
22	Rajasthan	0.54	0.50	0.46
23	Sikkim	0.60	0.51	0.45
24	Tamil Nadu	0.41	0.45	0.47
25	Telangana	NA	NA	0.43
26	Tripura	0.54	0.43	0.43
27	Uttar Pradesh	0.70	0.72	0.75
28	Uttarakhand	NA	0.68	0.70
29	West Bengal	0.59	0.56	0.53
30	A & NIS	0.39	0.38	0.37
31	Chandigarh	0.56	0.45	0.49
32	D & NH	0.75	0.85	0.91
33	Daman & Diu	0.56	0.77	0.68
34	Delhi	0.65	0.79	0.65
35	Lakshadweep	0.63	1.00	0.84
36	Puducherry	0.55	0.60	0.53
	India	0.63	0.53	0.52

Source: Author(s) calculation based on Agriculture Census 1990–1991, 2005–2006, 2015–2016.

NA- data not available.

Table A2. Changes in the Gross Cropped Area of Different Crops in NER and ER States (2005–2006 to 2015–2016).

	Total Food Grains (TFG)										Total Non-food Grains (TNFG)								
	Cereals					Other Food Grains (OFG)						Fibres		Plantation Crops					
State	Paddy	Wheat	Other Cereals	Total Pulses	Total	Total Sugar	Total Spices & Condiments	Total Fruits	Total Vegetables	Total	Total Oilseeds	Cotton	Jute	Tea	Coffee	Rubber	Other	Total	Gross Cropped Area
Arunachal Pradesh	–400	–8	203	97	–108	10	230	134	443	817	31	0	0	47	0	1	97	176	884
Assam	143	–303	145	95	80	–9	258	243	320	812	250	–3	–110	257	65	23	152	634	1509
Manipur	–267	1	19	20	–227	15	38	12	179	243	52	0	0	0	0	0	0	52	68
Meghalaya	34	2	41	82	159	1	364	286	29	680	25	2	5	1	0	8	19	60	899
Mizoram	–350	0	9	0	–341	4	82	75	36	197	37	0	0	0	–1	31	104	171	26
Nagaland	948	–10	1720	–403	2255	–5	–119	–7	–179	–310	–57	–1	9	13	3	23	–83	–93	1852
Tripura	1021	–3	20	16	1054	–1	13	252	71	335	87	–3	–7	–52	–1	554	–170	408	1795
Sikkim	–67	–62	–53	9	–173	0	–15	71	36	92	–4	–1	0	0	2	0	2	–1	–83
Odisha	–3239	–40	–449	-2593	–6321	–129	–33	-495	–245	–902	–918	70	–44	0	0	0	–112	–1004	–8227
West Bengal	–1961	–258	307	-226	–2138	–54	–298	701	3440	3788	520	–3	–998	–350	0	0	–63	–894	757

GCA in '00' ha.

Source: Author(s) calculation based on Agriculture Census 2005–2006, 2015–2016.

Table A3. Distribution of Diversification, Value of Output and Nutrition Indicators (2015–2016).

State Under Zone	Diversification	HHI (2015–2016)	Value of Output (Crop)	Stunting (%)	Wasting (%)	Under weight (%)
Highly diversify zone	Mizoram	0.36	89.25	29.84	7.91	13.69
	A & N	0.37	242.78	26.3	15.92	20.76
	Goa	0.4	134.18	20.11	20.37	23.02
	Maharashtra	0.42	47.37	36.06	25.18	37.3
	Andhra Pradesh	0.43	81.89	32.05	17.01	32.05
	Arunachal Pradesh	0.43	95.18	29.86	16.77	18.46
	Telangana	0.43	63.17	29.62	19.32	30.11
	Tripura	0.43	85.75	25.17	17.76	25.17
	Sikkim	0.45	118.16	29.4	15.37	14.81
Moderate diversify zone	Gujarat	0.46	94.86	39.85	28.07	41.37
	Meghalaya	0.46	8.25	43.84	15.62	29.17
	Rajasthan	0.46	39.47	38.81	23.83	37.21
	Karnataka	0.47	51.73	37.89	24.95	36.03
	Kerala	0.47	200.28	19.6	16.11	16.6
	Tamil Nadu	0.47	108.14	27.06	20.23	24.71
	Chandigarh	0.49	80.56	29.89	10.92	25.29
	Puducherry	0.53	101.7	26.46	17.25	21.16
	West Bengal	0.53	98.89	33.8	20.85	33.33
	Madhya Pradesh	0.53	47.06	42.19	26.26	43.55
	Manipur	0.57	125.69	30	7.02	13.96
	Assam	0.58	90.62	35.99	16.02	28.4
Less diversify zone	Delhi	0.65	135.84	29.96	17.99	26.38
	Himachal Pradesh	0.68	20.04	25.54	14.38	20.83
	Daman &Diu	0.68	20.04			
	Uttarakhand	0.7	73.38	33.05	19.97	26.62
	Haryana	0.71	66.45	34.08	21.66	30.2
	J & K	0.75	97.85	28.42	11.45	16.76
	Uttar Pradesh	0.75	60.22	45.91	17.8	38.91
	Punjab	0.78	75.58	25.39	15.47	21.3
	Jharkhand	0.79	87.62	44.9	29.64	48.07
Specialised	Nagaland	0.81	57.86	28.99	11.58	16.94
	Lakshadweep	0.84	242.78	26.33	13.52	22.42
	Odisha	0.89	57.27	34.83	21.73	35.76
	Chhattisgarh	0.91	45.4	38.38	24.25	39.15
	D & NH	0.91	45.45	35.38	24.2	33.3
	Bihar	0.92	58.38	48.41	21.47	44.63

Source: Author(s) calculation based on Agriculture Census (2015–2016) and NFHS-4 (2015–2016).

NB: Crop diversification has a positive relationship with income and nutrition indicators. The state's traditional nutrition indicators, that is, stunting, wasting, and underweight, have declined toward specialisation (see Figure A1).

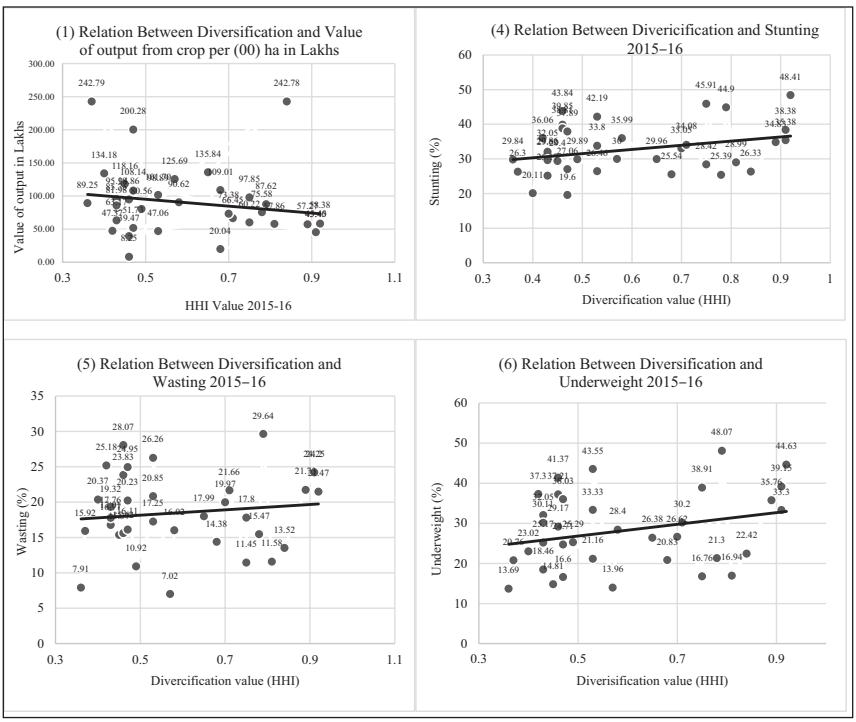

Figure A1. Crop Diversification and Nutrition Indicators State-level Status (2015–2016).

Source: Author(s) own scheme based on Agriculture Census 2015–2016 and NFHS-4 (2015–2016) data.

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Note

1. Recently Government of India has taken several initiatives under the PLISFPI scheme (see the details: https://mofpi.gov.in/) to promote food processing industries and link production and ensuring remunerative prices of farm produces and higher income to farmers.

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Article

Digital Technology Adoption as a Game Changer for Community-based Tourism (CBT) Homestay Operators: A Qualitative Investigation

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Abstract

Malaysia's tourism industry has incorporated digital technology to attract, inform and serve travellers, but its adoption is limited among community-based tourism (CBT) providers. Because of its importance in the tourism industry, exploring the factors that trigger or hinder the adoption of digital technology among CBT operators is essential. A qualitative approach was utilised, and semi-structured interviews were conducted with 35 CBT homestay operators selected through purposive sampling. The study found differences in the perception and usage behaviour of tourism-related technology among homestay operators. They find digital technology has improved their business operation efficiency and revenue performance. By improving internet connectivity and access to digital resources, homestay operators will be better positioned to utilise digital technology effectively, facilitating improved communication and marketing strategies. Besides, implementing targeted training programmes to enhance homestay operators' digital literacy is crucial. The study also identified specific challenges that hindered homestay operators' use of digital technology. Study implications and limitations are also discussed.

Keywords

Community-based tourism, homestay, digital technology, adoption, Malaysia

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Introduction

Digital technology is crucial in transforming the global tourism industry, creating new opportunities and expectations for operators and travellers. It reshapes industry structures, enabling travellers to quickly identify, customise and purchase tourism products. This digital shift strengthens the industry's globalisation by providing universal tools for developing, managing and distributing offerings. For tourism businesses, it opens new avenues to engage customers, streamline operations and deliver personalised, enhanced experiences (Buhalis & Law, 2008; Gössling, 2020; Kourtit et al., 2011; Muhammedrisaevna et al., 2020).

The increasing applications of digital technology in the tourism industry, without a doubt, improve the competitiveness among tourism organisations and destinations. Digital technology provides a powerful tool that enlightens benefits in promoting and strengthening the tourism industry's strategy and operations (Gan et al., 2018). Perhaps it has become one of the key success determinants among the tourism businesses in the 21st century. The developments in digital technology abilities, paired with the improvisation of the size of the equipment and costs, evidently improved the reliability, compatibility and interconnectivity of numerous tourism terminals and applications (Janjua et al., 2021). For example, in several tourism sectors ranging from e-airlines, e-hospitality, e-tour operators and e-travel agencies to e-destinations, the advancement, integration and usage of digital technology among travellers have benefited significantly in obtaining information, making reservations and sharing experiences (Bethapudi, 2013; Gössling, 2020; Muhammedrisaevna et al., 2020).

Since tourism is primarily visual, digital technology is also used to commercialise urban and rural tourism destinations by conveying vacation spot images to tourists (Choi et al., 2007; Greaves & Skinner, 2010). Regarding rural tourism, various governments of the world, either developed or developing countries, are continuously taking heed in diversifying the tourism industry, as well as playing active roles in managing economic activities to increase the local communities' incomes (Chin et al., 2014; Nooripoor et al., 2021). Spenceley and Meyer (2012) highlight that digital technology can cultivate micro-enterprise tourism within rural destinations, which complements and promotes local-level businesses as community-based tourism (CBT) products to reduce poverty and help conserve rural cultural and natural resources. Besides, the digital technology introduction expands their opportunities and uplifts performance (Murniati et al., 2023; Priatmoko & David, 2021; Promburom, 2024; Van Tran et al., 2023). It enhances the attractiveness of rural tourism in terms of promoting tourism resources, establishing independent businesses, developing new products, increasing tourists and foreign income, and ultimately contributing to economic development (Cheuk et al., 2017; Choi & Turk, 2011; Kourtit et al., 2011; Marschall, 2015).

Digital technology is deemed advantageous in more ways than one since its adoption has already proven to benefit other types of niche tourism sectors (Bethapudi, 2013; Buhalis & Law, 2008; Choi & Turk, 2011; Gössling, 2020; Kourtit et al., 2011; Marschall, 2015; Muhammedrisaevna et al., 2020). However, Malaysian CBT providers rely heavily on conventional word-of-mouth (WOM) or

direct contact (through phone calls or emails) for bookings or related information-related activities. Within the theoretical understanding, Janjua et al. (2021) did a systematic literature review of past studies on homestay sustainability. Past studies have looked at ecological and cultural aspects of the visitor experience (Bhuiyan et al., 2012; Dey et al., 2020; Tiberghien et al., 2018), the local community in the management of homestays (Bhalla et al., 2016; Reimer & Walter, 2013; Towner, 2016), creative tourism in CBT (Blapp & Mitas, 2017), community-based agritourism (Addinsalla et al., 2016; Agyeiwaah, 2020; Bhatta & Ohe, 2019), responsible rural tourism (Nair & Hussain, 2013; Ponnan, 2013; Tay et al., 2016), and tourist's satisfaction and perceived value in community-based homestays (Jamal et al., 2011; Rasoolimanesh et al., 2016; Zhao et al., 2022). Although digital technology plays a significant role in the operations of tourism operators, no studies are focusing on CBT homestay operator perception and usage of digital technology, particularly in the Asia Pacific region (Asyraff et al., 2024; Janjua et al., 2023).

Understanding the triggering factors and perceived challenges can help CBT homestay operator identify the gaps in the adoption process and provide insights to improve their competitiveness. Besides, by exploring the triggering factors and perceived challenges of digital technology adoption, policymakers and industry practitioners can identify areas where technology can be leveraged to achieve sustainability goals. In addition, exploring the triggering factors and perceived challenges of digital technology adoption among CBT homestay operators can help identify the challenges rural areas face in adopting digital technology. This information can be used to develop policies and strategies to address the digital divide issues. In summary, exploring the triggering factors and perceived challenges of digital technology adoption among Malaysian CBT homestay operators is vital to enhancing their competitiveness, increasing CBT's sustainability, supporting tourism industry growth and addressing digital divide issues. These arguments warrant further investigation, especially on the triggering factors and perceived challenges of digital technology adoption among Malaysian CBT homestay operators.

Literature Review

Community-Based Tourism

Considered one of the popular CBT products, the homestay programmes offer sustainable economic systems since they encourage the rural community to get involved in the tourism industry to stimulate economic activities that provide continuous revenues to the local communities (Acharya & Halpenny, 2013; Samsudin & Maliki, 2015; Walter et al., 2018). This niche CBT homestay sector involves high interactivity of contacts between the visitors and hosts (Reimer & Walter, 2013; Walter et al., 2018), where the two-way information communication happens to start from the hosts reaching their prospective visitors through promotions of the homestay's, inquiries from the potential visitors, booking and reservations until the visitors come physically to the place or even getting feedbacks from them after they return to their place.

Acharya and Halpenny (2013) investigate women-managed homestays in Nepal as alternative tourism products that promote community well-being, empowering women and fostering local economic growth. Samsudin and Maliki (2015) critically review how cultural landscapes are preserved through homestay programmes in Malaysia, contributing to sustainable tourism. Meanwhile, Walter et al. (2018) examine host learning in community-based ecotourism in Nepal, highlighting the educational and social benefits for hosts in Sirubari and Ghalegaun homestays. Together, these studies underscore the importance of homestay programmes for sustainable community-based tourism and cultural preservation.

Scholars also collectively agreed that the fundamental nature of the CBT involves the local community in certain tourism development (Bhuiyan et al., 2013; Halstead, 2003; Harris, 2009; Jamaludin et al., 2012; Kayat, 2014; Mohamad & Nasir, 2019; Mohd Rafee et al., 2012; Pakshir & Nair, 2011; Peaty, 2009). It is a tourism project coordinated by the locals. It allows them to work with respective parties, visitors and hosts (Asker et al., 2010). It brings people through some communal obligations and the ability of representative bodies to make collective decisions (Jamaludin et al., 2012). The fundamental characteristics include local ownership of development efforts, active engagement at all project progress levels and a genuine host-guest connection. Economic and social benefits include rural development and poverty eradication (Goh, 2015; Müller et al., 2020; Salazar, 2012), enforced indigenous cultural traditions (Kayat, 2011; Lenao, 2015), empowered rural communities (Salazar, 2012), cross-cultural communication (Kayat, 2014) and improved the household income (Lenao, 2015).

CBT programmes play a significant role in promoting sustainable development, particularly in areas abundant with natural resources. These programmes are designed to leverage the unique attributes of local environments while fostering community engagement and economic empowerment. Research indicates that CBT initiatives are primarily implemented in regions rich in natural resources, providing a foundation for diverse tourism products. These offerings include homestay services, local cuisines, beverages and various indoor and outdoor activities (Benur & Bramwell, 2015; Hussin & Kunjuraman, 2014). Outdoor activities such as trekking, camping and strolls are prevalent among tourists, as they allow visitors to immerse themselves in the natural beauty of these regions. In contrast, indoor activities often feature traditional practices such as cooking and weaving, which offer a glimpse into the local community's cultural heritage (Jugmohan et al., 2016).

The success of CBT programmes is further influenced by the active participation of local communities in tourism development. Goodwin (2005) posits that enhancing the status of rural areas is most effective when local community engagement is maximised. This engagement is essential for ensuring fairness in the distribution of resources and opportunities, ultimately leading to a more holistic community transformation. However, several critical factors must be considered to ensure the efficacy of CBT initiatives. Ashley et al. (2001) identify key elements that affect the success of CBT, including market access, commercial viability, policy framework and implementation challenges. First, access to markets is often hindered by geographical limitations, economic hierarchies and

social constraints that affect the ability of marginalised groups to participate in tourism (Ashley et al., 2001). Second, commercial viability depends on factors such as product quality, pricing, branding and the overall strength of the destination, alongside available financial resources. Furthermore, a supportive policy framework encompassing land tenure, regulatory environments and government attitudes is vital for fostering a conducive atmosphere for CBT. Lastly, the challenges of implementation cannot be overlooked. Addressing skill gaps, managing costs and expectations and optimising stakeholder participation is critical for the success of CBT initiatives. CBT can contribute to sustainable economic development by focusing on these elements while preserving rural areas' cultural and environmental integrity.

The Malaysian Homestay Experience Programme (MHEP)

As part of the CBT concept and since 1995, the MHEP under the Ministry of Tourism, Arts, and Culture (MOTAC) is executed, which aims to increase the participation of the rural community in tourism, boost the incomes and a way to reduce the rural–urban migration (Chin et al., 2014; MOTAC, 2010; Nooripoor et al., 2021). MHEP is designed for domestic and international tourists, encouraging them to embrace and experience the diversity of Malaysian sociocultural, artistic and culinary norms and discover a more straightforward way of life in the countryside (Pusiran & Xiao, 2013). The MHEP is unique since it exposes tourists to the daily routines of a local family and Malaysian culture (Jamal et al., 2011). The MHEP is also a promotional tool for Malaysia's unique culture and heritage (Balasingam & Bojei, 2019; Ibrahim & Razzaq, 2010; Kayat, 2014; Kumar et al., 2012). In addition, the MHEP enables employment opportunities for the communities involved (Leh & Hamzah, 2012), benefits the residents in terms of foreign language skills (Ahmad et al., 2013) and public facilities and infrastructures (Ibrahim & Ahmad, 2009; Ibrahim & Razzaq, 2010; Leh & Hamzah, 2012).

As of June 2020, there were about 4,289 homestay operators with 222 clusters and 6,088 rooms, and the increment, however, was slightly slow in 2021 due to the pandemic COVID-19 (Mohamad & Nasir, 2019). Integrating digital technologies into CBT homestays in Malaysia presents a transformative opportunity for local operators yet unveils significant challenges. Studies show that while digital literacy is crucial for enhancing marketing strategies and operational efficiency (Janjua et al., 2023; Murniati et al., 2023), many rural homestay operators still lack essential skills in digital platforms. This gap limits their potential to reach broader markets and engage effectively with tourists. Additionally, the reliance on social media for promotion raises concerns about market saturation and the ability of smaller operators to compete with more prominent players (Hussin & Buchmann, 2019). Despite these challenges, the effective use of digital tools can significantly enrich the tourist experience, facilitating more significant cultural exchanges and local economic benefits (Anuar & Qian, 2024). Thus, while digital technologies hold promises for the CBT sector, a concerted effort is necessary to equip local operators with the skills and resources needed to thrive in an increasingly digital landscape.

Methodology and Data

A qualitative approach through the interview is applied for information gathering. The subject and unit of analysis were among the CBT homestay operators registered with the MOTAC under the MHEP. A purposive sampling strategy was used during the interview. A sample of 35 homestay operators, which included award-winning and non–award-winning, was predetermined and subsequently contacted via telephone, obtaining permission to be interviewed. The interview dates and times were then arranged based on their convenience and wishes, which required unlimited flexibility on the researcher's part.

Open-ended semi-structured interview questions were designed to obtain in-depth information. Questions were employed to discover rather than prescribe to prevent any biased responses. The subject guide was constructed based on the study's goal and the relevant literature search. A list of the primary questions derived from the subject guide is shown in Table 1. The interview questions range from the demographic profile, perception of digital technology, the importance of digital technology adoption and the extent of digital technology adoption among Malaysian CBT homestay operators. The semi-structured questions were administered in Malaysia and then translated into English by language experts.

Before the interviews, each homestay operator was informed that their participation was voluntary, all information provided would remain strictly confidential and their identities would not be disclosed. Face-to-face interviews were conducted in compliance with the written consent of 35 homestay operators. These face-to-face interviews, which lasted one and one-and-a-half hours, were conducted at locations convenient to the operators, ensuring flexibility in scheduling. The interviewees' ages ranged from 35 to 56 years old, most of whom were homestay owners. They have had more than seven years of experience in the homestay business.

Table 1. Interview Questions.

Research Objectives	In-depth Interview Questions
RO1: To identify the perception of digital technology among CBT homestay operators	• What do you understand about digital technology usage in tourism? • How would you perceive digital technology in your business?
RO2: To understand the adoption and usage of digital technology among CBT homestay operators	• Could you explain the level of adoption of digital technology in your homestay operation? • Could you explain the level of digital technology usage in Homestay operations?
RO3: To explore the roles of digital technology in homestay business performance	• What are the roles of digital technology in homestay business performance?

Source: Researcher postulation.

Each interview was recorded with prior written consent and transcribed immediately after completion to capture details such as hesitance, background noise and language nuances, reducing biases as per Bryman's (2016) recommendation. The interview guide, comprising open-ended questions, was designed to elicit the operators' perceptions of digital technology, its importance and the extent of its adoption. The coding was performed manually, and qualitative data analysis was conducted using ATLAS.ti version 8 ensued. The research themes and subthemes were revealed using inductive and deductive approaches. The codes were categorised, and the primary domains were discovered. To ensure content validity, the verification of homestay operators and the related processes involved were well-documented. The inter-rater reliability tests were shown to be acceptable.

Results and Discussion

Table 2 summarises the thematic qualitative analysis findings on the perception, adoption and role of digital technology among CBT homestay operators.

Awareness of Digital Technology Usage in Tourism

Most homestay operators perceive digital technology primarily as a communication method involving technological devices such as computers, smartphones and internet-based applications. They recognise the internet as essential for improving

Table 2. Thematic Analysis Summary.

Theme	Sub-theme	Findings	Literature Support
Awareness of digital technology usage	Communication tool	Homestay operators see digital technology primarily as a communication method. They utilise devices like smartphones and internet applications for efficient connectivity.	Beed and Sarkar (2017); Greenberg (2005)
	Business efficiency	All operators acknowledge digital technology's role in enhancing efficiency, particularly in managing bookings and customer inquiries. Social media is vital for marketing.	Buhalis and Law (2008); Hong et al. (2010)

(Table 2 continued)

(Table 2 continued)

Theme	Sub-theme	Findings	Literature Support
Digital technology and homestay operation	Marketing and promotion	Reliance on social media platforms like Facebook and Instagram signifies a shift in marketing strategies, enhancing global reach and customer engagement.	Kane et al. (2012); Gunelius (2011)
	Communication	Digital technology enhances communication efficiency, facilitating faster and more reliable customer interactions.	Subramaniam et al. (2019)
Digital technology and homestay business performance	Increase business performance	Operators credit digital technology with improving business performance by driving bookings, enhancing customer service and generating positive reviews.	Robbins and Coulter (2021)
	Revenue performance	Digital technology is crucial in increasing revenue through online marketing and social media, enhancing visibility and booking demand.	Nyangarika and Ngasa (2020)

Source: Researcher postulation.

communication efficiency and connectivity, aligning with the 'world without borders' concept. The operators emphasised how digital technology facilitates swift, global communication, benefiting their homestay businesses.

Communication Tool

Understanding digital technology as a primary communication tool among homestay operators highlights technology's limited but practical adoption in daily operations. Most operators perceive digital technology as essential for maintaining

connectivity, mainly through internet services and communication applications like WhatsApp. Their reliance on basic communication platforms such as WhatsApp reflects a functional, yet minimal, engagement with the broader capabilities of digital technology. While some operators acknowledge the benefits of social media for business promotion, their understanding and utilisation of digital technology remain somewhat constrained by factors such as age and technological literacy. For instance, Homestay Operator 5's comment, 'Always heard about digital technology, but at my age, I am left behind. Mostly, I use it for communication, like WhatsApp with tourists', suggests that generational barriers may limit the adoption of more advanced digital tools. Similarly, Homestay Operator 10 recognises the value of the internet but primarily associates it with social media for promotional purposes.

> I've always heard about digital technology, but at my age, maybe I am quite left behind. Mostly, it is for communication, the internet, WhatsApp with the tourists…. (HO5)

> I understand its concept. The current trend is using the Internet. This is a value-added feature for my business. I use social media for my homestay business…. (HO10)

These perspectives align with existing literature, which defines digital technology as encompassing a range of communication devices and systems, from the internet to telecommunications (Beed & Sarkar, 2017; Greenberg, 2005). However, the operators' limited use of digital technology, focusing predominantly on communication, suggests that while they recognise its value, there may be missed opportunities for leveraging digital technology to enhance operational efficiency and customer engagement more comprehensively. This underscores the need for targeted training and support to broaden digital technology adoption beyond communication, allowing homestay operators to harness its potential for full business growth (Gan et al., 2018; Pratt, 2019).

Business Efficiency

All operators acknowledged digital technology's vital role in enhancing business efficiency, particularly in managing bookings and customer inquiries. Digital technology helps streamline operations, making booking, promotion and customer communication more efficient. Many operators noted the significance of social media for marketing, with some hiring staff specifically to manage digital tools. For example, Homestay Operator 12 reported, 'Digital technology benefits my business. I use Facebook and Instagram for promotion'. Similarly, Homestay Operator 7 emphasised, 'Digital technology reaches beyond word-of-mouth marketing, helping me reach global clients'.

> In any business, digital technology is beneficial. Now, anyone can learn about my business. I use the Internet, Facebook, and Instagram to promote my business and activities…. (HO12)

> Yes, digital technology is crucial in this digital era. I am actively using them. Business is in good shape with digital technology. I am not the one who manages it, but my daughter…. (HO11)

> …digital technology aids homestay business. WOM would only reach limited clients, while digital technology has no limitations. I can reach all my potential clients easily…. (HO7)

This is consistent with findings that digital technology enables businesses to improve operational efficiency, especially in tourism, where innovations like online booking and virtual communication enhance service delivery (Buhalis & Law, 2008; Murniati et al., 2023; Priatmoko & David, 2021; Van Tran et al., 2023).

Digital Technology and Homestay Operation

Acknowledging digital technology's vital role in enhancing business efficiency by all operators underscores its transformative impact on the homestay sector. Digital technology has streamlined critical processes, including managing bookings, promoting services and communicating with customers. By simplifying these functions, digital technology enhances operational efficiency and expands market reach, a key factor for homestay businesses.

As Homestay Operator 12 pointed out, social media platforms like Facebook and Instagram have become indispensable for marketing, allowing operators to connect with global clients. This shift from traditional WOM marketing to digital platforms signifies a paradigm shift in how small-scale businesses promote their services, as highlighted by Homestay Operator 7. Furthermore, operators without technical expertise often delegate digital technology management to younger family members, as seen in Homestay Operator 11's case. This highlights a generational divide in technological adoption and points to the importance of having a tech-savvy individual in the business. Such delegation enables operators to maintain a competitive edge in the digital age.

> Yes, I use only the basic devices. Computer, internet, and mobile phones, the latest is a booking platform specialized in homestays named jomehomestay. my. This online platform receives and manages bookings, a payment gateway, promotion, and activities arrangement…. (HO3)

> I am using my handphone to manage my homestay business, especially on the bookings. Since I am illiterate due to age factors, family members and the young ones aid in gradually updating the information on my Facebook page…. (HO15)

> I could only use the basic ones due to poor connection. …. otherwise, few advanced features could be adopted…. (HO10)

This aligns with the literature on digital technology's role in tourism, where it is recognised as a critical enabler for improving efficiency and service delivery (Buhalis & Law, 2008; Murniati et al., 2023; Van Tran et al., 2023). Digital

technology's ability to transcend geographical boundaries through online booking and communication tools is particularly beneficial in the homestay industry, allowing businesses to reach a broader international audience (Hong et al., 2010). Consequently, integrating digital technology has enhanced operational efficiency and allowed homestay operators to scale their businesses beyond traditional limitations, providing them with a significant competitive advantage.

Marketing and Promotion

Operators' reliance on social media platforms such as Facebook and Instagram to promote homestays highlights a significant shift in CBT's marketing strategies. These platforms offer unparalleled advantages, allowing operators to reach a global audience quickly, far surpassing the limitations of traditional marketing methods like pamphlets, which are often geographically restricted and slow to distribute. Social media lets homestay operators upload images, videos and client reviews, fostering real-time interaction with potential customers. The interactive nature of social media also facilitates direct communication, enabling homestay operators to engage with inquiries and bookings instantly, contributing to an efficient customer journey.

Homestay operators have diversified their marketing channels by incorporating online booking platforms such as Booking.com and Agoda.com, catering to a broader, international customer base. By leveraging these platforms, operators can ensure their offerings are visible to global travellers, which is essential for small-scale tourism businesses in rural areas with limited marketing budgets. As Homestay Operator 9 expressed, online booking platforms streamline the reservation process and enhance customer trust and convenience, leading to increased bookings.

> …I use basic digital technology, namely social media and mobile phones, in promoting my homestay and our natural activities. Most of the customers used these platforms in booking my homestay…. (HO15)

> …For now, Facebook, where I uploaded videos, pictures, and client reviews as my marketing strategy. Booking.com and Agoda.com are the latest marketing and bookings platform. (HO9)

> …We use social media for our village to promote our homestay business and outdoor activities like cooking, jungle tracking, caving, and fishing by creating the FB page. Those well-versed in digital technology are given tasks to update and maintain it. We could not survive without these marketing tools… Digital technology is a blessing for us…. (HO14)

Adopting digital technology, particularly social media and online booking systems, has allowed operators to market their natural and cultural activities more effectively, thereby driving business sustainability. This shift underscores the transformative role of digital technology in enabling small-scale tourism operators to compete in the global marketplace, making it a critical tool for the growth

and survival of homestays (Priatmoko & David, 2021; Promburom, 2024). Consequently, these findings align with Kane et al. (2012) and Gunelius's (2011) findings, emphasising how digital platforms revolutionise customer engagement and marketing.

Communication

Integrating digital technology in homestay operations significantly enhances communication between operators and clients, making interactions faster, more efficient and more reliable. Platforms such as WhatsApp allow operators to quickly confirm bookings, manage cancellations and respond to customer inquiries, streamlining the process and improving overall service quality. This convenience is critical in the tourism industry, where prompt communication can be a key differentiator in customer satisfaction and loyalty.

The transition from traditional communication methods, such as face-to-face interactions and phone calls, to digital platforms has revolutionised how homestays operate. As highlighted by Homestay Operator 4, 'Digital technology makes communication easier. Most matters are settled quickly', emphasising the immediacy and convenience digital technology brings to operational efficiency. Similarly, Homestay Operator 1 remarked on the transformation digital technology has facilitated, noting, 'Digital technology's role in communication has changed from face-to-face interactions to more digital forms, making operations more efficient'. These statements underscore digital technology's practical benefits, particularly for older operators who have witnessed this technological evolution.

> Digital technology is meant for communication. Connection with customers is much easier and more effective. Most importantly, matters are settled within a short period. Honestly, I am grateful for technology, which makes life easier.… (HO4)

> …Besides marketing, digital technology is an effective communication tool through many social media platforms. As a senior citizen, I can see the difference between our younger days and now.… (HO1)

These insights are consistent with research showing how digital technology facilitates business-to-business and social communication, transforming how businesses interact with customers. The adoption of digital technology not only improves communication but also strengthens customer relationships. Digital technology allows homestay operators to provide timely responses, manage expectations and foster professionalism, enhancing customer satisfaction. As noted in previous studies, digital technology's role in business-to-business and social communication is well-documented, showing its capacity to transform interactions (Subramaniam et al., 2019). This integration of digital tools is crucial for homestay operators to stay competitive, especially in an increasingly digital and globalised marketplace (Murniati et al., 2023; Van Tran et al., 2023).

Digital Technology and Homestay Business Performance

Increase Business Performance

Operators credited digital technology with significantly enhancing their business performance by driving increased bookings, improving customer service, generating positive reviews and attracting new clients. Homestay operators acknowledged that digital technology, particularly social media platforms like Facebook and Instagram, played a pivotal role in helping their businesses reach a wider audience, especially after the challenges posed by the COVID-19 pandemic. These platforms enabled operators to maintain relevance and visibility despite having limited resources.

For example, Homestay Operator 9 shared how digital technology boosted business growth, stating, 'Digital technology helps businesses move forward. Social media platforms significantly improved my business performance'. This highlights the role of digital marketing tools in creating opportunities for homestay operators to tap into new customer segments while maintaining relationships with existing clients through consistent online engagement. Moreover, positive online reviews contributed to the homestay's reputation, helping to attract potential customers.

Homestay Operator 13 emphasised digital technology's role in post-pandemic business recovery, noting, 'Digital technology helped my business bounce back after the pandemic'. This reinforces how essential digital technology has become in navigating business disruptions and adapting to changing market conditions. The ability to quickly resume operations, promote their services and communicate effectively with customers was largely facilitated by digital technology, as illustrated by the operator's remark: 'Honestly, the appearance of the internet, WhatsApp, Facebook, Instagram, and a few others soared my homestay business'.

> I cannot deny that digital technology helps businesses move forward. Honestly, the appearance of the internet, WhatsApp, Facebook, Instagram, and others soared my homestay business. I consistently received existing and new clients.… (HO9)

> Honestly…. with the digital technology, my homestay business was doing good. I could easily get customers, and our business performance was promising. However, business was prolonged during the period of the COVID-19 pandemic. Yes, now the business has bounced back. Digital technology makes it happen. (HO13)

This critical analysis aligns with the broader literature that recognises digital technology's transformative potential in enhancing business performance through innovation, customer-focused strategies and resilience in the face of market challenges (Murniati et al., 2023; Promburom, 2024; Robbins & Coulter, 2021).

Revenue Performance

The role of digital technology in increasing revenue among homestay operators was highlighted through the significant impact of online platforms and social media marketing. Homestay operators recognised that digital

technology was a powerful tool for reaching a broader audience, enhancing market visibility and ultimately driving higher booking demand. This is evident in Homestay Operator 1's remark about how platforms like WhatsApp, Facebook and Instagram improved their revenue performance, particularly during the post-pandemic endemic period. Similarly, Homestay Operator 3 emphasised the importance of targeted marketing, noting how focusing on specific demographics like lower and middle-income families resulted in positive revenue outcomes.

> … Digital technology is mainly used in many homestay operations for communication and marketing. Internet, WhatsApp, Facebook, and Instagram really heightened our revenue performance as many customers stayed and took activities at our homestay during the endemic…. (HO1)

> …knowing your target market is very crucial. I normally target families from lower and middle-income groups. My social media marketing focused on these groups. It works, as my revenue performance shows a positive indicator. (HO3)

These insights are consistent with broader research that supports the idea that digital technology is instrumental in helping small businesses increase their market reach and productivity (Nyangarika & Ngasa, 2020). By leveraging digital tools, homestay operators can promote their services more effectively and at a lower cost than traditional marketing methods. This creates a competitive advantage, allowing them to attract and retain more customers while keeping operational costs down. Additionally, digital technology facilitates better customer communication, improving the overall customer experience, which drives repeat bookings and positive WOM marketing (Promburom, 2024; Van Tran et al., 2023).

Policy Implications

This study undoubtedly provides an understanding of the perception, adoption and usage of digital technology among CBT homestay operators. In other words, it is revealed whether the Malaysian CBT homestay operators are to be left behind in digital technology applications or keep abreast with the technological advancement aligned with waves of modernisation. Thus, the findings significantly contribute to both academic and practical implications. From the lens of academics, many researchers have widely highlighted digital technology related to education, hospitality and tourism, maintenance management, business operations and rural development. However, the literature on digital technology adoption, mainly dealing with SMEs and CBT homestays, has not been holistically extended. Therefore, the findings of this study extend the body of knowledge and offer an opportunity for other researchers to explore the issue in a different study setting.

On practical implication, one thing that has always fascinated entrepreneurs or business owners, regardless of size, is getting benefits and profits through various business improvement strategies. Despite running a small business, the CBT

homestay operators perceived digital technology as crucially important and, thus, adopted and used some of the basic ones in their business. Those basic digital technology gadgets are used for promotional or marketing and communication tools, which leads to their business operation efficiency. This is considered a good move made by all CBT homestay operators, regardless of location, as they are not left behind but embrace the technological application together. Despite this, the homestay operators should not become complacent with the basic application, knowledge and what they have. Operators in all areas, rural in particular, should continuously upgrade their technical expertise and gain an in-depth understanding of the benefits of technology adoption in their business. Owners should at least understand and be able to apply digital technology rather than depend on others to manage it.

Another essential matter obtained and the remarkable finding is that various promotional tools and communication using different digital technology platforms have increased business and revenue performance. This finding supports the previous literature that every accommodation operation, regardless of location, is set up to win guests to stay and gain profit. The guest's stay is obtained through promotion and providing overall good services. Other determinants like comfortability, conducive environment and activities are also affected by guest inclinations. Thus, it is apparent that the level of business operation depends on the operators' ability to improve or maintain their marketing strategies. On the part of operations and management, the CBT homestay operators should seriously be looking at how to improve or maintain the digital technology mechanism in promoting their homestay. At the same time, they should reevaluate the service elements and other components in their operations to satisfy the customers and sustain their business over a long period. This is based on the notion that technology and services like micro-organisms are subjected to alteration or change, and the changes are always swift.

A broader implication drawn from this study is related to the government authorities. In this context, the proactive action undertaken by some government agencies in developing, upgrading and maintaining the infrastructures of urban and rural tourism, including the homestay programme, is a valuable and worthwhile initiative along with and without question that the homestay in the present day explicitly contributes to a good market. Thus, besides individuals and the community, the success and survival of the homestay business depend not only on the services but also on the application of digital technology to support the services and business operations. In addition to their efforts, the responsible authorities should continuously educate the homestay operators in technological marketing, accounting and operation. In other words, the authorities must always be active and forceful in organising frequent training, seminars and talks about digital technology closely related to the homestay business operation. Finally, it would be a significant loss and detrimental to the homestay operators and the responsible government agencies if there were no reciprocal relationship between all parties, as direct involvement of both parties is fundamental in creating harmonious business and prosperous future tourism development.

Conclusion

This study provides valuable insights into the critical role of digital technology in enhancing operational efficiency and improving revenue performance. Despite a limited adoption of advanced digital tools, all operators recognise digital technology as vital to their business operations. They primarily employ basic digital resources for promotional and marketing activities, indicating a growing awareness of the potential benefits of digital technology within this sector. For CBT providers, embracing modern digital solutions can significantly improve their ability to connect with potential guests and manage day-to-day operations.

Notably, enhancing the digital technology infrastructure in rural tourism areas is essential. By improving internet connectivity and access to digital resources, homestay operators will be better positioned to utilise digital technology effectively, facilitating improved communication and marketing strategies. Besides, implementing targeted training programmes to enhance homestay operators' digital literacy is crucial. These training initiatives should focus on effectively using digital marketing and operational management tools, empowering operators to fully harness digital technology's benefits. Policymakers should encourage collaboration between local governments, educational institutions and industry stakeholders to promote innovation in digital technology applications within the tourism sector. Providing grants or incentives for adopting advanced digital solutions can further facilitate the transition towards a more digitally oriented business model.

Overall, this study has contributed to the literature on digital technology adoption among CBT providers. It is hoped that the findings of this study will inform future research, policymaking and practice in CBT and digital technology adoption. Nonetheless, this study also has several limitations. The study's limitations include the small sample size, which limits the generalisability of the findings to a broader population of CBT operators. Additionally, the study may be subject to response bias, where participants may have provided socially desirable responses or may have been reluctant to disclose certain information. Future studies could consider using a larger sample size and a quantitative approach to complement the qualitative data obtained in this study. The study could also explore the perspectives of other stakeholders in the CBT industry, such as tourists and government agencies, to gain a more comprehensive understanding of the challenges and opportunities of digital technology adoption in CBT. Additionally, examining the impact of particular digital technology tools can enhance our understanding of their effectiveness. A focused study on how different tools—such as online booking platforms, social media and customer relationship management software—contribute to operational efficiency and customer engagement can yield actionable insights for homestay operators. By quantifying the effects of these tools on measurable performance indicators, such as booking rates and customer reviews, researchers can identify best practices for digital technology utilisation.

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Article

Addressing Wetland Flood Disasters Through Community-led Strategies in Bangladesh

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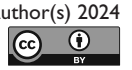
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Abstract

This study focused on mitigating wetland flood disasters in Bangladesh through community-led strategies, particularly in land-based minority communities. Wetland ecosystems, integral to the country's landscape, are increasingly vulnerable to floods exacerbated by climate change. Recognising the intersectionality of environmental challenges and community well-being led to proactively addressing the impacts of wetland floods. This study uses participatory methods to engage minority communities, particularly those in the wetland regions. Focusing on local community-engaged approaches, the research aims to develop community-led adaptive strategies. The study emphasises the active participation of community members in decision-making processes through a community-led approach, enhancing resilience and sustainability. The study also explores the role of women in these community-led initiatives, acknowledging their unique perspectives and contributions to adaptive strategies. Ultimately, the findings aspire to inform policy frameworks and global discourse on disaster resilience, offering insights into how community-led strategies can serve as effective models in mitigating the impact of wetland flood disasters and foster a sense of hope and optimism for the future.

Keywords

Minority, vulnerabilities, flood disaster, resilience, adaptions, mainstreaming

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Introduction

Bangladesh, situated in a geographically vulnerable position, faces significant challenges from climate change, particularly in its wetland areas (Rahman et al., 2016). Among the various natural disasters, floods are exceptionally impactful, disrupting ecosystems, damaging agricultural output, increasing water pollution, and causing economic and communication network disruptions (DeClerck et al., 2006; Islam et al., 2014). There has been much research on flood impacts in Bangladesh and their multifaceted nature (Haque et al., 2016; Rawlani & Sovacool, 2011; Smith et al., 2021). Similarly, Abedin and Khatun's 2019 study focused on the effects of the 2017 flash flood and assessed the efficacy of adaptation strategies employed by inhabitants in pre-, during, and post-flood situations. In another study, Azad et al. (2021) contributed by examining the mechanisms employed by wetland communities to recover from disasters, explicitly focusing on their ability to withstand flash floods. Notably, vulnerable populations, such as children, the elderly, and pregnant women in wetland areas, have been identified as severely affected by unexpected flooding (Abedin & Khatun, 2019). Furthermore, studies emphasise the social vulnerability and resilience of communities, particularly the economically disadvantaged in floodplains and coastal regions, who may or may not receive government support during disasters (Abedin & Khatun, 2019; Khan, 2015; Parvin et al., 2016).

Studies suggested that many extreme climate events are exacerbated mainly by human activities (Ahmed, 2022; Haque & Jahan, 2021; Khan, 2015). For example, rapid urbanisation, tourist industries, industrial expansion, deforestation, and the overexploitation of natural resources have contributed significantly to environmental degradation and climate change in many areas of Bangladesh (Haque & Jahan, 2021). Industrial emissions and unsustainable agricultural practices have increased greenhouse gas emissions, a major driver of global warming resulting in extreme weather patterns such as more intense floods, cyclones, and droughts (Rahman et al., 2018). The construction of large-scale infrastructure, including embankments and dams, has disrupted natural river systems, exacerbating flood risks and altering sedimentation patterns along Bangladesh's coasts (Islam & Mustafiz, 2019). Human-induced climate change has also heightened the intensity of monsoons and led to more frequent heatwaves, contributing to severe food and water insecurity (Karim & Thiel, 2017). The failure of international actors to curb emissions and the continuous reliance on fossil fuels have disproportionately affected Bangladesh. This country contributes minimally to global emissions yet suffers extreme consequences (Ahmed, 2022).

Bangladesh's disaster management policies and practices have historically overlooked local land-based knowledge due to several structural and systemic factors (Datta & Kairy, 2024). The dominance of top-down, centralised governance frameworks has marginalised Indigenous and local communities in decision-making processes. Many Indigenous and land-based local communities, such as the Munda people in coastal areas, possess extensive ecological and cultural knowledge about their environment, but their expertise is often viewed as inferior to scientific and technological interventions promoted by international

development agencies and national authorities (Datta, & Kairy, 2024; Rahman & Marinova, 2022). The rush to implement rapid, scalable solutions to mitigate climate impacts, like building embankments and cyclone shelters, has sidelined slower, more contextualised approaches rooted in traditional land-based knowledge (Ahmed & Chowdhury, 2020). The lack of institutional mechanisms to incorporate local voices into policy design further perpetuates this exclusion, reducing the potential for truly inclusive disaster management strategies (Hasan & Shah, 2023). Moreover, policymakers often emphasise technological solutions over the long-standing, adaptive knowledge systems held by local communities (Alam et al., 2020), exacerbating the marginalisation of Indigenous knowledge in decision-making (Islam & Walkerden, 2017).

Despite these challenges, emerging possibilities exist for integrating local land-based knowledge into disaster management frameworks. Global shifts toward participatory and community-driven development models present opportunities for local communities to assert their role in policy formation (Roy et al., 2021). International organisations like the United Nations and development partners increasingly recognise the value of Indigenous and local knowledge in resilience-building efforts (Saha & Adnan, 2021). In Bangladesh, initiatives such as community-based disaster preparedness and co-management approaches are gaining traction (Rahman & Khan, 2022). However, significant challenges remain, including entrenched power dynamics, lack of formal recognition of Indigenous land rights, and the need for capacity building within local communities to advocate for their knowledge systems in national and international arenas (Rahman & Marinova, 2022). Successful integration will require structural reform in governance and a deliberate shift in how development agencies engage with local communities (Ahmed & Chowdhury, 2020).

Thus, addressing wetland flood disasters in Bangladesh requires a holistic approach, emphasising community-led climate change strategies (Chowdhury & Moore, 2017; Smith et al., 2011). Given the country's vulnerability to climate-induced events, particularly in low-lying regions, communities must play a central role in developing adaptive measures (Ali et al., 2016). It is crucial to empower local communities to identify and implement sustainable solutions, as they possess invaluable traditional knowledge and a deep understanding of their ecosystems (Nandy et al., 2013). Integrating communities' land-based practices with modern technologies can enhance resilience against wetland floods, promoting sustainable coexistence with the environment (Kamal et al., 2018). Collaborative efforts between government bodies, NGOs, and communities are essential to establish early warning systems, build climate-resilient infrastructure, and implement community-based adaptation programmes (Rabbani et al., 2013). Through these initiatives, Bangladesh can foster a sense of ownership and unity among its people, creating a more resilient and adaptive society in the face of ongoing climate challenges.

This article investigates how wetland communities address flood disasters, shedding light on their adaptation and resilience strategies. The article's primary objectives involve exploring community-led climate change strategies implemented in wetland communities during sudden floods. It begins by outlining the

authors' positionality and theoretical framework before focusing on the methodology and approach employed. The data analysis outcomes are presented and organised into themes and sub-themes. The article concludes by addressing issues raised by male and female storytellers and providing recommendations based on the findings. Reflecting on lessons learned, the study also discusses potential areas for improvement.

The specific objectives of the article include (a) exploring the mechanisms employed to address floods in Bangladesh's wetlands and (b) summarising the solutions proposed by the wetland community. To achieve these goals, the article details its positionality and theoretical framework, outlines the methodology and approach, presents data analysis outcomes in thematic structures, addresses issues raised by women storytellers, and concludes with recommendations and reflections on lessons learned and potential improvements.

Researcher Positionality

The role of researcher positionality is of utmost importance in Indigenous research, as it significantly impacts the research process and raises ethical considerations (Datta, 2018; Wilson, 2008). It is essential to recognise that Indigenous research frequently delves into sensitive subjects and engages with marginalised communities. Researcher positionality encompasses their cultural background, personal experiences, and social identity, which can profoundly influence their interactions with Indigenous participants and their comprehension of the issues. Acknowledging and understanding one's positionality is crucial for approaching research with humility and respect, reducing the risk of inadvertently perpetuating harmful stereotypes or colonial attitudes. It empowers researchers to establish trust within Indigenous communities, nurture meaningful collaborations, and formulate research questions that are culturally sensitive and aligned with Indigenous worldviews.

Author 1: As a decolonial and anti-racist community-based disaster researcher, I see research as a critical responsibility for advocating community-led climate change adaptation and governance. My commitment centres on dismantling colonial legacies and combating systemic racism in disaster management. My research lies in building the adaptive capacity of marginalised populations, with a particular focus on empowering women. By prioritising community-driven approaches, I aim to foster resilience that transcends traditional frameworks, addressing climate change impacts comprehensively. Through my work, I seek to confront environmental challenges and advance climate justice, ensuring equitable outcomes and amplifying the voices of those historically marginalised in the face of global climate shifts.

Author 2: Focusing on the Indigenous community-based research in Bangladesh, I am dedicated to strengthening the voices of the unheard, motivating my active participation in this study. My research interest lies in listening to the stories of my community, and my goal is to narrate these narratives to the global audience, serving as a representative for Indigenous people. My deep connection with my community propels my enthusiasm to collaborate with other communities, fostering understanding and unity in the broader context.

Author 3: She is a climate change adaptation and governance researcher in Canada with experience working with Indigenous peoples and communities in Canada, South America, and South Asia. Her goal is to build the adaptive capacity of people, especially women, and their communities, address climate change, and advance climate justice.

As authors, our positionality is critical in addressing historical power imbalances in Indigenous research, where Indigenous communities have often been treated as research subjects rather than active participants or collaborators. We have redefined our research agenda by critically examining our positionality to ensure that it aligns with the community's needs and benefits. Our positionality is fundamental for nurturing ethical, respectful, and empowering research relationships with Indigenous communities and advancing knowledge that genuinely serves their interests and well-being.

Conceptual Framework and Methodology

The choice of a decolonial community-based approach in exploring flood disasters stems from a commitment to fostering an inclusive and culturally sensitive research paradigm. Recognising the historical context of uneven approaches and shifting away from traditional top-down methodologies that often perpetuate power imbalances is critical. Using a decolonial lens, this research aims to deconstruct colonial narratives and prioritise the voices of local communities residing in wetlands. This approach centres on community voices and needs as active agents in the research process, acknowledging their unique perspectives, knowledge, and adaptive strategies for addressing flood disasters. By valuing diverse ways of knowing and incorporating Indigenous knowledge systems, the study seeks to create a more equitable and respectful research environment that transcends Eurocentric frameworks. Our decolonial community-based approach aligns with the principle of reciprocity and mutual respect, emphasising collaboration rather than extraction of information. Following the decolonial community-based approach, we acknowledge that communities are not just passive subjects but active participants with agency and expertise. We tried to ensure that the research process is co-created, allowing for a more nuanced understanding of the complex dynamics surrounding flood disasters in wetlands. The study aims to decolonise knowledge production, promoting a more inclusive, context-specific, and community-driven perspective on addressing disaster challenges.

Following the decolonial community-based approach, we used deep listening as our research method. Alcoff (1991) argues that deep listening is a fruitful way to resist the prevalent academic proclivity for mastery and immunity from criticism and to conceptualise an ethic of openness and intellectual humility in geographic research. In August 2023, we engaged in conversations with the men and women from the wetlands, valuing their narratives. Deep listening played a fundamental role in respecting and honouring the women's perspectives from the wetlands. Given that community-led and community-based narratives are intimately linked to the land, steeped in the language, and deeply rooted in the Nation of the people, storytelling

served as a means to reestablish a profound connection with land-based wisdom (Datta, 2017). Indigenous peoples use stories to realise, recognise, and resist colonial violence (Sium & Ritskes, 2013). Our commitment extended to following traditional Indigenous rituals and ceremonies alongside conventional research methodologies. In addition to deep listening and community storytelling, we integrated reflective writing to engage with and analyse our research findings and experiences deeply. The storytelling process was anchored in 10 individual narratives and five traditional focus group discussions (FGDs) conducted in August 2023. Each individual or collective session lasted between 60 and 90 minutes, allowing for rich, nuanced dialogue. Instead of relying on structured interview questions, we encouraged the community members to share their experiences of past and recent disaster challenges and their adaptive strategies. We also invited them to express their visions for building greater self-determination in managing future disasters, fostering a space for open and authentic dialogue about their aspirations and resilience.

This practice allowed us the autonomy and freedom to engage in thoughtful reflection. It enabled us to distil and value our discoveries more effectively, enhancing the depth and quality of our research. We upheld strict adherence to ethical protocols, prioritising the privacy and confidentiality of the respondents while demonstrating our respect and gratitude. Given the participants' vulnerable status as members of a minority community, preserving their privacy was paramount. Moreover, we ensured that their participation was informed and entirely voluntary, underscoring our commitment to ethical research practices.

Research Findings

Bangladesh is home to several wetland regions, and for this research, we conducted our study in the Kolkolia union of Jagannathpur upazila, situated in the Sunamganj district within the Sylhet division of Bangladesh. In 2022, a sudden flood occurred in the region, resulting in devastating results. According to the area's people, they have never seen such a big flood. Usually, there is nothing but a shelter system in the wetlands, as other disaster-prone areas have. So, the temporary shelter was set up for immediate support in a college building. This article will discuss the unique shelter system and community-led climate change strategies.

We participated in multiple listening sessions to uncover central themes and related topics from recorded stories. Reflecting on these insights helped deepen our understanding of the subject matter. The stories featured emotional and challenging accounts of the area's inhabitants, offering a unique perspective. Direct quotes and anecdotes were chosen based on personal reflection and those that resonated with the researchers. The research process involved continuous listening and reflective learning, developing main themes and sub-themes (Table 1).

Our findings are organised based on thematic categories, reflecting an examination of the community's efforts at different stages: the initial response at the onset of the flood, actions taken during the flood, and the community's survival strategies in the aftermath of the disaster. This division aims to provide a comprehensive depiction of the strategies employed by the community throughout the

Table 1. Main Themes and Sub-themes of the Results.

Addressing Flood Disasters Through Community-led Climate Change Strategies			
Challenges During Disaster	Different Group Interventions During the Disaster	Challenges in Post-disaster	Suggested Community-led Solutions
• **Challenges in Mainstream-led flood shelter** • **Challenges in systematic approach**	Help from the government Equal distribution of goods	• Challenges at Home • Challenges in professional change and migration • Challenges in self-effort of survival	• Proper planning and Sustainable Development • Researchers' Responsibility • Accountability of the Policy Makers

entire timeline of the disaster, offering insights into their proactive measures, adaptive responses, and post-disaster resilience.

Challenges During Disaster

Upon discovering the absence of a shelter system comparable to that found in other disaster-prone regions, it became evident that the survival of local communities in the wetlands relied entirely on their initiatives. In this section, we delve into the community-driven process of establishing shelters, elucidating the mechanisms behind their development, operations, and how individuals sought refuge within these structures.

In the wetlands, annual floods are a common occurrence; however, the sudden and unforeseen nature of the 2022 flood caught the residents off guard, preventing any preparation. Compared to other regions with designated shelters, the wetlands lacked such facilities. The organiser of the makeshift shelter explained, 'There was no pre-existing shelter. We repurposed educational institutions as shelters, as we do not have dedicated facilities like coastal areas. People sought refuge in schools and colleges, while mosques remained inaccessible'. The abrupt floodwaters submerged the area, leaving roads impassable and stranding the population. A health worker recounted the challenges: 'Transportation came to a standstill during the flood. With water everywhere, we could not leave our homes. It took three or four days for the water to recede, allowing us to reach the affected individuals'. The transportation shutdown and a non-functional mobile network severed communication channels, complicating the rescue efforts.

Once the water levels receded and telecommunication services were restored, the convener of the shelter, who also serves as the college principal, initiated the shelter and assisted in relocating people. Overcoming challenges, the convener highlighted, 'Initially, people hesitated to leave their homes, but as the water levels rose, they eventually made their way to the shelter. Regrettably, some could not reach the shelter in time and succumbed to the flood at their residences'. This

harrowing experience underscored the critical importance of having designated shelters during disasters and revealed the newfound awareness among the community regarding the imperative of shelter in surviving such calamities.

The flood brought immense hardship to the people, causing the loss of homes, livestock, and possessions. However, the makeshift shelter played a crucial role in ensuring their safety. The principal highlighted the shelter's unique and systematic operation: 'People were better off in my shelter. We had individuals for cleaning the shelter and a generator for electricity to ensure women's safety'. The shelter functioned efficiently, providing everyone with food, medicine, and necessary services. The health worker emphasised the equitable distribution during the flood, saying, 'When people from all communities stayed together, the distribution of food, goods, and medicine was equal'. Despite the devastating losses, the resilient community adapted to the situation, utilising classroom benches for nighttime rest. A woman in the shelter praised the residents, stating, 'People in this area are hardworking and can cope with any situation. They fought well in the flood and adapted to it, discovering what benefited them'. The temporary shelter's success offers a potential model for other disaster-prone areas.

In this part, we discuss the help and assistance the affected people received during the disaster. To some extent, the success of recovery after a disaster depends on this. The woman-1 said, 'The first day when people's suffering peaked, nobody came from the Upazilla office or the administration. The next day, they appeared. It is not that they did not want to; the force of water makes it difficult to get in here'. Therefore, immediately after the flood, the affected people were unreachable due to the impact of the disaster; roads were broken, and the telecommunication system was disrupted. In the shelter, people were provided food, drinking water, treatment, and other service. The convener of the shelter said, 'I tried to supply them with food. Moreover, the administration, especially the upazila executive officer, provided some food to me so that I could equally distribute them. Moreover, I tried to distribute equally'. The honesty and integrity of the convener were renowned, and he got additional support from the government instead of the local chairman and his acquaintances for the flood-affected people.

The local government personnel are well-known for their corruption. He added, 'That's why instead of the local chairman, he provided me with all food, all assistance. And the Bangladesh army also came to me. Moreover, they also supply me with food, water, and materials like that'. During the flood, people got quickly sick, so the health system in the shelter was very important. The adult male said, 'All the medicines were brought from the Upazila Health Complex. We did not get any help from other organizations regarding our medicine'. This was the scenario there. He also added, 'Rich people sent relief, cooked food, medicines, etc. to the shelter'. At the time of an emergency, people need help to pass the time and also to start a new life after a disaster. The success of their survival also depends on this.

Post-disaster Challenges

The post-disaster time and support system are also very important parts of any big disaster. Post-disaster is the moment when people think about what they are going

to do next to start over again. In this section, we discuss the challenges during this period. Post-disaster survival is crucial for affected people. Usually, people go to the shelter during the disaster. But when they return from the shelter, they see the devastation of the flood in their area. As the government or any other parties did not help after returning from the shelter, they tried to find a way to survive independently. 'After returning to our house, the government did not help us. We tried to find a way by ourselves to survive. We try to produce food', said the male adult-2. That means some people started cultivation to produce food for themselves. If they can grow extra crops, they can sell them in the local market to make a livelihood.

The sudden flood of 2022 in the wetland made people change their profession. The flood most likely attacked the marginalised people. The convener of the shelter said, 'It impacted people of all occupations, especially the most vulnerable marginalised people. Many people migrated to other areas in search of an earning source'. This made the women of those families more vulnerable as they were living at home alone. They could eat if their male counterpart could save money and bring it home. 'Most male members went out for work and got involved in various occupations. The people who had only a little bit of money lost everything. However, they tried to revive again', said the adult male. The people who did not leave the area for work were financially destitute. Although these people had some money, they lost their houses, cattle, and all other valuable things. They lost everything. It was tough for this group to achieve what they lost again.

Right after the flood, people returned to their homes in the wetlands; they had already lost everything. There were fewer options for post-disaster help. So, they tried to survive on their own. The woman said, 'The loss we have faced due to the flood – we tried to adapt on our own. We have rebuilt our home'. So, they built their houses and managed to stay on their land. The convener of the shelter said, 'When they returned to their home after the flood, their house was broken. Somehow, they managed to stay inside of their home for the last six months or one year'.

The adult male said, 'If one family were affected, his rich neighbors and relatives would help him. They have provided tin to the affected people to make their house'. This means that the people who did not have rich neighbours or relatives could not get this kind of help. This creates a situation where some people are privileged. It was an example of self and community-driven survival.

Suggested Community-led Solutions

After every flood, the people of the wetland get practical experience about adaptation and survival. Some people, especially the women, were heartbroken. While discussing the disaster, woman 3 said, 'What can we do? We become vulnerable'. They indeed become helpless when a flood strikes them so severely. However, in the future, they know more about the disaster, the reasons behind it, and how they can better adapt. Therefore, they provided some solutions. They emphasised proper planning of the government, the researchers' role, and the accountability of the policymakers.

People of the wetland have some Indigenous knowledge about how to adapt to the disaster. They know what to do and what can make their life better during and

after a disaster. However, they always have the challenge of scarcity of resources to cope with during and after the disaster. The woman said, 'If people build their houses to maintain a safer height, it would be better. Canal digging will help to hold extra water'. If the people know the reason for the flood, they know what can be done in the future. The male adult-4 said, 'Unplanned roads are responsible for creating the flood'. So, they have talked about changing the housing structure and making water flow easy by proper canal digging. They have strongly suggested that proper measurements be taken. The woman said, 'If there were individual shelters for flood and digging, and people stopped making unplanned roads here and there, it would improve the situation'. The people of the wetland think that unplanned development is responsible for the disasters. The community's male members think that government planning should be proper and sustainable. The male adult-1 said, 'The government has a planning division, but they do not have any plan'. The people do not have trust in the planning department. They are worried about the capriciousness of the planning division. They hope that future planning will be based on the real needs of the people of the wetlands and that any development projects should not harm the general people.

The people of the wetlands think that researchers have a vital role in helping them address the disaster. The women-1 said in this perspective,

> If researchers work on the adaptation and awareness building program, including practical knowledge in the curriculum instead of theories, provide practical knowledge to people of what can be done before, during and after the flood, make the house appropriate for flood, that would be better.

Researchers can assist by conducting research, creating appropriate documentation, and submitting it to the appropriate authorities. Researchers can study the reality of flood vulnerability and adaptation and disseminate their findings to draw the attention of civil society and other related bodies to make the changes.

The way the people of the wetland give suggestions to the researcher is the same way they have provided suggestions to the policymakers. They have raised their voice regarding climate change and excessive carbon in nature. The male adult-5 said, 'People should minimize their use of carbon dioxide. They should minimize their use of coil and fuel'. This way, nature will be balanced, and they will be able to cope better in the future with disasters. The wetland inhabitants think policymakers are less concerned about disasters and climate change. In this regard, the male adult-6 said, 'Policymakers think climate change is not so important but they don't know how they will be able to face a situation if climate change is not under control'. The people of the wetlands also expect policymakers to discover policies that will be utilised for the well-being of the disaster-prone areas and will be helpful collectively.

The wetland inhabitants know and experience the flood disaster well and have suggested solutions for further research and policy implications. They have emphasised the need for proper government planning. They expect that any development should be sustainable and not harm anyone. Researchers can work on the challenges, find solutions for disasters, and apprise them to the respective

authorities so that their suffering can be acknowledged and hopefully reduced. Moreover, the findings also can be used to further policy.

Discussion and Conclusion

Our study found that, unlike other disaster-prone areas, wetlands do not have any government-led adaptions. Wetland communities, particularly minority communities such as Hindu land-based spiritual communities, do not have any established shelter for protection from sudden disasters, no disaster tracking system, and no proper relief distribution system provided by the government. Also, communities have found that their resilience was insufficient for the flood-affected people. Although people stayed in the temporary shelter for a long time, it was not a permanent solution as wetlands have a common trait to face sudden disaster.

Our study identifies multiple challenges that wetlands face in the context of climate change and its adaptation effects, necessitating targeted interventions. The loss of occupation, damage to resources, and income instability experienced by wetland inhabitants contribute to a cycle of debt and poverty, highlighting the need for sustainable disaster management. The insights from our research can serve as a valuable guide for scholars, policymakers, planners, and researchers in developing strategies for sustainable disaster management, particularly in areas prone to potential dangers.

Our study reveals a significant shift in the professions of wetland residents, mirroring findings in other studies highlighting the highest rural-urban migration in the study area as a response strategy (Alam, 2016; Alam et al., 2016). This migration trend, as observed in our study, also reflects households with limited agricultural land seeking alternative sources of income. As Alam et al. (2017) indicated, such transitions leave women behind with minimal financial stability and underscore the gendered dimensions of these adaptive strategies. While temporary community shelters have proven essential for enabling people to survive during floods, our findings underscore several overlooked implementation aspects. There was a significant lack of support from various authorities, exasperating peoples' vulnerability and emphasising the pivotal role of the government in this context. Since wetlands often receive less attention than other disaster-prone areas, it becomes imperative for governmental and respective authorities to enhance the support systems. To achieve this, as the community suggested, governments should integrate socio-economic capacity-building strategies into resilience policies, necessitating ethical commitments from disaster management leaders and a relational leadership framework (Abedin & Khatun, 2019; Khan, 2015; Parvin et al., 2016). A community-led approach ensures inclusive and enduring benefits in climate and disaster risk reduction efforts (Crosweller & Tschakert, 2020).

Our research underscores the resilience of wetland communities through self-reliant efforts in establishing and managing the entire shelter system. Emphasising the importance of community collaboration, disaster response, and recovery, our study aligns with the notion that community-based adaptation is critical for reducing vulnerability in these areas (Azad et al., 2021; Huq & Reid, 2007). Recognising the

government's vital role in empowering communities in Bangladesh, it becomes imperative for authorities to focus on wetland areas, leveraging local knowledge for effective adaptation and fostering knowledge sharing among stakeholders to promote long-term climate change adaptation and enhance societal awareness (Ahmad & Abu Talib, 2014; Ayers et al., 2013; Ensor & Harvey, 2015; Næss, 2012; Wahid et al., 2017).

Our study suggested that local land-based knowledge is crucial in fostering self-determination for dealing with disasters in Bangladesh. The findings from community-led strategies in wetland flood management, particularly in the Kolkolia union of the Jagannathpur upazila, underscore how Indigenous and local knowledge systems are vital for disaster preparedness and recovery. For instance, during the 2022 flood, the community demonstrated resilience by repurposing educational institutions as temporary shelters, showcasing their ability to adapt and survive without external intervention. Their understanding of their environment, including recognising the limitations of mainstream-led flood shelters, helped them develop their solutions. Such actions illustrate how local knowledge empowers communities to take ownership of disaster response, enhancing self-determination (Ahmed & Chowdhury, 2020).

The community's emphasis on adaptive measures, such as maintaining housing at safer heights and advocating for canal digging to manage water flow, reflects a deeper understanding of the land and its challenges. Their ability to integrate traditional practices with modern needs allows for sustainable development tailored to local conditions (Sultana et al., 2022). By prioritising their lived experiences, these communities manage disasters more effectively and assert their autonomy in decision-making processes (Islam & Walkerden, 2021). These findings highlight the potential for local knowledge to drive self-determination in disaster management (Rumpa et al., 2023).

Therefore, through this article, we suggest that engaging in a decolonial learning experience while examining community-led responses to flood disasters in Bangladesh's wetland areas must illuminate the imperative of dismantling traditional power structures. This approach has allowed us to challenge Eurocentric perspectives that often overshadow Indigenous knowledge and local resilience strategies. By prioritising the narratives and practices of the affected communities, we acknowledge the historical context of colonisation and work towards breaking free from imposed frameworks that may perpetuate inequities. Embracing a decolonial lens has enabled a more inclusive understanding of the complex dynamics surrounding flood disasters, recognising the agency of residents and emphasising their cultural wisdom in developing sustainable solutions.

The importance of community-led initiatives in wetland areas is magnified through a decolonial learning perspective, as it emphasises collaboration and reciprocal relationships. This approach underscores the significance of acknowledging and valuing the unique knowledge systems embedded in the community's cultural fabric. Learning from the local inhabitants about their adaptive strategies and resilience measures becomes a shared process rather than an extractive one, fostering mutual respect and understanding. By embracing a decolonial learning approach, we not only gain insights into effective disaster response within the context of wetlands but

also contribute to a paradigm shift in academia that recognises the richness of diverse voices and perspectives in shaping our understanding of environmental challenges.

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Book Review

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Arup Mitra, Saudamini Das, Amarnath Tripathi, Tapas Kumar Sarangi and Thiagu Ranganathan, *Climate Change, Livelihood Diversification, and Well-Being: The Case of Rural Odisha (SpringerBriefs in Economics)*. Springer Nature Singapore Pte Ltd., 2021, 112 pp., €50.28, ISBN: 978-9811670480.

The relationship between climate change, livelihood diversification and well-being in rural areas is important. Research shows that households with diversified livelihoods are less vulnerable to climate change impacts (Beltrán-Tolosa et al., 2022). Strategies like diversifying agricultural practices and seeking additional sources of income increase household wealth and well-being (Neudert et al., 2015). However, diversification benefits may be limited for households with high levels of well-being (Peng et al., 2022). Rural communities facing climate change impacts on agriculture and food security have implemented adaptation strategies, including growing drought-tolerant crops, using water harvesting techniques and integrating livestock (Kangalawe & Lyimo, 2013). The connection between climate change, livelihood diversification and well-being is particularly important in vulnerable regions like Odisha, India. In their book, '*Climate Change, Livelihood Diversification and Well-Being: The Case of Rural Odisha*', Mitra et al. explore how rural communities in Odisha adapt to climate variations through livelihood diversification. This book is written based on their exploratory study of these issues in the context of Odisha, India. The study findings are crucial for addressing climate-related events threatening traditional livelihoods and rural populations' well-being. Understanding these dynamics is essential for developing sustainable development policies that enhance resilience globally.

Odisha, an eastern state of India, is vulnerable to climate change due to its geography and socioeconomic conditions. Rural communities, reliant on agriculture and natural resources, are particularly at risk (Patel, 2016; Sharma et al., 2014). Odisha has already experienced climate-related disasters, hindering development and poverty reduction efforts (Patel, 2016). Vulnerability levels differ across districts, influenced by factors such as poverty rates, borrowing levels, degree of crop diversity and access to agricultural insurance (Acharya & Das, 2020; Panda, 2017). Climate vulnerability also affects household nutrition by impacting agricultural production (Acharya & Das, 2020). To address these

challenges, diversifying livelihoods and implementing climate change policies are crucial for managing risks and enhancing resilience. Mitra et al.'s book examines how Odisha's communities adapt to climate change, emphasising the importance of livelihood diversification for resilience and well-being. It provides a valuable case study for local policymakers and contributes to the global discourse on climate change adaptation in vulnerable regions.

The book comprises six chapters. Chapter 1 provides an overview of the impact of climate change on the livelihood and well-being of the rural poor in Odisha. This chapter outlines the theoretical framework and background of the research, emphasising the significance of understanding the relationship between climate change and livelihood diversification. Livelihood, a diverse portfolio of activities and social support capabilities that enable survival and improve living standards, can be severely impacted by climate change, particularly in traditional livelihoods such as agriculture. The authors review the literature on sustainable livelihood diversification and climate change, highlighting the complex interplay of the two. The review includes various aspects such as seasonality, risk strategies, labour market returns, asset strategies, credit market behaviour and farm–non-farm interlinkages. The chapter describes the data and methodology used in the study, including primary and secondary sources. It overviews Odisha's macroeconomic conditions, the region's structural and geographical factors and economic performance. The chapter concludes by emphasising the importance of understanding the impact of climate change on rural livelihoods and the potential for livelihood diversification as a coping strategy. It highlights the need for policies and interventions that support diversification and promote sustainable development in rural areas.

Chapter 2 explores the research methodology used to assess climate change's impact on Odisha's rural livelihoods. The study employed a mixed-methods approach, combining qualitative and quantitative data collection and analysis. Four districts were selected based on their distinct geographical and bio-physiological characteristics: Dhenkanal, Angul, Sambalpur and Bargarh. The study surveyed 1,200 rural households using a multi-stage sampling process. Data were collected through extensive rural household surveys, surveys of both women and men within households, surveys of non-farm enterprises, collection of village information and surveys of migrants in nearby urban areas. The research was conducted in two phases: an initial qualitative survey followed by a rigorous quantitative survey. The surveys focussed on livelihood indicators, climatic stress, well-being and gender relations. The study's findings highlight significant disparities in livelihoods between Odisha's southwest and coastal regions, attributed to different climate shocks and institutional variations. In the KBK districts, where literacy rates are low, households have diversified their livelihoods in response to frequent droughts and erratic rainfall, as there are limited job opportunities and underdeveloped agriculture. Migration has emerged as a key strategy for livelihood diversification in these regions. The chapter emphasises the importance of ongoing research into the effects of climate change on rural livelihoods, particularly in relation to climate-induced disasters such as cyclones and floods, which have increasingly displaced communities and forced them to adapt to new occupations and lifestyles.

Chapter 3 of the book focuses on the perception of climate change and adaptation strategies explored in the study. This region is vulnerable to extreme weather events that impact its agriculture-dependent economy and livelihoods. The study aims to understand how rural communities perceive climate change, the factors influencing these perceptions and how they adapt. The findings reveal mixed perceptions among the rural population. While 37.7% of respondents believe there has been an increase in surface temperatures over the past 20 years, a larger portion (44%) reported a perceived decrease. Similarly, perceptions of rainfall variability were inconsistent, with 66% noting a decline in annual rainfall, but only 10% observed an increase. Those with better access to irrigation, forest cover and proximity to rivers were less likely to agree with the perceived decline in rainfall, suggesting that local environmental factors significantly shape climate perceptions. The study also identifies key factors influencing these perceptions, including education, access to extension services, civil society presence, age and gender. Accurately perceiving climatic changes is crucial for successful adaptation, highlighting the importance of education and climate information services in promoting effective responses to climate change. Regarding adaptation strategies, the study found that rural households unintentionally adapt to climate change by changing farming, animal husbandry and forestry practices. Common strategies include adjusting planting dates, changing crop varieties and altering livestock management practices. However, the study also highlights significant barriers to adaptation, particularly the lack of financial resources and labour shortages, which rural households ranked as the most serious constraints. These findings indicate that addressing financial and informational barriers is essential for enhancing the resilience of rural communities to climate change in Odisha.

Chapter 4 of this book examines the diversification of households' livelihoods in Odisha, India. It focuses the findings on four aspects: the number of livelihood activities, individual-level diversification, seasonal allocation of labour and diversification across different months. The findings show that most households engage in multiple livelihood activities, with the level of diversification varying by district. Cultivation is the most common primary occupation, followed by non-farm rural wage employment and agricultural labour. Unemployment rates are particularly high among individuals with less education. The labour allocation also varies across seasons, with more household heads engaged in agricultural labour during the kharif season. Agricultural labour fluctuates across months depending on the cultivation pattern, peaking in October and declining till December. These findings have important implications for policymakers and practitioners working to reduce poverty and promote livelihood diversification in rural areas. The chapter provides a comprehensive analysis, uses various statistical methods and offers a detailed overview of diversification. However, further discussion on the policy implications and exploring the reasons behind high unemployment among less educated individuals could be beneficial. Future studies can expand on this research by examining the impact of livelihood diversification on poverty reduction and household well-being, the role of access to credit and markets in promoting diversification, and variations in livelihood diversification across different regions and communities in Odisha.

Chapter 5 explores the relationship between climate change, diversification strategy and well-being, measured explicitly through consumption outcomes. The authors argue that occupational diversification is crucial for households dealing with crisis and seasonal stress, especially those reliant on livelihood sources affected by seasonal factors and vulnerable to climate change. The chapter is divided into five sections, which provide a comprehensive understanding of the role of occupational diversification in enhancing well-being. These sections cover the job profile and diversification of sample households, the distribution of households based on consumption patterns and the factors influencing changes in calorie intake. The main findings underscore the significance of occupational diversification in adapting to climate change. Although the number of households engaged in an activity varies throughout the year due to the seasonality of agricultural activities and the stability of non-farm sector livelihoods, the level of occupational diversification is not correlated with household income. However, the number of activities the household head pursues is positively associated with average annual income, but only up to a certain point. Additionally, a significant percentage of households consume less than the minimum threshold of 24,000 kcal, and changes in consumption are influenced by individual efforts to enhance income and cope with fluctuations. The response to these consumption changes differs among religious and caste groups, with better-off households demonstrating more effective responses than those in poorer living conditions. Overall, the chapter emphasises the importance of occupational diversification and income-enhancing strategies in improving well-being, as measured by consumption outcomes, in the face of climate change.

Chapter 6 presents the study's key findings, emphasising the crucial role of livelihood diversification in coping with climate change. However, it also reveals that this practice is often a response to distress rather than a deliberate choice. One reason is the lack of awareness and information among rural households in Odisha, who are largely unaware of climate change and its impacts. The study shows that livelihood diversification is influenced by factors such as age, education, caste and land ownership, but not by gender. Despite these challenges, households that engage in livelihood diversification experience improvements in their consumption patterns, important for overall well-being. However, a significant proportion of households in Odisha consume fewer calories per day than required, indicating a higher poverty rate than officially reported.

To overcome these challenges, the study recommends a multi-faceted approach that addresses the information, financial and infrastructure gaps hindering rural households' ability to adapt to climate change. First, the government and multilateral agencies should provide information on climate change and its impacts on rural households, enabling them to make informed decisions about adaptation strategies. Second, rural households should have easy access to institutional finance to support adaptation activities, focussing on water-saving activities to promote water conservation. Additionally, the government should create opportunities for gainful employment, such as through MGNREGA, to support livelihood diversification and reduce distress diversification. Moreover, the government should initiate schemes to supplement income and augment consumption,

especially for households that consume fewer calories daily than required. Finally, investing in rural construction and irrigation programmes can create livelihood opportunities and support climate resilience. Furthermore, promoting rural industrialisation, particularly agro-based industries, can create productive employment opportunities in the non-farm sector.

In conclusion, the study emphasises the need for a comprehensive approach to help rural households in Odisha adapt to climate change. By addressing the information, financial and infrastructure gaps, the government and multilateral agencies can assist rural households in building resilience to climate change and improving their overall well-being. The study suggests that a combination of awareness, financial support, livelihood diversification and infrastructure development can help rural households in Odisha adapt to climate change, improve their consumption patterns, increase their income and enhance their quality of life.

The book '*Climate Change, Livelihood Diversification and Well-Being: The Case of Rural Odisha*' by Mitra et al. contributes to our understanding of livelihood diversification as a crucial aspect of rural resilience. It emphasises the need for targeted interventions that address the specific needs of climate-vulnerable communities in Odisha and similar regions. The book advocates for context-specific adaptation strategies and a coordinated approach to climate change adaptation and mitigation. By highlighting community challenges, the authors offer insights to inform the design and implementation of climate-resilient development programmes. Furthermore, the book emphasises the importance of integrating well-being into climate change adaptation strategies, considering social and environmental dimensions. It challenges approaches that prioritise agricultural productivity and food security. The authors argue for a nuanced understanding of the relationships between climate change, livelihoods and well-being, which has implications for developing effective adaptation and mitigation strategies in rural areas of developing countries. The book's analysis and recommendations make it a valuable resource for advancing the discourse on sustainable development and climate change adaptation.

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