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Livelihood Security Index Assessment among Millet Farmers in North Eastern Hill (NEH) States of India

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ABSTRACT

The present study was conducted from August, 2022 to August, 2023 in the North Eastern Hill (NEH) areas of Arunachal Pradesh, Tripura, and Meghalaya as part of the ICAR-IIMR, Hyderabad institutional project. Ex-post facto research design was used for assessing the livelihood security of millet farmers in tribal areas. The study constituted to 6 districts in 6 blocks and 24 villages with a sample of 240. Livelihood security index values were used to find the livelihood security of tribal farmers. According to the research findings, various components of livelihood security viz., social, food and nutritional, institutional, ecological, infrastructural, and economic aspects were assessed. Results indicated that economic security (0.85), food and nutrition security (0.84), infrastructural security (0.81), and ecological security (0.77) have received higher livelihood index values. The higher value of the livelihood index stated that significant improvements were observed in the livelihoods of tribal farmers through the technological implementations of IIMR with the support of central and state agricultural universities in the study area. The study revealed that social security was recorded as low. The study also highlighted that there is a strong need to improve the social status of millet farmers in NEH areas after post-project implementation. Achieving social security requires time and it can be improved through greater community engagement by the farmers, capacity-building initiatives, and advanced technical support for stimulating the social standards of NEH areas.

KEYWORDS: Livelihood, NEH areas, millets, sustainability, food security

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Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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1. INTRODUCTION

The agricultural sector is essential to promote inclusiveness and ensure sustainability for future generations. It supports the livelihoods of 48% of the rural workforce. It plays a crucial role in securing food and nutrition (International Food Policy Research Institute, 2015). To reduce poverty and malnutrition intake of balanced diet is essential (Anonymous, 2008). The World Health Organization (WHO) aimed to eliminate food insecurity and enhance nutrition through the promotion of sustainable agriculture practices (Anonymous, 2015). The Food and Agriculture Organization (FAO) defined sustainable agriculture as the effective management of agricultural resources to meet the evolving needs of humanity by preserving environmental quality and conserving natural resources (Anonymous, 1991). Achieving sustainability in agriculture therefore necessitates a careful balance between social equity, ecological stability, and economic efficiency (Uma and Gandhi, 2009; Das et al., 2023; Hatai and Sen, 2008; Singh and Hiremath, 2010; Deshmukh and Patil, 2020).

India's North Eastern states, often referred to as the "Seven Sisters" are distinguished by their rich culture and biodiversity as well as their unique agricultural practices. Despite these strengths, the region has long grappled with challenges like inadequate infrastructure, rugged terrain, and the overexploitation of natural resources that have stunted its agricultural progress (Barah, 2007; Konwar, 2015). However, recent years have brought a resurgence in millet cultivation and processing in the NEH region due to their high nutritional value, climate resilience nature and potential to tackle food security and environmental issues (Verma et al., 2017; Li and Strielkowski, 2019). The Government of India, along with various non-governmental organizations and Farmer Producer Organizations (FPOs), has been promoting millet cultivation and processing as a means to achieve food security, economic resilience, and sustainable agricultural practices in the North Eastern states (Patidar et al., 2018, Sangpuii and Malhotra, 2023).

Millets are climate resilient crops that can tolerate any kind of climatic conditions (Pulla, 2013). Millets have considerable potential to generate livelihoods, increase farmers' income and ensure food and nutritional security by addressing the SDGs (Muneer et al., 2023, Yadav et al., 2018, Borah and Basumatary, 2015; Roy et al., 2015). The comparatively low input requirements of millet cultivation offer a key advantage to small-scale farmers, who often lack access to extensive irrigation systems and expensive agricultural inputs. Farmer Producer Organizations (FPOs) focus on supporting small and marginal farmers throughout various stages of agricultural production. They help farmers by securing inputs, facilitating access to finance, connecting their produce to networks, ensuring processing and quality control, establishing market linkages, and offering training and technical guidance (Singh et al., 2021).

A livelihood is considered sustainable when it can withstand and recover from stress and shocks while maintaining its capabilities and assets both in the present and for the future (Kumar et al., 2017; Negi et al., 2017; Deb et al., 2018; Singh and Kumar, 2019). The livelihood index is a composite indicator that measures the overall well-being of rural households based on factors such as income, food security, access to education and healthcare, and social capital (Minshra et al., 2023). In the context of the North Eastern states, improving the livelihood index is a key priority. With the above background, a study was conducted to compute the Sustainable Livelihood Security Index (SLSI) in NEH areas of Arunachal Pradesh, Tripura and Meghalaya.

2. MATERIALS AND METHODS

The present study employed an ex post facto research design and was conducted as part of an IIMR, Hyderabad institutional project during, 2022–2024 in the North Eastern Hill (NEH) areas of Arunachal Pradesh, Tripura, and Meghalaya. This project provided free inputs such as seeds, mechanization, agricultural implements, technical advisory, and employment opportunities to tribal farmers in these three states. For the study, two districts were selected from each state. From each district, two blocks were chosen, and from each block, two villages were further selected. In each village, 10 farmer beneficiaries were randomly selected who had benefitted from the project. Consequently, the sample consisted of 6 districts, 6 blocks, and 24 villages across the three states and totalling 240 farmers as the sample for the present study. The selected districts were East Siang and Siang in Arunachal Pradesh, West Tripura and Khowai in Tripura, and Ri-Bhoi and East Khasi Hills in Meghalaya. Data was collected using a well-structured interview schedule with the farmers in the NEH study area. The collected data were scored, compiled, tabulated, and analyzed using various statistical tools to derive significant results and conclusions. To assess the livelihood security of the respondents, a Livelihood Security Index was calculated. The index was developed based on different indicators of farmers' livelihood security with six components identified through a review of the literature (Jha et al., 2015; Sajjad et al., 2024). These components were social security, food and nutritional security, institutional security, ecological security, infrastructural security, and economic security (Gautam et al., 2022). Different indicators of livelihood security were weighted based on ranks provided by scientists, expert opinions, and judges. The method proposed by Alfares et al. (2008) was used to

transform ranks into weights. The mean of these indicators was calculated to determine the weightage for each specific indicator.

$Z\ ind_a$=(Indicator a-Min a)/(Max a-Min a)

Where,

Z inda=Standard indicator

Max a and Min a=Maximum and minimum value of indicator 'a'

Then, Livelihood security index for each indicator was calculated by using the formula given as below

$LS_b=\Sigma Zind_a/N$

Where,

LS_b=Livelihood security for one indicator

$\Sigma Zind_a$=Summated standardized score of all respondents for one indicator

N=Number of farmers covered in the study

Once Livelihood Index for one indicator was constructed, and then the composite overall "Livelihood Security (LS) Index was calculated by using the formula given as below:

$LS_b=\Sigma W_b\ HLS_a/\Sigma Wb$

Where,

LS_b=Livelihood security

HLS_b=Household livelihood security

ΣW_b=Summated value of weightage of all indicators

3. RESULTS AND DISCUSSION

Table 1 presented a detailed analysis of the relevance of various social security parameters among selected farmers in NEH areas. The findings indicated that community mobilization emerged as the most significant parameter, with a Mean Relevance Score (MRS) of 2.87. Forwarding community unity and empowerment through training sessions designed to encourage collective action among farmers in the study area. The results shows similar with the findings of Isapeule et al., 2018. The high relevance of community mobilization highlighted its effectiveness in maximizing the impact of agricultural initiatives (Hmingthanzuala et al., 2023). Following community mobilization, awareness about the right to utilize millet schemes (MRS=2.78) and participation in outreach activities (MRS=2.71) were also identified as important parameters. These scores suggested that knowledge and engagement in specific programs are essential to enhance social security among farmers. In contrast, networking with social organizations (such as Farmer Producer Organizations (FPOs) and Farmer Interest Groups (FIGs) recorded the lowest MRS (2.54) due to limited awareness among farmers regarding the benefits of joining FPOs and insufficient outreach efforts by FPOs to connect with farmers in remote areas.

The analysis of food and nutrition security among farmers in the North Eastern Hill (NEH) regions, as detailed in Table 2, highlighted that easy access to nutritional food to avoid malnutrition was noted as crucial factor, with a Mean Relevance Score (MRS) of 2.89. The project facilitated the distribution of high-quality millet seeds to farmers with the aim to enchance millet cultivation and consumption. The outcome of this initiative not only expanded the area under millet cultivation in the NEH regions but also addressed malnutrition by promoting the consumption of nutrient-rich millet and the overall health of beneficiaries. Following this, the factors balanced diet available throughout the year (MRS=2.83) and health benefits (MRS=2.80) were identified as the next significant contributors to food and nutrition security as they played a critical role in maintaining a year-round balanced diet for good health. Easy availability

Table 1: Social security (N=240)

Sl. No.	Parameters	Relevancy weightage (RW)	Mean relevance score (MRS)
1.	Networking with social organization (FPOs/FIGs)	0.84	2.54
2.	Empowerment towards public relations	0.93	2.66
3.	Participation and outreach activities	0.81	2.71
4.	Awareness about right to utilize millet schemes	0.88	2.78
5.	Community mobilization	0.92	2.87

Table 2: Food and nutrition security (N=240)

Sl. No.	Parameters	Relevancy weightage (RW)	Mean relevance score (MRS)
1.	Easy availability of nutritional food	0.87	2.71
2.	Balanced diet available throughout the year	0.93	2.83
3.	Health benefits	0.87	2.80
4.	Nutritional security through millet in the study area	0.84	2.58
5.	Easy access to nutritional food to avoid malnutrition	0.86	2.89

of nutritional food (MRS=2.71) and nutritional security through millet in the study area were recorded as the lowest MRS (2.58) stating that still some farmers are not aware of millet health benefits.

The results from Table 3 provided an overview of the responses regarding institutional support security in the North Eastern Hill (NEH) regions. Method Demonstrations or Front-Line Demonstrations (FLD) were identified as the most relevant support to the farmers during this NEH project with the highest Mean Relevance Score (MRS) of 2.88. These demonstrations, conducted by the IIMR team and Central Agriculture Universities, effectively shared valuable millet farming knowledge and research with farmers for enhancing farming practices at the grassroots level. Training and capacity-building schemes ranked second with an MRS of 2.83 stating that farmers gained skills and knowledge through institutional support provided by the IIMr. Additionally, access to institutions like Krishi Vigyan Kendras (KVKs) and State Agricultural Universities (SAUs) ranked third with an MRS of 2.81 and RW of 0.84,

Table 3: Institutional support security (N=240)

Sl. No.	Parameters	Relevancy weightage (RW)	Mean relevance score (MRS)
1.	Access to credit and Banks	0.97	2.44
2.	Access to Agri-inputs	0.88	2.76
3.	Training and capacity building schemes	0.94	2.83
4.	Method demonstrations/ FLD	0.79	2.88
5.	Access to KVKs, SAUS etc	0.84	2.81
6.	Access to markets	0.86	2.64

highlighting their importance in providing essential support and introducing new agricultural technologies to farmers. Access to agricultural inputs, such as seeds, fertilizers, and pesticides was ranked fourth with an MRS of 2.76. Similarly, access to markets and access to credit was perceived with MRS of 2.64 and 2.44. Thus, approaches towards enhancing the financial status of farmers can be done by involving them in the microcredit system.

The factors that influenced the ecological security of the farmer respondents were tabulated in Table 4. Among all the listed parameters climate resilience and environment protection received the highest Mean Relevance Score (MRS) of 2.89, indicating that farmers in the NEH areas considered it as the most crucial factor for maintaining ecological security. This high score reflected the role of IIMR in adopting eco-friendly millet practices in NEH areas for

Table 4: Ecological security (N=240)

Sl. No.	Parameters	Relevancy weightage (RW)	Mean relevance score (MRS)
1.	Crop intensification /land area under millets	0.84	2.83
2.	Climate resilience and environment protection	0.85	2.89
3.	Sustainable agricultural practices	0.93	2.73
4.	Effective utilization of cropping areas	0.89	2.77

enhancing resilience to climate change and protecting the environment. Crop intensification and expanding land area under millets was also highly regarded with an MRS of 2.83 stating that farmers recognized the value of increasing crop density and promoting millet cultivation as essential strategies for ecological sustainability. Effective utilization of cropping areas is considered moderately relevant with an MRS of 2.77 highlighting the optimum land utilization in the hilly tracts of NEH areas. Lastly, sustainable agricultural practices despite having the highest relevancy weightage of 0.93, received a slightly lower MRS of 2.73. Overall, the responses from farmers in the NEH areas suggested climate resilience and effective land use as primary concerns for achieving ecological security.

Table 5 outlined the key parameters that influenced infrastructural security in the North Eastern Hill (NEH) areas based on the responses of selected farmers. The findings highlighted that the availability of the machine and primary processing unit was the most critical factor, with a Mean Relevance Score (MRS) of 2.87. The efforts made

Table 5: Infrastructural security (N=240)

Sl. No.	Parameters	Relevancy weightage (RW)	Mean relevance score (MRS)
1.	Access to transport	0.94	2.65
2.	Procurement of grains (storage)	0.89	2.74
3.	Establishment of market channel	0.85	2.69
4.	Availability of roti making machine/unit	0.83	2.86
5.	Availability of machine and primary processing unit	0.79	2.87

by the IIMR team in establishing a primary processing unit at NEH areas through FPOs helped to achieve this score. Availability of roti making machine/unit, with an MRS of 2.86, indicated that local processing facilities developed by IIMR through incubating FPOs played a crucial role in adding value to millets and thereby increasing the incomes of farmers. Procurement of grains (storage), with an MRS of 2.74, highlighted the importance of having adequate storage facilities developed by FPOs to reduce post-harvest losses and maintain a steady procurement of millets. The establishment of market channels and access to transport have low MRS values of 2.69 and 2.65 respectively stating that there exists a strong need for improvement in these areas.

The important factors for economic security in the North Eastern Hill (NEH) regions were shown in Table 6. Income generation from members (MRS: 2.91), increased savings (MRS: 2.89), expanding land holdings (MRS: 2.86), and investment in agricultural inputs (MRS: 2.77) were the top contributions for the economic security perceived by the farmers. Other key factors like adding value to agricultural products (MRS: 2.76) and ensuring year-round self-employment opportunities (MRS: 2.74) were perceived with low MRS value by the respondents. To stable the economic environment for agricultural communities in the NEH regions, it may be essential to diversify income sources, promote savings and investments, increase land ownership, enhance value addition, and provide continuous employment.

Table 6: Economic security (N=240)

Sl. No.	Parameters	Relevancy weightage (RW)	Mean relevance score (MRS)
1.	Income generation from the members	0.88	2.91
2.	Increase in Land holding	0.82	2.86
3.	Increase in investment (Agri inputs) and returns	0.79	2.77
4.	Increased savings	0.93	2.89
5.	Investment/return through value addition	0.89	2.76
6.	Ensure economic security	0.92	2.68
7.	Self-employment throughout the year	0.97	2.74

3.1. Livelihood security index in northeast hilly areas

Results in Figure 1 showed that, the economic security parameter in the NEH region has achieved the highest index value of 0.85. Distribution of high-quality free

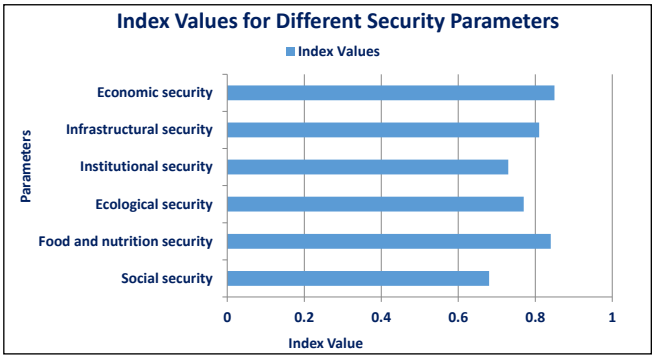

Figure 1: Livelihood security index values in northeast hilly areas (N=240)

millet seeds and training on millet cultivation practices for increasing the economic stability were the key factors for this improvement. Further, the higher value was due to the significant improvements in the livelihoods of farmers that were engaged in millet based economic activities and value addition through FPOs supported by the project. Food and Nutrition security had an index value of 0.84 due to training and awareness programs provided to farmers on millet cultivation practices, nutritional and health benefits of millets through the project. The infrastructural security index value was noticed as 0.81 and this is due to the establishment of millet primary processing units at farm gates, supply of agricultural inputs and roti making machines to the farmers. Ecological security and Institutional security values were shown as 0.77 and 0.73 respectively. Efforts made by ICAR-IIMR in promoting crop diversification programs through millets by highlighting the climate resilience nature had encouraged the adoption of millet cultivation by the NEH farmers. Furthermore, IIMR has provided credit facilities through loans and schemes to farmers as institutional support. The social security index was noticed as low, as the social security cannot be achieved in a short span but it was noticed that the social status of farmers was improved after the implementation of the project in the selected NEH areas.

4. CONCLUSION

The Livelihood Security Index study in India's North Eastern Hill regions highlighted a multi-faceted approach that enhanced farmers' livelihoods in Arunachal Pradesh, Tripura, and Meghalaya areas. The findings showed that economic security scored highest (0.85) due to millet-based activities promoted by FPOs. Food and nutrition security (0.84) was found as next important parameter by the farmers followed Infrastructural security (0.81), ecological (0.77) and institutional security (0.73). Project interventions by ICAR-IIMR, Hyderabad helped farmers to improve their living standards, adopt climate-resilient practices through millets.

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