Significance of Farmers' Distress Index in Reducing Agrarian Crisis: An Approach to Study Vulnerability in the Context of Dryland Farmers in India

Reddy, A. Amarender; Bhattacharya, Anindita; Reddy, Venku

Veröffentlichungsversion / Published Version
Arbeitspapier / working paper

DVARA RESEARCH

Significance of Farmers' Distress Index in Reducing Agrarian Crisis: An Approach to Study Vulnerability in the Context of Dryland Farmers in India

A Amarender Reddy*

Anindita Bhattacharya

Venku Reddy

Abstract

Vulnerability assessments by developing Farmers' Distress Index (FDI) can play a vital role in the design of appropriate adaptation and mitigation policies directed towards the various structural changes in the recent era — for those who depend on agriculture for their livelihood and well-being. This paper attempts to build a picture of the vulnerability of distressed agricultural households by identifying the distress indicators — based on seven major dimensions, namely exposure, mitigating and adaptation strategies, adaptive capacity, triggers, sensitivity, psychological factors and impact. The aim of developing the Farmers' Distress Index (FDI), considering 50 indicators in the context of 640 dryland farmers of 4 districts in Andhra Pradesh and Telangana, was to identify sources and forms of vulnerability that are specific to the context of designing resilience measures. The study we undertook reports the top 10 major indicators that drive the overall vulnerability of the districts. It also recommends a particular 'distress management package' by involving the local administration, research institutions and NGOs to build a specific action plan for intervention against each indicator.

Keywords: distress indicators, resilience measure, distress management, intervention

*Author E-mail: anugu.amarender.reddy@gmail.com

Contents

1. Introduction

1.1 Context

India stands first among the rainfed agricultural countries in the world, with the largest total cropped area (66 per cent) (Planning Commission, 2012) and rainfed land, which relies on rainfall for water and contributes to half of the country's total food production (FAO, 2021).

Despite low or erratic rainfall (less than 75 cm annually) and no assured irrigation facilities, the dryland regions play a vital role not only in the progress of agriculture but also in the entire Indian economy, as most of the coarse grain crops, pulses, oilseeds and raw cotton are grown on these lands (Krishi Jagran, 2017). The contribution of drylands to Indian agriculture is of great importance, as 68 per cent of the total net sown area, covering 177 districts (Sindhuja and Asokhan, 2018), and 44 per cent of the nation's total food production come from the drylands (Vijayan R, 2016).

But, in recent years, not only the dryland regions, but also the agricultural systems in India, have undergone major structural changes, which have enhanced the vulnerability of the rural population (Thakur A K, Kumar S, 2009). In the past century, there has been a severe crisis in agriculture, throughout the country (GOI, 2008), due to climatic changes, affecting agricultural productivity (IPCC, 2007a) and acting as a hunger risk multiplier by negatively impacting the entire food production system and the farmers' income (Krishnamurthy, Lewis, Choularton, 2012). Across the world, the agricultural production of smallholder farmers, in particular, is vulnerable to numerous risks, such as pest and disease outbreaks, market shocks and extreme climate events that often undermine the farmers' livelihood security (O'Brien et al, 2004).

Marginalised populations in all developing countries suffer severely from the impact of such risks, as they mainly depend on tropical agriculture. Tropical agriculture is dominated by the dryland agriculture system, which is extremely vulnerable to climate change (Sathyan, Funk, Aenis and Breuer, 2018). Almost 80 per cent of the global agriculture is based on this kind of farming system (Wani, Rockstr om and Oweis, 2009), which increases the dependency on climate sensitive activities, pessimistic agricultural yield, poverty and food insecurity.

Farmers in tropical countries, including India, have limited resources and capacity to cope with these shocks (Srinivasa et al., 2018). They experience immediate hardships mainly due to their low adaptive capacity (Burnham and Ma, 2016) and inability to make adequate decisions in agriculture (NIC, 2009). So, any decrease in agricultural productivity severely impacts their livelihood and well-being (McDowell, Hess, 2012).

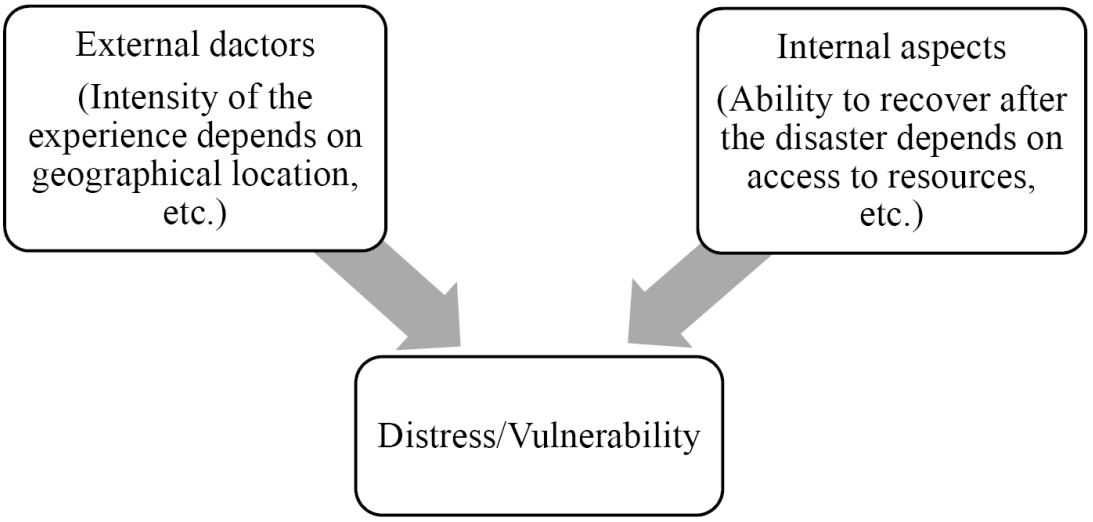
1.2 Concept of vulnerability

According to Madhuri, Tewari and Bhowmick, 2014, vulnerability is the capacity to anticipate, cope with, resist and recover from the impact of natural and social disasters. It has a different impact on different households, depending on the differences in their livelihood choices. It also varies widely across communities, sectors and regions (Raju, Deshpande, Satyasiba, 2016).

A comprehensive view of vulnerability, comprising exposure, susceptibility, socio-economic conditions and resilience measures of households, is considered more appropriate to understand the severity of distress (Birkmann 2006). Poor people, such as small and marginal farmers in the poorest countries, are the most vulnerable groups (Stern et al. 2006) and have the weakest ability to adapt to climatic impact, as they depend on natural resource-based livelihoods that are disproportionately affected by climate change.

The vulnerability of the agricultural households in dryland regions depends on external (intensity of disaster and harm inflected) as well as internal factors (differential capacity of households) (Figure 1). This is referred to as the 'dualistic structure of vulnerability' (Wisner 2002). Households with less capacity are comparatively at more risk and are more vulnerable as it worsens their livelihood conditions.

FIGURE 1: Internal and external aspects of livelihood distress (Chamber, 1989)



1.3 Need for Farmers' Distress Index (FDI)

As agricultural distress is increasingly observed and experienced by farmers, there is an urgent need to focus on identifying the approaches based on which the distress of farmers can be reduced and the adaptive capacity of farmers, their households and communities can be enhanced (Harvey et al., 2014; Frank and Penrose-Buckley, 2012). Although there some district-level indices are available for sustainability, risk and vulnerability, there is no FDI for tracking farmers' distress at the grassroot level.

In this circumstance, vulnerability assessments of farmers can play a crucial role in the design of appropriate adaptation and mitigation policies directed at all physical, social, ecological and economic changes and those who depend on these resources for their livelihood and well-being (Raju, Deshpande, Satyasiba, 2016). Thus, both distress indicators and the distress index of farmers in dryland farming system are important tools in planning and decision-making to reduce the misery of the most vulnerable people.

The factors that determine the vulnerability of households are i) exposure (natural disaster), which is the magnitude and duration to which the population is exposed to distress, ii) mitigating strategies that aim to tackle the causes and minimise the possible impact of

exposure to risk, iii) adaptive capacity (socio-demographic profile, livelihood strategies, social networks), which denotes the household's or farmer's ability to resist and absorb distress, iv) triggers and occurences that cause severe distress v) sensitivity (health, food, water), i.e. the degree to which a household is affected by distress (Ebi, Kovats & Menne 2006) vi) psychological factor, which is an important driver for extreme events such as farmer suicides, and vii) impact, which is the result of agrarian distress. All these factors together constitute the essence of FDI.

2. Objective of the study

Therefore, to assess the variability in vulnerability of distressed households, the distress indicators were identified and FDI was developed, according to the context of the study area. FDI aims to identify the sources and forms of vulnerability that are specific to the context to design appropriate resilience measures.

The study not only developed a futuristic agrarian distress index at the farmer level, but it also broke down the index into various components such as exposure, mitigation and adoption strategies, triggers, sensitivity and psychological factors and impact.

As a part of this attempt, the study recommends the prioritisation of interventions to alleviate farm distress.

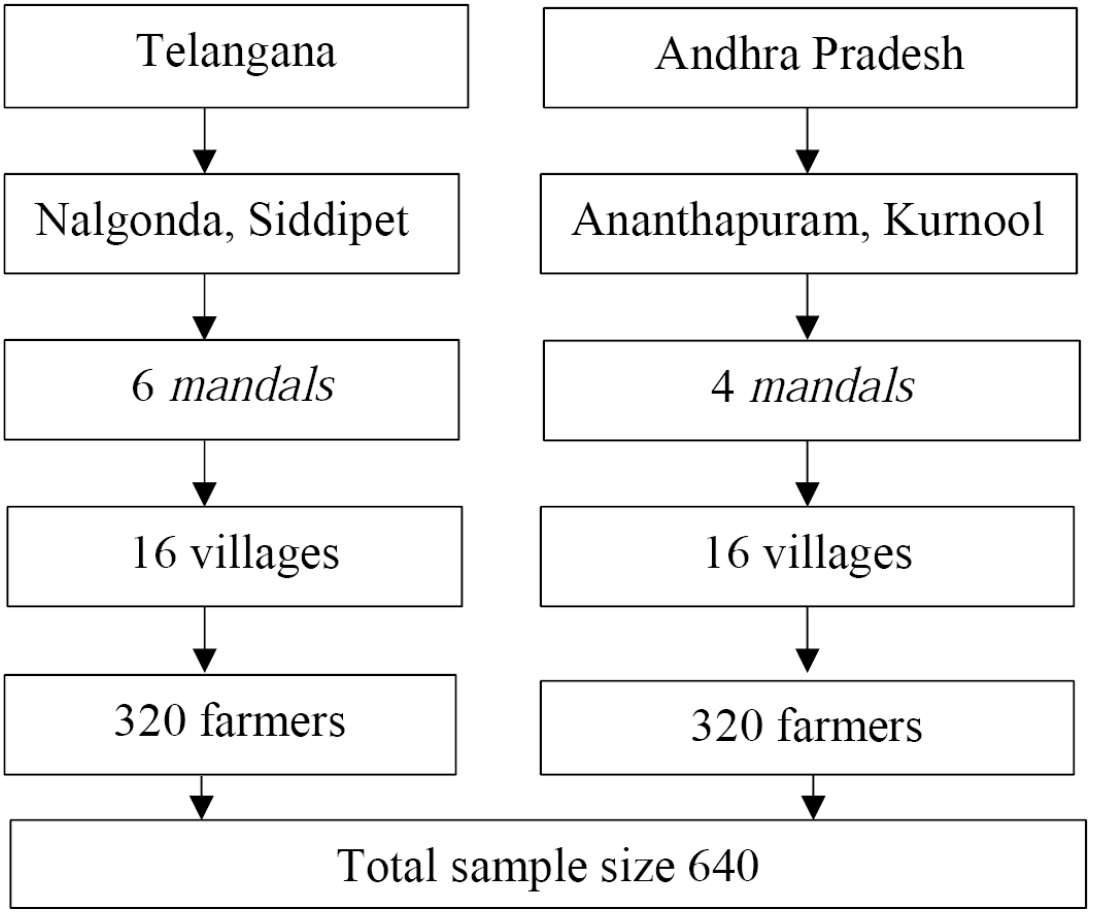
3. Methodology

3.1 Study location and sampling frame

The study was conducted in Andhra Pradesh and Telangana, the two adjacent states situated in the southern region of India. They are among the five states with the largest number of farmer's suicides in India. The states cover an area of 162,975 sq. km and 112,077 sq. km respectively, with a population of 52.5 million and 39.8 million respectively, as per the 2021 Census of India. The economy of the region under study is driven by agriculture. Although the two important rivers Godavari and Krishna flow through the states providing water for irrigation, most of the the region is rain-fed (1,2).

The selection of the districts was based on the maximum number of suicides and the large area under dryland agriculture (with equal weightage). The sample comprises 4 districts, 10 *mandals*, 32 villages and 640 farmers. The data was collected from December 2020 to February 2021. The detailed sampling framework is shown in Figure 2.

FIGURE 2: Sampling framework

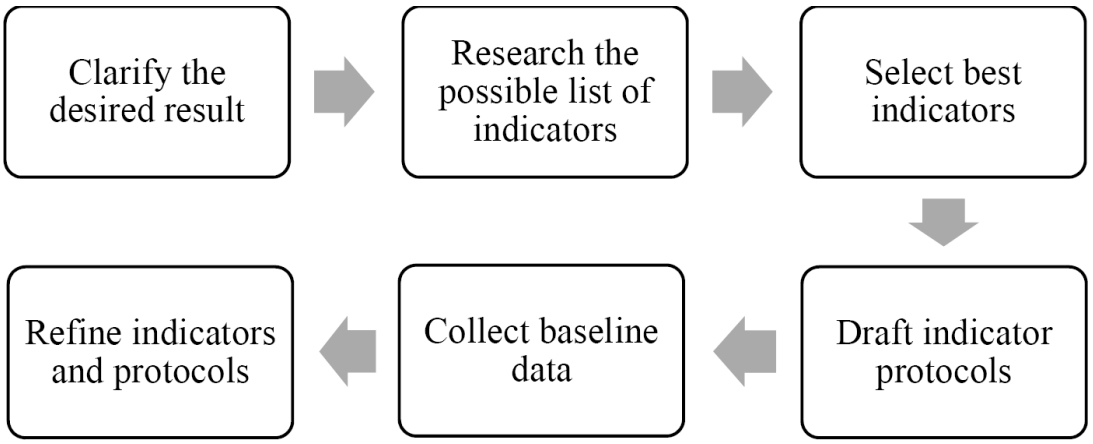


3.2 Identification of indicators for preliminary inclusion

The indicators for farmers' distress were collated and screened through an extensive review of published literature in peer reviewed journals and also based on focus group discussions

with key informants. The identification of the indicators was done through a specific process, which is elaborated in Figure 3.

FIGURE 3: Steps for selecting indicators



The indicators used in this study were classified based on the dimension they have been considered to represent by various authors: social, economic, ecological, cultural, demographic, governance, legal, institutional.

The closely related components of dimension based on individual examination of the context of the study are shown in Figure 4.

3.3 Collection of primary data

The primary data was collected from an intensive household survey, using the above sampling framework. The secondary data on different villages was collected from published sources of government agencies. Primary data was canvassed among sample households, using a structured questionnaire with both open- and closed-ended questions. The study was undertaken at the farmers' level by using some specific indicators to understand the status of farmers' distress.

3.4 Screening of variables for final FDI

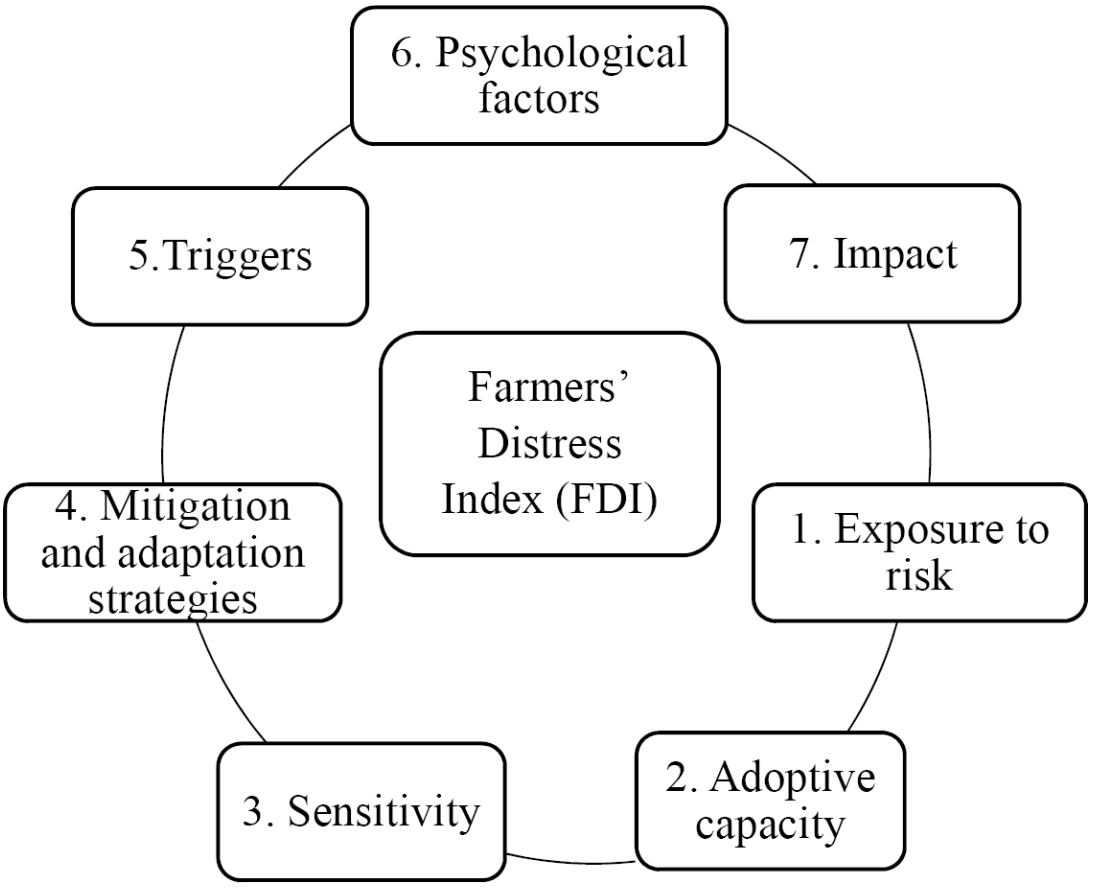
After the collection of baseline data (more than 100 variables of 32 indicators), the variables of each indicator were rated as per the following table and considered the most leading indicators, which were tested for inclusion. The rating was ranged between 0 (low) and 2 (high) to determine the extent of the indicator.

Finally, a list of indicators with 50 variables tested for inclusion were determined as leading indicators (details shown in Annexure Table I).

3.5 Tools and techniques

The indicators were measured on different scales. For instance, some of them were numbers or percentages, and others were indices. The indicators used for index development were tested for correlations with 95% confidence. Therefore, they were normalised to a

FIGURE 4: Major dimensions of agricultural distress



range between 0 and 1. For indicators that decrease the distress, the values were transferred, so that we derived a positive (hypothetical) value from the actual value (e.g., 100 minus the indicator value, in case of percentage units), which contributes to an increase in farm distress.

The indicators and their weights were determined by using multiple techniques such as expert opinion, literature review, eliminating highly correlated indicators and regressing each variable with farmers distress indicators like farm debt from informal sources with high interest rate.

TABLE 1: Rating of the variables of indicators

Variables	Scores						Total score	Selected variables of each indicator with the best score
	A	B	C	D	E	F		

A- Clear meaning

B- Data is easily available

C- Less effort in data collection and does not require expert analysis

D- Sufficiently representative for the total of the intended results

E- Tangible and observable

F- Difficult to qualify but very important (proxy indicator)

TABLE 2: Calculation of indices

Standardise indicator formula	$\text{Index}_{sw} = \frac{S_w - S_{min}}{S_{max} - S_{min}}$	Index scale 0 = Least vulnerable to 1 = Most vulnerable
Major component formula (7 components)	$R_w = \frac{\sum_{i=1}^{m} \text{Index}_{swi}}{n}$	
Overall index formula (consisting of 50 variables)	$FDI = \frac{\sum_{i=1}^{10} W_{mi} M_{wi}}{\sum_{1=1}^{10} W_{mi}}$	

S_w is the original indicator value for the household.

S_{min} and S_{max} are the minimum and maximum values, respectively.

M_w is one of the major components under the various dimensions of distress.

Index s_{wi} is the indexed indicator for households

n is the number of indicators under each major component.

W_{mi} is the weight of each major component

M_{wi} is the average value of each major component.

4. Results and Discussions

4.1 General profile of the households

Several studies have explained that the preponderance of marginal holdings is increasing due to great demographic pressure and land segregation (Dinesh M, Bassi N, Kishan K, Vedantam N & Sivamohan M, 2015). This was reflected in this study too, where the average operational landholding of the household was 3.8 acre, of which 90 per cent area was under rainfed farming.

The major sources of the households' income are cultivation, agricultural labour, casual labour in non-agricultural sectors and salaried employment in other non-farm sectors. The average household income is around ₹97K per annum. Lack of basic education is starkly observed among the farmers. The age distribution of the household members explores the higher population of productive age group, which indicates the higher potential of economic growth of the region. But the severe crisis in agriculture is ruining the potential, making the farmer's life extremely vulnerable.

4.2 Measuring multiple drivers of distress

When the vulnerability is taken to be the potential state of society, context-specific methods of assessment are required to assess the levels of vulnerability. Multiple drivers of vulnerability are recognised at the local level, which can be used to assess farmers' distress. The major components and the contributing indicators of distress that help identify the key areas of vulnerability among the districts are analysed below.

a. Exposure to risk

Exposure helps determine the level or magnitude and duration for which the farmer households are exposed to disaster (Ebi, Kovats & Menne, 2006). The dimension of exposure comprises major components such as flood, cyclone, drought, infestation of pest, disease in crops, poor inputs, low output price and exposure of livestock to various diseases. Reports on the occurrence of such disasters in the past five years were obtained in the household surveys. They were the reasons for severe crop loss.

Table 3: Indexed values of the major indicators of exposure

		Ananthapuram	Kurnool	Nalgonda	Siddipet
Flood/Cyclone		0.321	0.186	0.256	0.143
Drought		0.335	0.421	0.288	0.300
Low output price		0.000	0.000	0.000	0.012
Mean		**0.22**	**0.20**	**0.18**	**0.15**

Here, the Ananthapuram district depicts the highest value towards the disasters as this district was highly affected by weather calamities and other disasters. This is possibly

because of its geographical location, which makes the district more prone to flood, cyclone or drought. It also doesn't receive adequate warnings of disaster.

b. Adaptive capacity

This indicator, directly as well as indirectly, represents the households' capacity to cope with distress. Socio-demographic profile and livelihood strategies are indicative of the choices that people make and undertake in pursuit of income, security, well-being, and other productive and reproductive goals (DFID, 1999).

TABLE 4: Indexed values of major indicators of adaptive capacity

Indicators	Ananthapuram	Kurnool	Nalgonda	Siddipet
Socio-demographic profile	0.46	0.46	0.48	0.46
Socio-economic assets	0.85	0.88	0.89	0.91
Livelihood strategies	0.48	0.48	0.46	0.49
Social networks	0.71	0.75	0.78	0.71
Agricultural activities	0.57	0.55	0.56	0.52
Mean	**0.61**	**0.62**	**0.63**	**0.62**

There is not much difference in the indexed values of adaptive capacity in the districts. This is possibly because of similar physical settings and due to fact that the variables of each indicator contribute to the various proportions among the districts (Annexure Table III).

c. Sensitivity

Under the sensitivity dimension, there are five major indicators i.e., water, health, food, infrastructure, children and finance. These basic and essential elements of any community were analysed.

The four districts exhibited very low index values for health, infrastructure and finance. This shows a positive sign of reduced vulnerability of agricultural distress. Nalgonda displayed the highest vulnerability towards water as a result of severe water scarcity, due to the failure of borewells.

With respect to the health indicator, there were many human diseases linked to climate variabilities and malnutrition due to crop failure (Krishnamurthy, Lewis and Choularton, 2012). Having high exposure to risks, the index value for health was greater in Ananthapuram and Nalgonda districts, and all these factors enhanced the vulnerability of these districts.

d. Mitigation and adaptation strategy

Despite having possibilities, Indian agriculture is considered a riskier sector than others (Ghosh and Yadav, 2008), due to several factors, which have been discussed in the

TABLE 5: Indexed value of sensitivity indicators

Indicators	Ananthapuram	Kurnool	Nalgonda	Siddipet
Water	0.78	0.68	0.90	0.72
Health	0.03	0.04	0.04	0.05
Food	0.00	0.28	0.27	0.28
Infrastructure	0.00	0.04	0.02	0.00
Children	0.36	0.47	0.45	0.47
Financial	0.03	0.05	0.03	0.04
Mean	**0.33**	**0.37**	**0.43**	**0.37**

previous sections. In such circumstances, farmers adopt some immediate strategies that reduce distress and increase the resilience of households.

TABLE 6: Indexed values of the indicators of mitigation and adaptation strategy

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Farmers' initiative	0.12	0.12	0.11	0.07
Government help	0.42	0.44	0.47	0.49
Adaptation strategies to reduce distress	0.48	0.50	0.43	0.47
Constraints	0.66	0.59	0.64	0.60
Mean	**0.42**	**0.41**	**0.41**	**0.41**

The low value of the indicator of farmers' initiative in the above table indicates that, to mitigate agricultural distress, farmers must adopt their own strategies, such as non-farm employment, borrowing money or utilising savings. These are of greater importance than government support.

e. Triggers

The analysis of indicators such as the size of landholdings and its utilization, cropping pattern, irrigated area, climatic variability, capital formation from agriculture, and institutional credit flow show the dimensions and implications of the micro-level manifestations of agrarian distress. As agrarian distress has multidimensional aspects, the parameters of representative indicators are broadly categorised as farmers' initiative, government help and adaptation strategies to reduce help and its constraints. The most significant and immediate factor that leads to agrarian distress is the failure of crop. The drastic reduction of government investment in agriculture, along with collapsing farm prices, severely affect the economic activity of agricultural households.

f. Social and psychological factors

TABLE 7: Indexed values of the indicators of triggers

Indicators	Ananthapuram	Kurnool	Nalgonda	Siddipet
Chronical illness	0.04	0.13	0.09	0.12
Children marriage dowry	0.01	0.02	0.02	0.03
Unemployment	0.57	0.59	0.62	0.59
Lower price of output	0.61	0.62	0.69	0.61
Crop failure	0.74	0.71	0.73	0.70
Mean	**0.39**	**0.41**	**0.43**	**0.41**

Several studies have found that agrarian distress is somehow related to the psychological conditions of farmers. So, this study also focussed on specific social and psychological factors and the behavioural change of farmers with respect to society and household members.

We observed, from the study, that the most common factor that affected farmers of all districts psychologically is family burden. The feeling of inability to fulfil the family's responsibility properly, along with the lack of moral support from them, upsets the farmers psychologically to such an extent that it affects their agricultural productivity significantly. Also, the mental trauma that farmers face due to loan repayment or some serious conflict with society negatively impacts farming activities. These factors are also responsible for the farmers losing their self-confidence and other behavioural changes in them. One of the main behavioural changes is addiction to some form of intoxication. Therefore, all these factors together make both agriculture and farmers' life vulnerable.

TABLE 8: Indexed values of the indicators of social and psychological factors

Indicators		Ananthapuram	Kurnool	Nalgonda	Siddipet
Change social position		0.04	0.2	0.08	0.16
Family burden		0.52	0.55	0.14	0.33
Deterioration of economic status		0	0	0.14	0.51
Behavioural change		0.29	0.39	0.49	0.35
Losing self confidence		0.18	0.18	0.08	0.24
Mean		**0.21**	**0.26**	**0.19**	**0.32**

g. Impact

The factors discussed in the previous sections have caused several negative effects on rural households. The low and highly fluctuating income from agriculture causes a detrimental effect on farm investments and traps the farmers into a debt. Over time, this

results in farmer's indebtedness. The indebtedness of Indian farmers is perhaps the major determinant of agrarian stress, as it is quickly destroying the farm sector (Dandekar and Bhattacharya, 2017). Severe crisis in agriculture starts with the failure of crops and it sets off a vicious cycle of socio-economic impact, such as erosion of assets, income decline, indebtedness, poverty with poor food consumption and nutrition, and deterioration in standards of living, thus increasing the vulnerability of poor farmers (World Bank, 2006).

The following table shows the values of the indicators of various impacts; vulnerability is the highest in Siddipet district.

TABLE 9: Indexed values of the indicators of various impacts

Indicators	Ananthapuram	Kurnool	Nalgonda	Siddipet
Reduced income	0.72	0.73	0.77	0.74
Increase indebtedness	0.74	0.75	0.77	0.75
Increased poverty	0.68	0.69	0.64	0.64
Face distress in last 5 years	0.00	0.03	0.53	0.87
Mean	**0.53**	**0.55**	**0.68**	**0.75**

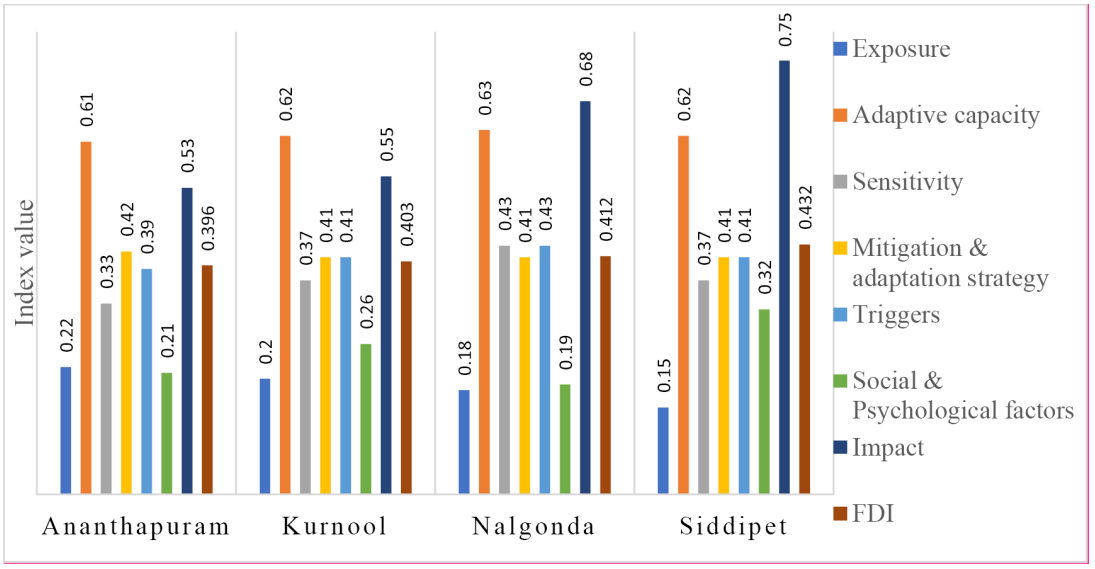
4.3 Dimension of agricultural distress and the Farmer Distress Index (FDI)

To assess the agricultural distress of farmers, seven components were assessed along with their respective major indicators and variables, which indicate the vulnerability of different categories of farmers' households. The value ranges from 0 (less vulnerable) to 1 (more vulnerable) and shows the difference in households' adaptive strategies, sensitivity, triggers, mitigating strategies, exposures, social and psychological factors, and impact. The empirical results, after analysing all the indices, revealed that all the households are extremely vulnerable in terms of adaptive capacity and mitigating strategies, along with their triggers and impacts.

The overall value for FDI in the districts ranged between 0.396 and 0.432, indicating a moderate vulnerability to agricultural distress, impact of climate change, and environmental degradation. The major vulnerability components for FDI are presented in Figure 6, which illustrates the features that contribute to the vulnerability of each area.

As seen in the figure, adaptive capacity and impact are the largest contributors to the vulnerability of farmers. The demographic profile of the area, including inadequate educational status, high caste discrimination and disabled population, increase the vulnerability of the districts. Apart from these, poor economic assets and large dependency on agriculture, along with small landholdings and lack of irrigated area, made the conditions of farmers worse. Sensitivity, triggers and psychological factors have a moderate impact on farmers' distress. The component that has a comparatively lower effect on vulnerability is exposure. Therefore, the overall results of FDI suggest that the studied regions have

FIGURE 5: Dimensions of vulnerability and resulting FDI of four districts



a moderate vulnerability to agricultural distress. Among all the districts, Siddipet is the most vulnerable district.

A closer look at each component of vulnerability reveals some interesting differences. Overall, adaptive capacity has the lowest variation among the districts, possibly due to similar physical patterns, while sensitivity, mitigation and adaptation strategy, and triggers have a moderate variation. The highest variability among the districts was reported for exposure, social and psychological factors, and impact. Exposure was more pronounced in Ananthapuram district while Siddipet showed a substantially lower index value; this indicates a greater vulnerability in Ananthapuram. Natural disasters such as flood and cyclones account for these differences (Exposure table).

The above analysis of the major components and the contributing indicators of the dimensions of vulnerability will help identify the key areas to be considered while restructuring planning, decision-making and implementation.

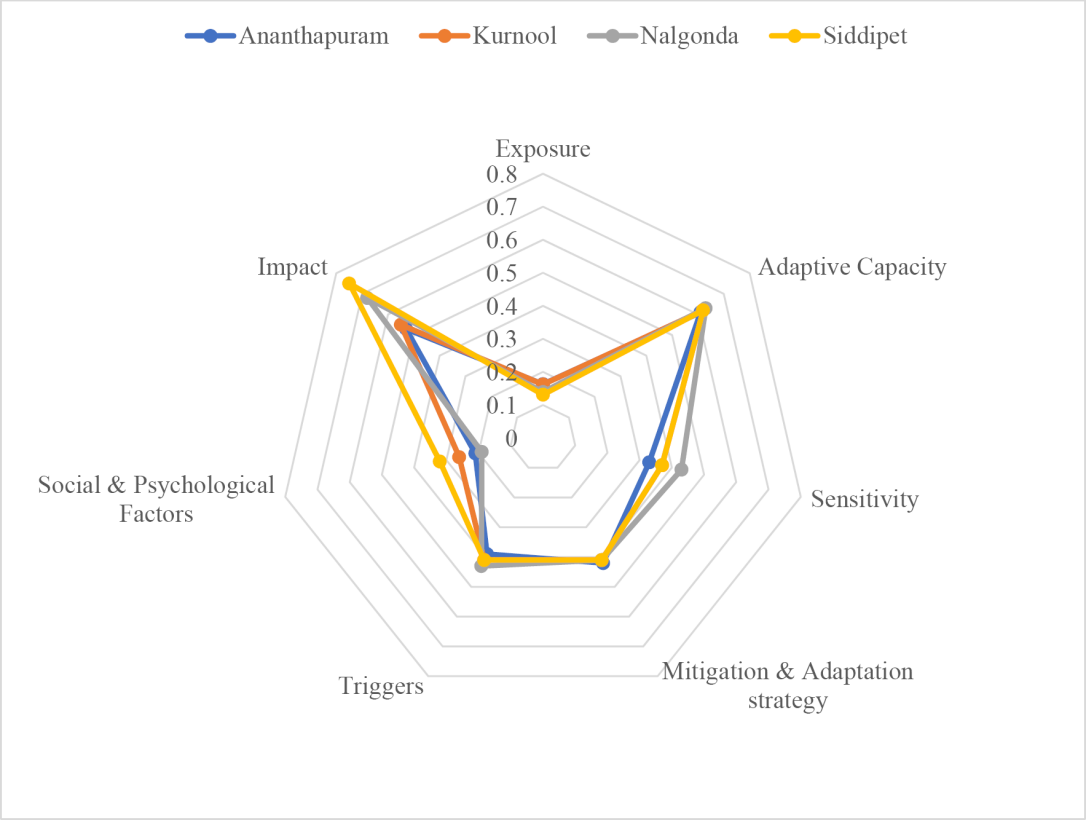
4.4 Scale-up and mapping of vulnerability

Figure 7 represents the severity of distress in districts, which was mapped based on FDI. This specular mapping will help provide a powerful tool to identify clusters, trends and patterns (Khan and Salman, 2012) by offering an overview of the results at the district level. It will also help identify areas of concern for the respective provincial governments (Said, Musaddiq, and Mahmud 2011). The areas in brown are the most vulnerable districts and those in yellow are the least vulnerable.

To track FDI at a further lower level for exploring the farmers' distress very minutely as well as for future policy work, the *mandals* of the districts were prioritised into three categories (Table 10) in terms of FDI values.

a. Category A *mandals* (demarcated in red): Severe distress *mandals* (top 30

FIGURE 6: Vulnerability diagram for the contributing major components of FDI



b. Category B *mandals* (demarcated in green; dark green for high moderate and light green for low moderate): Moderate distress *mandals* (30 to 60

c. Category C *mandals* (demarcated in yellow): Low distress *mandals* (bottom 40

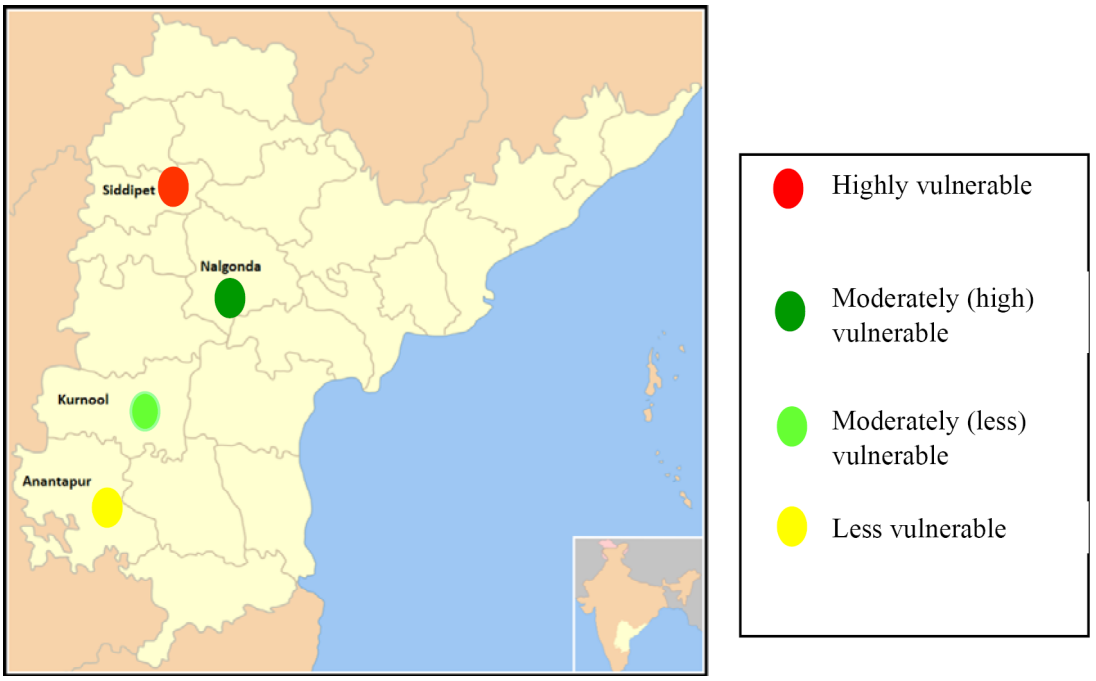
TABLE 10: Prioritisation of *mandals* for future planning

Category A	Category B	Category C
Chaddampet	Mulugu	Kanaganapalli
Dubbaka	Marriguda	Ramagiri
Markook	Kudumur	Kattamgur
	Pathikonda	

4.5 Main research findings

Dryland farmers, especially in low-to-middle income households, face many challenges, such as rising production costs, pressures from natural disasters, and dealing with the fluctuations of market price. Upgraded information and knowledge is very important to generate applicable measures to cope with, as well as reduce, agricultural risks and vulnerability (Kantamaneni, Rice, Yenneti and Campos, 2020). Accordingly, the current

FIGURE 7: Mapping of severity of distress among the districts



study measured the vulnerability of dryland farmers by developing FDI. The results revealed that agricultural vulnerability varies more or less among the sites.

Though the study covered many indicators, only 50 variables were considered for the development of FDI. Based on the index values, the indicators were ranked and the top ten variables with the highest values were remarked. Rank 1 indicates the maximum vulnerability, and the vulnerability decreases with decreasing rank. The following table depicts the top ranked variables of the districts with the most impact.

The study revealed that better access to resources does not necessarily mean that households have greater resilience measures. The findings show that although Siddipet district is reported as the most vulnerable district in the study region, by considering the overall 50 indicators and FDI value, the top-rated indicators of the most severe distress in agriculture impacted the Nalgonda district mostly.

This is mainly because of the very high index value of other indicators in Siddipet district. These indicators also impacted the remaining 40 indicators, finally negatively affecting the farmers' economic resources, leading to a profound disruption of social life and cultural practices within the community.

FIGURE 8: Vulnerability map of Ananthapuram district

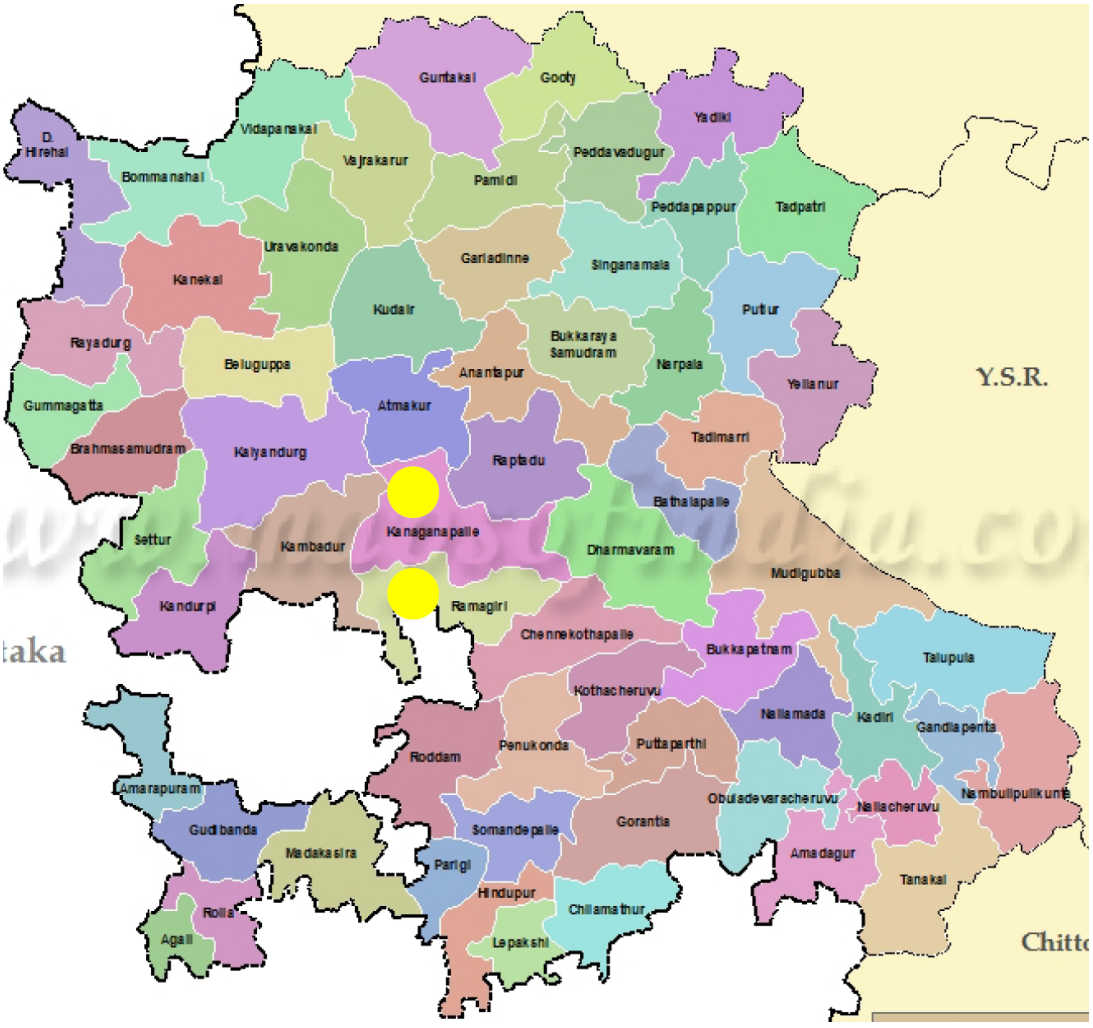


FIGURE 9: Vulnerability map of Kurnool district

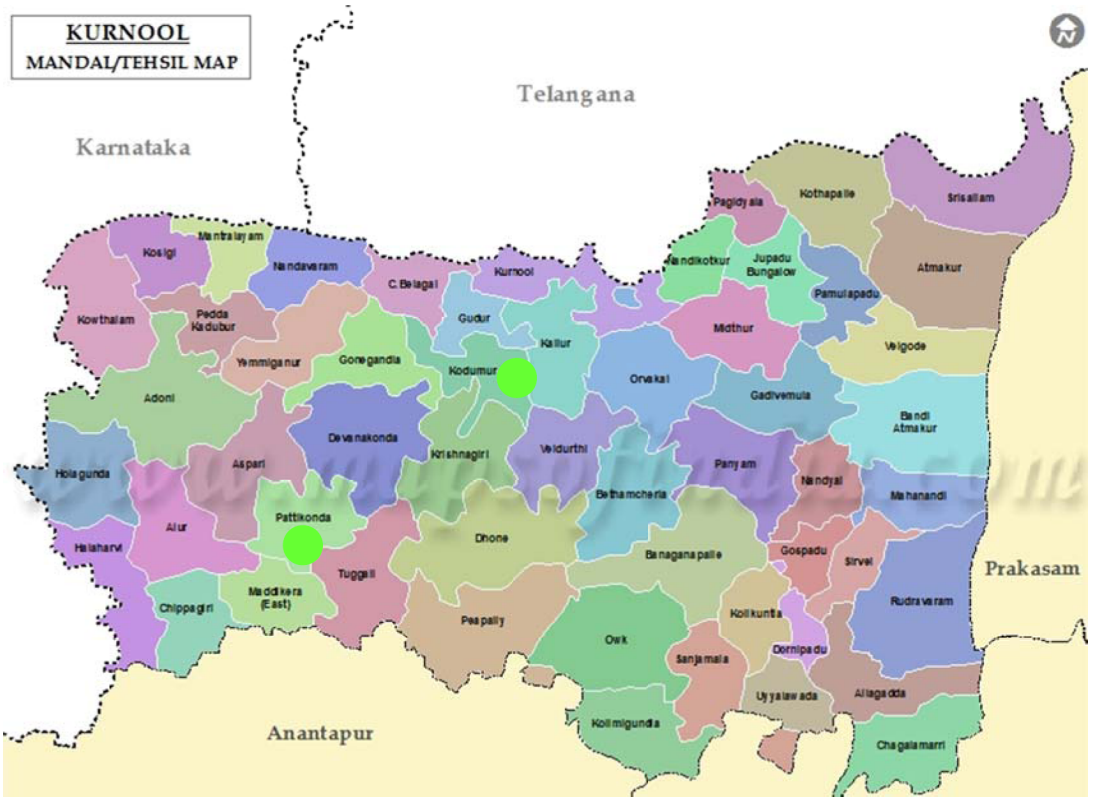


TABLE 11: Rank-wise top 10 indicators denoting severe distress (rank as per their index value)

Rank	Distress Indicators	Most impacted district
1	Inadequate total household income	Ananthapuram
2	Household assets value	Siddipet
3	Income from agriculture	Nalgonda
4	Agricultural landholding	Siddipet
5	Low educational status	Ananthapuram, Nalgonda
6	Failure of bore well (lack of irrigation)	Nalgonda
7	Reduced income and indebtedness	Nalgonda
8	Social networking with both SHGs and cooperatives	Nalgonda
9	Crop failure	Ananthapuram
10	High farm expenses	Nalgonda

FIGURE 10: Vulnerability map of Nalgonda district

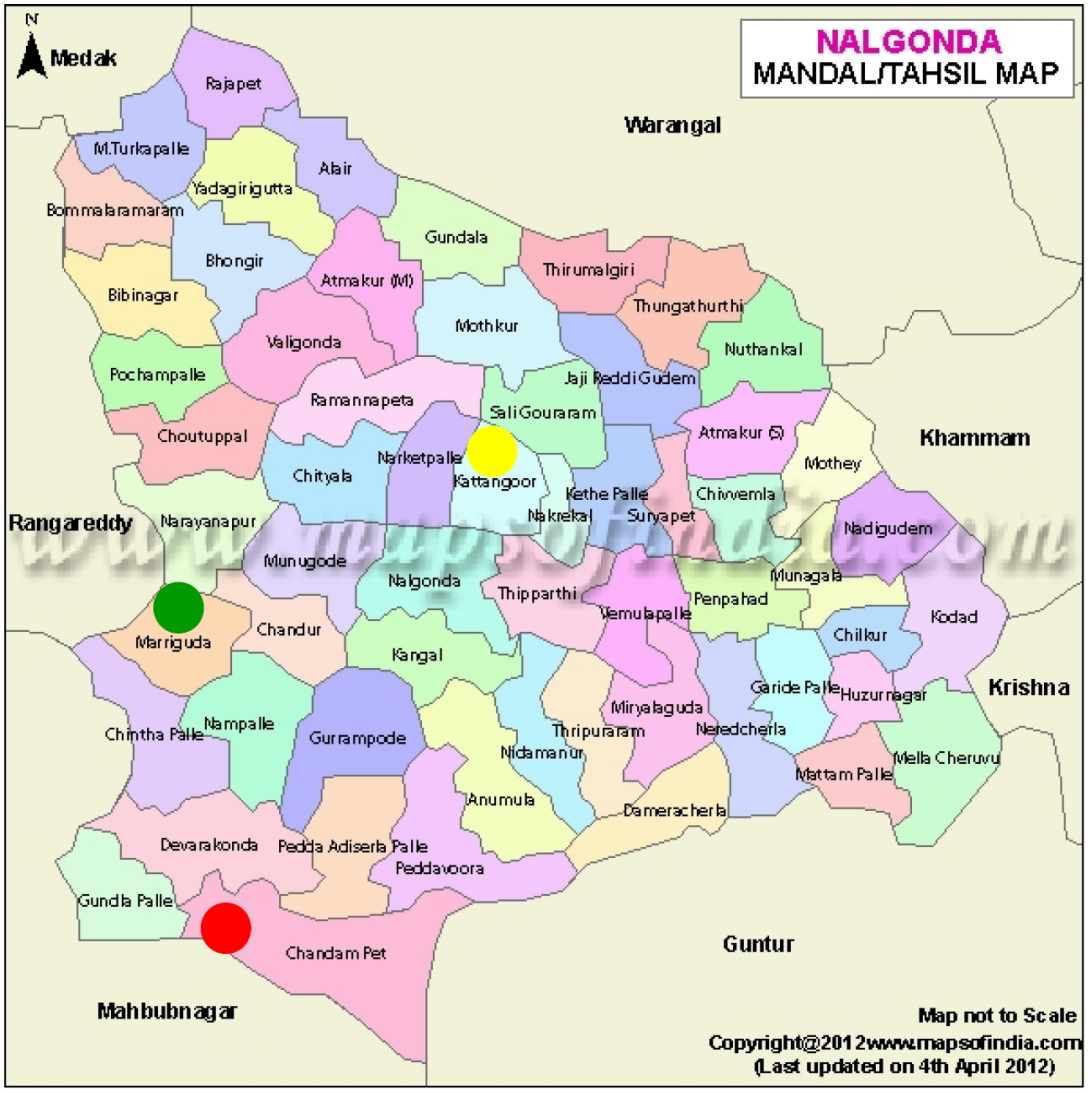
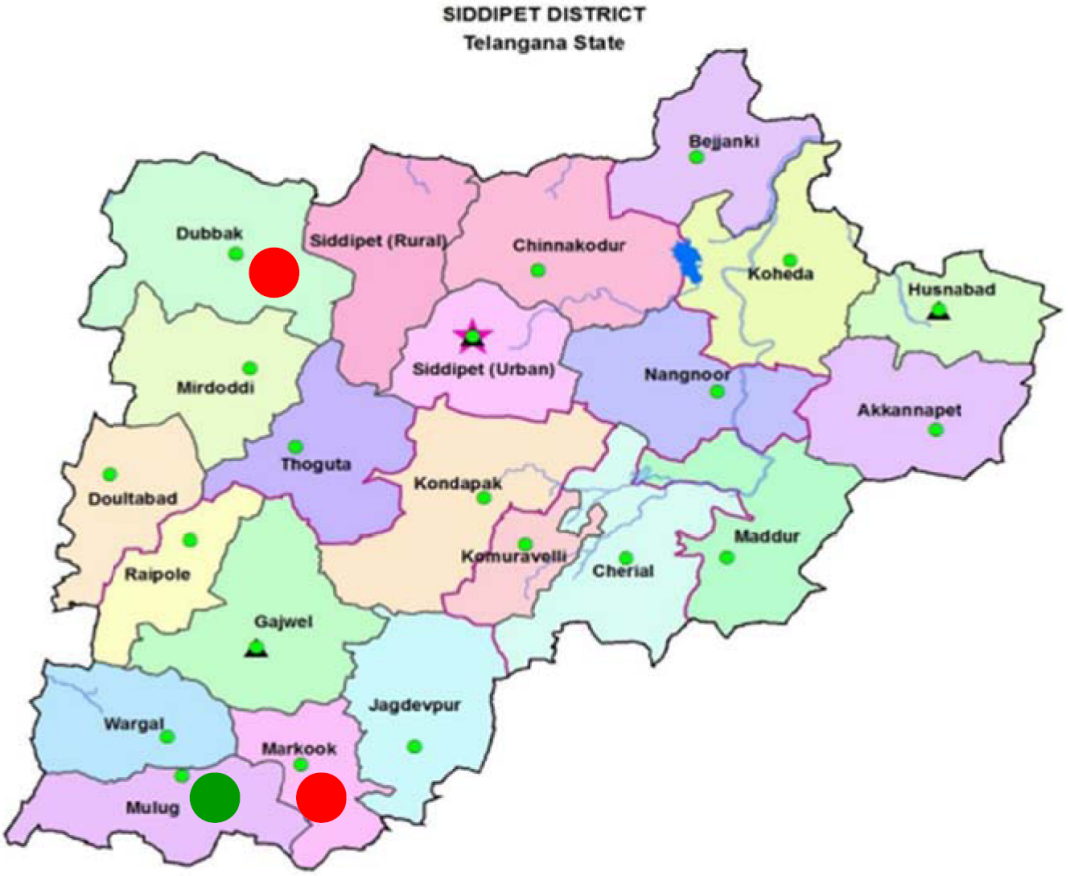


FIGURE 11: Vulnerability map of Siddipet district



5. Policy Implication

The study results have implications on several policy areas concerning agricultural distress and on preparing farmers to cope with the risks from exposure to extreme weather events and other relevant incidents.

Thus, under the present circumstances, priority-based policy development is extremely necessary in India. Considering the challenges discussed earlier, the following policy recommendations have been proposed to support adaptation at the farmers' level. They focus on the three categories of *mandals* A, B and C.

a) **Social protection measures:** Social protection measures, which build on traditional risk diffusion measures, such as storage of food grains for lean years and accumulation of financial assets, are recommended, as they can partially contribute towards improving the adaptive capacity of farmers.

b) **Scale up the drought prone areas:** Selection of suitable crops, such as weather-resistant crops (especially drought tolerant varieties) is important to improve crop cultivation. To select an area-specific variety, there is an urgent need for perfect demarcation of drought-prone areas up to the *mandal* levels.

c) **Realistic crop insurance system:** Although the adoption of agricultural insurance is one of the most effective mechanisms to mitigate agricultural risks, the long-run insurance schemes in India have been beset with several problems due to operational weakness (Gulati, Terway and Hussain, 2018). Therefore, the realistic crop insurance system based on probabilistic catastrophe models, leveraging satellite imagery, remote sensing technology and minimal reliance on human intervention, can provide yield assessment with 90 per cent accuracy at the village/panchayat level (Ghosh, 2018). Along with this, there is a need for transparency and fair coordination of each level and awareness among the farmers.

d) **Resource regulation and management:** Policies should also be focussed on regulation and management, including integration and recycling of locally available resources, along with creation of awareness of these practices, so that farmers can enjoy optimal benefits.

e) **Weather forecasting:** Weather-related information should be easily available to all the remote villages. Awareness of this must be created through media as well as the village-level government representatives. This will help farmers take precautionary measures and increase their resilience.

f) **Prioritisation of fund allocation:** A separate fund should be allocated to address farmers' distress, wherein category A and B *mandals* must be given priority. Of course, the fund transfer needs to be strictly monitored to ensure it reaches the farmers during a crisis.

6. Distress Management Package

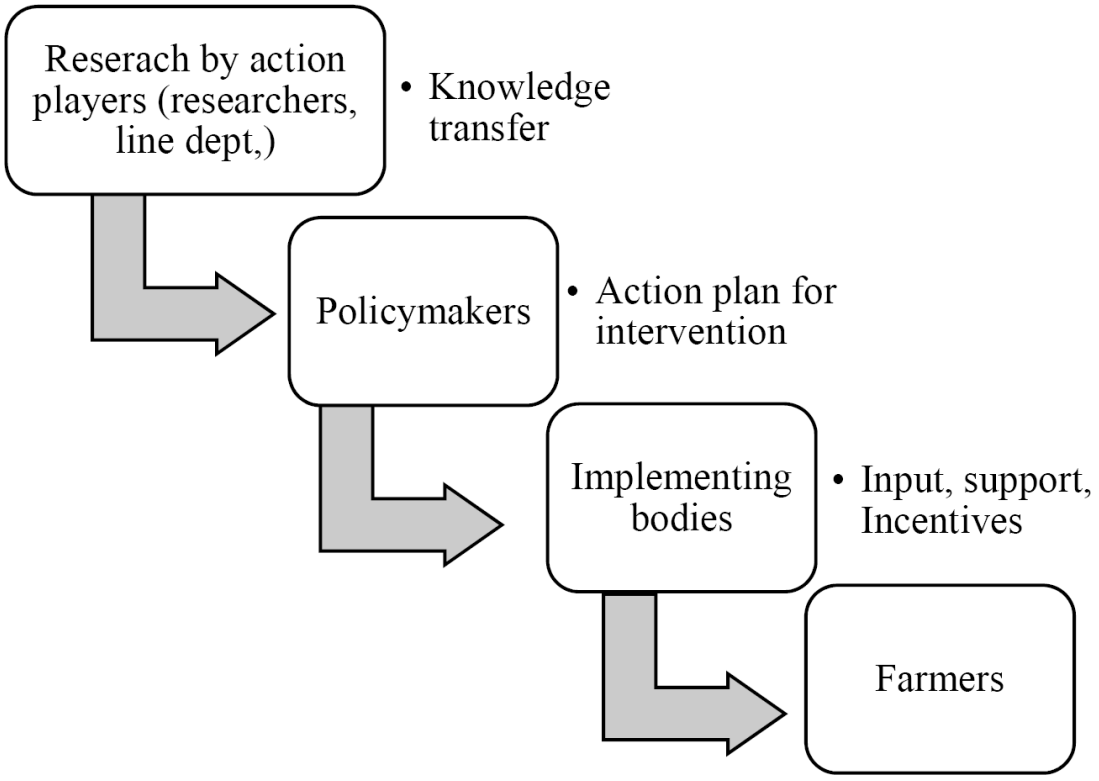
FDI offers a framework to evaluate and understand the vulnerability at the farmers' level. It captures indicators from all physical, ecological, social, economic and psychological aspects and identifies different levels of vulnerable zones. Based on these factors, particular adaption barriers are targeted for future intervention.

The FDI analysis can be used to inform local community-driven climate resilience strategies at 'climate innovation platforms', which can be established throughout the country (Simane et al. 2012). This analysis can also be applied to study landscape-scale vulnerability patterns across other tropical regions in a comparative perspective.

Finally, the study highlights that the top 10 indicators of agricultural stress (Table 11), which are directly or indirectly related to the other indicators, explore the extreme challenges of subsistence that agricultural communities are facing.

The study also points out the extreme demand for a proper package of distress management, with periodical monitoring at every level, to eradicate loopholes. The process constitutes an extensive knowledge transfer from researchers to policymakers for developing a successful action plan for intervention, through various organisations, by providing support, inputs and incentives (Figure 12).

FIGURE 12: Diagrammatic representation of distress management package in agriculture (modified from Srinivasa et. al., 2018)



For proper implementation of this package, a precise action plan, targeting the most severe distress indicators (with special focus on the top ten indicators), is required.

The study also emphasises the identification of the responsible bodies for implementing the intervention plan, targeting each indicator at the village level.

TABLE 12: Action plan for distress management package

Area of intervention	Distress indicators	Action plan for intervention	Responsible bodies
Strengthening and training of small enterprises	Inadequate total household income	Encourage women in cottage industry to engage with farm waste materials	NGOs
Credit support	Reduced income and indebtedness	Easy and smooth access of formal credit institution	Formal credit institutions (banks, co-operatives)
	Household assets value	Monitoring and proper delivery of various asset generating schemes like housing, vehicles and agricultural implements	Local level government bodies (Panchayat)
National level coordination regarding farm product management	High farm expenses	• Proactiveness of government for agricultural subsidy schemes to reach all farmers • Proper farm mechanisation • Usage of renewable resources	• State level government bodies • Research institutions, NGOs
	Income from agriculture	• Strict and effective implementation of minimum support price • Cooperative farming practices	Local level govt. bodies (Panchayat)
Mapping of local resources and their management	Agricultural landholding	Adoption of integrated farming system	Research institutions, KVKs
	Failure of borewells (lack of irrigation)	Practice of water harvesting and conservation	

capacity building	Low educational status	Provide extension services and special training to farmers	Extension agencies, research institutions, NGOs, SHG
Promotion of involvement in mitigation programmes	Crop failure	• Awareness of crop insurance schemes • Identification of drought-prone areas • Selection of proper crop varieties	Local, state and national level government bodies

7. Conclusion

Agricultural sustainability, in the era of climate change, concerns the entire society, including farmers, communities, policymakers and researchers. Scientifically evolved indicators for measuring vulnerability and level of resilience to recent changes help in planning interventions that are most appropriate for the current agricultural system. Although several studies have focussed on climate change dimensions and their impact on agriculture, very studies examine the comprehensive and composite set of indicators that represent all important dimensions of agricultural distress.

This study includes the distress indicators of all dimensions and provides a broad framework, which must be subjected to appropriate vulnerability profiling of the farming communities.

The study proves that FDI can be used as an effective tool to evaluate the vulnerability of dryland regions, according to the context and locality.

The study found out the differences between the seven dimensions and identified the major influencing indicators that led to the differences in vulnerabilities of the districts (Raghavan, et al., 2018). This will help the stakeholders address the identified deficiencies.

The study poses an important research question as to why there are different levels of vulnerability within a particular society, even in the context of similar kinds of hazards. The possible answer is that the variation is different in terms of equality, entitlement capacity, institutions, and the political and cultural aspects that are responsible for the differential vulnerability (Raju, Deshpande and Satyasiba B, 2016).

Therefore, the policy implications are crucial in restructuring the farming system and mobilising the marginalised sections through concerted research and development. Moreover, a timely and accurate weather forecasting system and awareness campaigns on resource management are emergent needs of the farming communities.

The framework of the study also provides an effective and conceptual model of a distress management package to develop a network of various players and location-specific action plans to mitigate agricultural distress (Raju, Deshpande and Satyasiba B, 2016).

References

1. Birkmann J (2006). Measuring vulnerability to natural hazards — Towards disaster resilient societies. United Nations University Press, Tokyo. Available online at https://archive.unu.edu/unupress/sample-chapters/1135-MeasuringVulnerabilityToNaturalHazards.pdf.

2. Burnham M and Ma Z (2016). Climate change adaptation: Factors influencing Chinese smallholder farmers perceived self-efficacy and adaptation intent. Regional Environmental Change. 17(1). Pp 171—186.

3. Chambers R (1989). Editorial introduction: Vulnerability, coping and policy. IDS Bulletine. 2(2). Pp 1-7.

4. Dandekar A and Bhattacharya S (2017). Lives in debt: Narratives of Agrarian distress and farmer suicides. Economic and Political Weekly. 52. Pp 77-84. Available at https://www.researchgate.net/publication/317750315_Lives_in_debt_Narratives_of_Agrariandistress_and_farmer_suicides.

5. DFID (1999). DFID Sustainable Livelihoods Guidance Sheets. ENN: Dongguan, China.

6. Dinesh M, Bassi N, Kishan K, Vedantam N and Sivamohan M (2015). The Factors Causing Agrarian Crisis in India: A Study from Four Agro-ecological Regions in India. Final report by IRAP Hyderabd. Pp vii-viii.

7. Ebi K, Kovats R S and Menne B (2006). An approach for assessing human health vulnerability and public health interventions to adapt to climate change. Environmental Health Perspectives 114. Pp 1930—1934.

8. Frank J and Penrose-Buckley C (2012). Small-Scale Farmers and Climate Change: How Can Farmer Organisations and Fairtrade Build the Adaptive Capacity of Smallholders? International Institute for Environment and Development. London, UK. Available online at https://pubs.iied.org/sites/default/files/pdfs/migrate/16518IIED.pdf?#:~:text=Both%20the%20case%20study%20and,and%20savings%20institutions%20and%20extension.

9. Food and Agricultural Organisation (2021). FAO India at a glance, FAO in India. Food and Agriculture Organization of the United Nations. Available online: http://www.fao.org/india/fao-in-india/india-at-a-glance/en/.

10. Ghosh R K (2018). Performance evaluation of Pradhan Mantri Fasal Bima Yojana (PMFBY). Part 1. Governance Analysis. Final report. Indian Institute of Management Ahmedabad. Pp 85-86.

11. Government of India (2008). National Action Plan on Climate Change; New Delhi, India. Pp. 56.

12. Gulati A, Terway P and Hussain S (2018). Crop Insurance in India: Key Issues and Way Forward. Working Paper No. 352, Indian Council for Research on International Economic Relations. Pp v-vii.

13. Harvey C A, Rakotobe Z L, Rao N S, Dave R, Razafimahatratra H, Rabarijohn, R H, Rajaofara H and MacKinnon J L. (2014). Extreme vulnerability of smallholder farmers to agricultural risks and climate change in Madagascar. Philosophical Transactions of the Royal Society B: Biological Sciences. 369 (1639). Pp 1-12.

14. IPCC (Intergovernmental Panel on Climate Change). (2007a). Summary for policymakers. Impacts, Adaptation and Vulnerability. Cambridge University Press. Cambridge, England.

15. Kantamaneni K, Rice L, Yenneti K and Campos L C (2020). Assessing the Vulnerability of Agriculture Systems to Climate Change in Coastal Areas: A Novel Index. Sustainability. 12 (11). Pp 4771.

16. Khan F A and Salman A (2012). A Simple Human Vulnerability Index to Climate Change Hazards for Pakistan. International Journal Disaster Risk Science. 3 (3). Pp. 163—176

17. Krishi Jagran, (2017). Know about Dryland Agriculture and Farming Technology. https://krishijagran.com/news/know-about-dryland-agriculture-and-farming-technology/.

18. Krishnamurthy P K, Lewis K, Choularton R J (2012). Climate Impacts on Food Security and Nutrition–A Review of Existing Knowledge. Met Office and WFP's Office for Climate Change, Environment and Disaster Risk Reduction. Exeter, UK.

19. Madhuri, Tewari H R and Bhowmick P K (2014). Livelihood vulnerability index analysis: An approach to study vulnerability in the context of Bihar. Jamba: Journal of Disaster Risk Studies. 6 (1). Available online at https://doi.org/10.4102/jamba.v6i1.127.

20. McDowell J Z and Hess J J (2012). Accessing adaptation: multiple stressors on livelihoods in the Bolivian highlands under a changing climate. Global Environmental Change. 22. Pp. 342 — 352.

21. National Intelligence Council (2009). Impact of Climate Change to 2030 -A Commissioned Research Report. New Delhi, India.

22. Planning Commission (2012). Final Report of Minor Irrigation and Watershed Management for the Twelfth Five Year Plan (2012—2017). Government of India: New Delhi, India. Pp. 3—4.

23. Raghavan S A, Funk C, Aenis T, Winker P and Breuer L (2018). Sensitivity analysis of a climate vulnerability index–A case study from Indian watershed development programmes. Climate change Responses. 5(1). Available online at https://climatechangeresponses.biomedcentral.com/track/pdf/10.1186/s40665-018-0037-z.pdf.

24. Raju K V, Deshpande R S and Satyasiba B (2016). Socio-economic and Agricultural Vulnerability Across Districts of Karnataka. Climate Change Challenge (3C) and

Social-Economic-Ecological Interface-Building. Environmental Science and Engineering. Pp 161-190. Available online at https://doi.org/10.1007/978-3-319-31014-5_11.

25. Said F, Musaddiq T and Mahmud M (2011). Macro Level Determinants of Poverty: Investigation through Poverty Mapping of Districts of Pakistan. Paper presented at the 27th Annual Meeting and Conference of Pakistan Society of Development Economists. Pp. 13—15.

26. Sathyan A R, Funk C, Aenis T and Breuer L. (2018). Climate Vulnerability in Rainfed Farming: Analysis from Indian Watersheds. Sustainability. 10 (9). Pp 3357.

27. Simane B (2011). Building resilience to climate change and green economy in mountain ecosystems of Ethiopia: Integrating research, capacity building and sustainable development activities. Proceedings of the stakeholder's workshop. Debre Markos, Ethiopia, Pp. 92.

28. Sindhuja P and Asokhan M (2018). Training Needs — An Analysis in Dryland Farming System with Gender Perspectives. Current Agriculture Research Journal. 6(1). Pp. 119-122.

29. Srinivasa Rao C, Kareemulla K, Krishnan P, Murthy G R K, Ramesh P, Ananthan P S and Joshi P K. (2018). Agro-ecosystem based sustainability indicators for climate resilient agriculture in India: A conceptual framework. Ecological Indicators. Available online at https://doi.org/10.1016/j.ecolind.2018.06.038.

30. The World Bank. (2006). Overcoming Drought: Adaptation Strategies for Andhra Pradesh, India. Available online at https://openknowledge.worldbank.org/bitstream/handle/10986/7085/372600IN0Overc101OFFICIAL0USE0ONLY1.pdf?sequence=1&isAllowed=y.

31. Vijayan R (2016). Dryland agriculture in India — problems and solutions. Asian Journal of Environmental Science. 11(2). Pp 171-177.

32. Wani S P, Rockstrom J and Oweis T Y. (2009). Rainfed Agriculture: Unlocking the Potential. Centre for Agriculture and Bioscience International. Available online at http://www.iwmi.cgiar.org/Publications/CABI_Publications/CA_CABI_Series/Rainfed_Agriculture/Protected/Rainfed_Agriculture_Unlocking_the_Potential.pdf.

33. Wisner B P (2002). Who? What? Where? When? in an emergency: Notes on possible indicators of vulnerability and resilience: By Phase of the Disaster Management Cycle and Social Actor', in E. Plate (ed.), Environment and Human Security, Contributions to a workshop in Bonn, Germany, October 23—25, 2002. Pp. 12/7— 12/14.

[1] https://en.wikipedia.org/wiki/Telangana.

[2] https://en.wikipedia.org/wiki/Andhra_Pradesh

Annexure

TABLE I: Rating of variables of indicators

Indicators	Variables	Scores (0-2)						Total score	Selected variables
		A	B	C	D	E	F		
Exposure to risk	Flood/cyclone	2	2	1	2	2	2	11	✓
	Drought	2	2	1	2	2	2	11	✓
	Pest/disease attack	1	1	1	1	1	1	6	
	Poor input	2	1	0	1	0	1	5	
	Less output price	2	2	1	2	2	2	11	✓
	Livestock diseases	1	1	1	1	1	1	6	
Socio-demographic profile	Female-headed households	2	2	2	0	1	1	8	
	Caste	2	2	2	1	1	2	10	✓
	Religion	2	2	1	0	0	0	5	
	HH size	2	2	2	1	1	1	9	
	Elderly population	2	2	1	1	1	1	8	
	Disability	2	1	1	0	0	0	4	
	Sex ratio	2	2	2	2	2	2	12	✓
	Educational status of head	2	2	2	2	2	2	12	✓
	Illiteracy	2	1	1	1	2	2	9	
	Dependency ratio	2	2	1	1	2	2	10	✓
Socio-economic assets	House value	2	1	1	2	1	2	9	✓
	Gold value	2	0	0	1	1	2	6	
	Total own land	2	1	1	2	2	2	10	✓
Livelihood strategies	Total savings	2	1	1	2	2	2	10	✓
	Total income	2	1	1	0	1	2	7	
	Simpson Index Income	2	0	1	2	2	2	9	✓
	SDI of cropping pattern	2	0	1	2	2	2	9	✓

	Household expenditure	2	1	1	2	1	2	9	✓
Social network	Membership of SHG	2	1	2	1	1	1	8	
	Membership of cooperatives	2	1	2	1	1	1	8	
	Membership of agricultural cooperatives	2	1	2	1	1	1	8	
	Membership of local cooperatives	2	1	2	1	1	1	8	
	All SHGs/cooperatives	2	1	2	2	1	1	9	✓
Agriculture	Expenditure on agricultural input	2	1	1	1	1	1	7	
	Income from agriculture	2	1	1	2	2	2	10	✓
	Profit	2	1	1	2	2	2	10	✓
	Production cost	2	1	1	1	1	1	7	
	Total owned land	2	2	1	1	1	1	8	
	Total leased land	2	2	1	0	0	0	5	
	Profit/acre	2	1	1	1	1	1	7	
	Rainfed area	2	2	2	1	1	2	10	✓
Water	Provision of rainwater harvesting in the village	2	2	1	1	1	1	8	
	Failure of borewells	2	2	2	1	2	2	11	✓
Health	Health expenditure	2	1	1	2	1	2	9	✓
	Likely health expenses	2	1	1	1	1	1	7	
	Chronic illness	2	1	1	1	1	1	7	
Food	Food expenses	2	1	1	1	2	2	9	✓
Infrastructure	Road	2	2	2	2	2	2	12	✓
Children	Children enrolled in private school	2	2	1	1	1	1	8	

Finance	Likely withdrawal of children from schools	2	2	2	1	1	2	10	✓
	Indebtedness through informal source	2	2	2	2	2	2	12	✓
Farmers' initiative	Reduced cropped area	2	2	1	1	2	2	10	✓
	Land kept fallow	2	2	1	1	1	1	8	
	Low input use	2	2	1	1	1	1	8	
	Reduced household expenses	2	1	1	1	2	2	9	✓
	Borrowing from relatives and friends	2	2	1	1	1	1	8	
	Borrowing from money lenders	2	2	1	2	2	2	11	✓
	Migrated out as casual labourer	2	1	2	1	1	1	8	
	Participation in MNREGA	2	2	1	1	1	0	7	
	Postponed health treatment	2	1	1	1	1	0	6	
	Postponed marriages	2	1	1	0	0	0	4	
	Sold livestock animals	2	1	1	1	2	2	9	✓
	Engaged in animal husbandry	2	2	1	1	1	1	8	
	Sending women for domestic work	2	2	1	1	1	0	7	
Government benefits	Benefitted by any formal institution	2	2	2	2	2	2	12	✓
	Benefitted by Rythu Bandhu	2	1	2	1	1	2	9	✓
	Benefitted by SHC	2	1	1	1	1	1	7	
	Benefitted by KCC	2	1	1	1	1	1	7	

	Benefitted by old age pension	2	1	2	1	1	2	9	✓
	Benefitted by health scheme	2	1	1	1	1	0	6	
	Got assistance for child education	2	1	1	1	0	0	5	
	Benefitted by insurance scheme	2	1	2	1	2	2	10	✓
Adaptation strategies	Using own savings	2	1	1	1	1	1	7	
	Migration to other places	2	2	2	1	2	2	11	✓
	Changing cropping pattern	2	1	1	1	1	1	7	
	Sale of assets	2	1	1	1	1	1	7	
	Reducing expenditure on food	2	1	1	1	1	1	7	
	Dropout of children from school	2	1	1	0	1	1	6	
	Borrowing	2	1	2	1	1	1	8	
	Depending more on non-farm employment	2	2	1	1	2	2	10	✓
	Bonded labour	2	0	0	1	1	1	5	
	Taking support from local governments	2	1	1	0	1	1	6	
Constraints	Low education level	2	2	2	1	2	2	11	✓
	Lack of access to information	2	1	1	1	1	1	7	
	Inadequate capital	2	1	2	1	2	2	10	✓
	Lack of extension services	2	1	1	1	1	1	7	
	Land not suitable	2	1	1	1	1	1	7	
	Lack of irrigation	2	1	2	2	2	2	11	✓
	Non-availability of labour	2	1	1	1	1	1	7	

	Lack of quality inputs	2	1	1	1	1	1	7	
	Health expenses	2	1	1	1	1	1	7	
	Marital disputes	2	1	1	0	1	1	6	
	Chronical illness	2	1	1	1	2	2	9	✓
	Children marriage dowry	2	1	1	2	1	2	9	✓
	Educational expense	2	1	1	1	1	1	7	
	Other marriage expense	2	0	0	1	0	1	4	
	Unemployment	2	1	2	1	1	2	9	✓
	Lack of alternative income source	2	1	1	1	1	1	7	
	Frequent pest and disease attack	2	1	1	1	1	1	7	
	Outbreak of livestock disease	2	1	1	1	1	1	7	
	Lower price of output	2	1	1	2	2	2	10	✓
	High farm expenses	2	1	1	1	1	2	8	
	Crop failure	2	2	2	2	2	2	12	✓
	Debt from informal sources	2	1	2	1	1	1	8	
Social factor and change in social position	Objection in women's participation	2	1	1	1	1	1	7	
	Catastrophe incident in last 5 years	2	1	1	1	1	1	7	
	Negative comment from society	2	1	1	0	1	0	5	
	Feeling isolated	2	1	1	2	2	2	10	✓
	Serious issue with society	2	1	1	1	1	1	7	
Family burden	Unable to fulfil family's responsibility	2	1	1	1	2	2	9	✓

	Didn't get moral support	2	1	1	1	1	1	7	
	Major family issue	2	1	1	1	1	1	7	
Deterioration of economic status	Worried about financial distress	2	1	1	1	2	2	9	✓
	Family problem regarding the deterioration in economic status	2	1	1	1	1	2	8	
Behavioural change	Addiction to smoking, alcohol or drugs	2	1	1	2	1	2	9	✓
Losing self-confidence	Stressed out for a long time	2	1	1	1	2	2	9	✓
	Lost pleasure in economic activities	2	0	0	1	1	1	5	
	Thoughts of ending life	2	0	0	1	2	2	7	
Impact	Reduced income	2	1	1	2	2	2	10	✓
	Increase indebtedness	2	1	1	2	2	2	10	✓
	Shortage in food consumption	2	1	1	1	2	1	8	
	Purchased food from outside	2	1	1	1	1	1	7	
	Increased poverty	2	1	1	2	2	2	10	✓
	Deteriorating health	2	1	1	1	1	1	7	
	Social stigma	2	1	1	1	0	1	6	
	Sale of livestock-/poultry	2	1	1	1	1	1	7	
	Faced distress in last 5 years	2	2	2	2	2	2	12	✓

TABLE II: Indices of crop loss during last 5 years due to natural hazards (exposure to risk)

District	Flood/ cyclone	Drought	Pest attack	Poor inputs	Low output price	Livestock diseases	Other losses
Ananthapuram	0.321	0.335	0.042	0.009	0.000	0.000	0.432
Kurnool	0.186	0.421	0.095	0.001	0.000	0.016	0.418
Nalgonda	0.256	0.288	0.061	0.000	0.000	0.000	0.366
Siddipet	0.143	0.300	0.118	0.004	0.012	0.015	0.326

TABLE III: Indices of socio-demographic profile

District	Sex	Caste	Religion	family size	Elderly population	Disability	Sex ratio	Educational status of head	Illiteracy	Dependency ratio	Mean
Ananthapuram	0.07	0.61	0.01	0.34	0.45	0.42	0.17	0.8	0.32	0.27	0.346
KurNool	0.08	0.60	0.05	0.37	0.53	0.48	0.17	0.78	0.36	0.28	0.370
Nalgonda	0.07	0.71	0.01	0.33	0.6	0.57	0.16	0.8	0.33	0.24	0.382
Siddipet	0.09	0.59	0.05	0.37	0.58	0.53	0.19	0.76	0.38	0.28	0.382
Total	0.08	0.63	0.03	0.35	0.54	0.5	0.17	0.79	0.35	0.27	0.371

TABLE IV: Indices of socio-economic assets

	Ananthapuram	Kurnool	Nalgonda	Siddipet
House value	0.99	0.97	0.96	0.94
Gold value	0.92	0.91	0.92	0.91
Total own land	0.71	0.79	0.82	0.88
Mean	0.81	0.82	0.83	0.84

TABLE V: Indices of livelihood strategies

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Total savings	0.81	0.822	0.837	0.77
Total income	0.91	0.88	0.89	0.866
Simpson Index Income	0.527	0.482	0.516	0.515
SDI	0.191	0.227	0.117	0.328
Household expenditure	0.392	0.381	0.369	0.359
Mean	0.566	0.558	0.546	0.568

TABLE VI: Indices of social networks

	Ananthapuram	Kurnool	Nalgonda	Siddipet
SHG	0.081	0.194	0.212	0.131
Cooperative	0.862	0.856	0.931	0.8
Agricultural cooperative	0.919	0.944	0.975	0.969
Local cooperative	0.981	0.987	0.987	0.956
Mean	0.711	0.745	0.776	0.714

TABLE VII: Indices of agricultural activities

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Agricultural input	0.122	0.104	0.082	0.063
Income from agriculture	0.856	0.791	0.857	0.818
Profit	0.703	0.701	0.694	0.682
Production cost	0.065	0.135	0.15	0.09
Total owned land	0.713	0.793	0.819	0.881
Total leased in land	0.002	0.044	0.025	0.015
Profit/acre	0.637	0.638	0.622	0.58
Rainfed operational	0.153	0.16	0.12	0.046
Mean	0.406	0.421	0.421	0.397

TABLE VIII: Indices of sensitivity indicators

		Ananthapuram	Kurnool	Nalgonda	Siddipet
Water	Provision of rain water harvesting	0.41	0.68	0.59	0.5
	Failure of borewells	0.78	0.68	0.9	0.72
Health	Health expenditure	0.03	0.04	0.04	0.05
	Likely health expenses	0.39	0.43	0.51	0.47
	Chronic illness	0.04	0.13	0.09	0.12
Food	Food expenses	0	0.28	0.27	0.28
Infrastructure	Road	0	0.04	0.02	0
Children	Children enrolled in private school	0.13	0.14	0.19	0.23
	Likely withdrawal of children from schools	0.36	0.47	0.45	0.47
Financial	Indebtedness through informal source	0.03	0.049	0.032	0.044
Mean		0.217	0.294	0.309	0.288

TABLE IX: Indices of farmers' initiative towards mitigation and strategies

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Reduced cropped area	0.122	0.104	0.082	0.063
Land kept fallow	0.144	0.209	0.143	0.182
Low input use	0.297	0.299	0.306	0.318
Reduced household expenses	0.065	0.135	0.15	0.09
Borrowing from relatives and friends	0.287	0.207	0.181	0.119
Borrowing from money lenders	0.002	0.044	0.025	0.015
Migrated out as casual labourer	0.363	0.362	0.378	0.42
Participation in MNREGA	0.144	0.209	0.143	0.182
Postponed health treatment	0.297	0.299	0.306	0.318
Postponed marriages	0.065	0.135	0.15	0.09
Sold livestock animals	0.287	0.207	0.181	0.119
Engaged in animal husbandry	0.002	0.044	0.025	0.015
Sending women for domestic work	0.363	0.362	0.378	0.42
Mean	0.188	0.201	0.188	0.181

TABLE X: Indices of government help

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Benefitted by any formal institution	0.08	0.08	0.03	0.16
Benefitted by Rythu Bandhu	0.09	0.15	0.04	0.07
Benefitted by SHC	0.96	0.87	0.9	0.96
Benefitted by KCC	0.96	0.98	0.99	0.99
Benefitted by old age pension	0.64	0.78	0.88	0.8
Benefitted by health scheme	0.92	0.96	0.96	0.96
Got assistance for child education	0.94	0.73	0.94	0.9
Benefitted by insurance scheme	0.85	0.76	0.94	0.91
Mean	0.68	0.664	0.71	0.719

TABLE XI: Indices of adaptation strategies to reduce the distress

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Using own savings	0.491	0.494	0.475	0.512
Migrating to other places	0.345	0.32	0.211	0.259
Changing cropping pattern	0.295	0.417	0.302	0.375
Sale of assets	0.244	0.344	0.253	0.305
Reducing expenditure on food	0.402	0.427	0.364	0.408
Dropout of children from school	0.209	0.287	0.18	0.247
Borrowing	0.694	0.691	0.664	0.708
Depending more on non-farm employment	0.614	0.673	0.641	0.68
Bonded labour	0.35	0.383	0.325	0.395
Taking support from local goverment	0.32	0.47	0.452	0.448
Mean	0.396	0.451	0.387	0.434

TABLE XII: Indices of the constraints in adaptation measures

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Low education level	0.4	0.466	0.541	0.547
Lack of access to information	0.388	0.519	0.484	0.519
Inadequate capital	0.725	0.609	0.659	0.606
Lack of extension services	0.475	0.359	0.347	0.306
Land not suitable	0.647	0.512	0.5	0.466
Lack of irrigation	0.85	0.709	0.719	0.637
Non-availability of labour	0.5	0.406	0.422	0.338
Lack of quality inputs	0.563	0.35	0.381	0.312
Mean	0.569	0.491	0.507	0.466

TABLE XIII: Indices of Triggers

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Health expenses	0.386	0.434	0.513	0.474
Marital disputes	0.03	0.07	0.11	0.07
Chronical illness	0.04	0.13	0.09	0.12
Children marriage dowry	0.008	0.016	0.015	0.025
Educational expense	0.45	0.462	0.488	0.476
Other marriage expense	0.447	0.449	0.495	0.463
Unemployment	0.569	0.594	0.615	0.588
Lack of alternative income source	0.647	0.672	0.664	0.658
Frequent pest and disease attack	0.632	0.636	0.606	0.576
Outbreak of livestock disease	0.413	0.441	0.437	0.375
Lower price of output	0.61	0.618	0.685	0.611
High farm expenses	0.692	0.688	0.747	0.685
Crop failure	0.738	0.709	0.734	0.7
Debt from informal sources	0.03	0.049	0.032	0.044
Mean	0.407	0.426	0.445	0.419

TABLE XIV: Indices of social and psychological factors causing agrarian distress

		Ananthapuram	Kurnool	Nalgonda	Siddipet
Social issues	Objection in women's participation	0	0.22	0.05	0.13
	Catastrophe incident in last 5 years	0.01	0.03	0.03	0.01
	Negative comment from society	0	0.11	0.03	0.09
Change in social position	Feeling isolated	0.04	0.2	0.08	0.16
Mental harassment	Serious issue with society	0.16	0.15	0.04	0.11
Family burden	Unable to fulfil family's responsibility	0.52	0.55	0.14	0.33
	Did not get moral support	0.05	0.26	0.08	0.19
	Major family issue	0.04	0.13	0.08	0.17
Deterioration of economic status	Worried about financial distress	0	0	0.14	0.51
	Family issues regarding the deterioration in economic status	0.12	0.26	0.07	0.18
Behavioural change	Addiction to smoking, alcohol or drugs	0.29	0.39	0.49	0.35
Losing self confidence	Stressed out for a long time	0.18	0.18	0.08	0.24
	Lost pleasure in economic activities	0.13	0.09	0.08	0.14
	Thoughts of ending life	0	0.05	0.03	0.01
Mean	0.11	0.187	0.101	0.187	

TABLE XV: Indices of the impact of agrarian distress on farmer's livelihood

	Ananthapuram	Kurnool	Nalgonda	Siddipet
Reduced income	0.722	0.731	0.768	0.739
Increased indebtedness	0.735	0.752	0.773	0.749
Shortage in food consumption	0.506	0.571	0.569	0.542
Purchased food from outside	0.492	0.538	0.513	0.516
Increased poverty	0.682	0.686	0.638	0.642
Deteriorating health	0.44	0.506	0.52	0.488
Social stigma	0.296	0.341	0.341	0.307
Sale of livestock/poultry	0.02	0.08	0.04	0.11
Faced distress in last 5 years	0	0.03	0.53	0.87
Mean	0.433	0.471	0.521	0.552