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Indicators that measure disaster resilience of farmers - A study undertaken among the thane affected cashew growers in Cuddalore district of Tamil Nadu

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ABSTRACT

The Disaster Resilience Index (DRI), brings together a group of indicators related to the disaster resilience performance of the cashew growers in the affected Cuddalore district. These reflect the organizational, development, capacity and institutional action taken to reduce damages and losses, to prepare for crisis and efficiently recover. This paper describes the development of a Disaster Resilience Index (DRI), of Thane cyclone affected cashew growers in Cuddalore district. The study was conducted in Panruti block of Cuddalore district with sample size of 194 Thane affected cashew growers. The objective of the paper is to measure the Disaster Resilience of farmers due to Thane storm. The composite Disaster Resilience Index (DRI) of Thane affected cashew was found to be 0.72. which indicates the fair ability of the cashew growers to cope up with the disturbance experienced due to Thane. The principle component analysis was carried out with all the indicators. Further grouping of indicators under each factor with their factor loadings were workout.

INTRODUCTION

Disaster resilience of cashew growers :

Disaster risk is not only associated with the occurrence of intense physical phenomenon but also with the vulnerability conditions that favour or facilitate disaster when such phenomenon occur. Vulnerability is intimately related to social processes in disaster prone areas and is usually related to the fragility, susceptibility or lack of resilience of the population when faced with different hazards. In other words, disasters are socio-environmental by nature and their materialization is the result of the social construction of risk. The resilience tool provides a framework for understanding the most effective combination of short and long term strategies for lifting families out of cycles of poverty and hunger. It is based on the principle that the factors that make households resilient to food security shocks must first be understood, and then strengthened. A commonly used definition of resilience is “the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change" (Neil Adger, 2000). In food security context, resilience is defined as "the ability of a household to keep with a certain level of well-being (*i.e.,* being food secure) by with standing shocks and stresses." This depends on available livelihood options and on how well households are able to handle risks. This definition implicitly considers both (ex-ante) actions that reduce the risk of households becoming food insecure, and (ex-post) actions that help households cope after a crisis occurs.

The insight of why and how people become food insecure suggests ways of preventing this from happening. If interventions are designed in ways that increase resilience by enhancing people's ability to manage risk over time, then the need for humanitarian interventions when hazards occur will diminish. Resilience index should not be seen as an alternative to vulnerability index, but as a complement. Vulnerability index tends to measure only the susceptibility of people to damage when exposed to particular hazards or shocks. Moreover, the lack of long–term reliable panel data means that vulnerability index as applied at present is appropriate only for cross-sectional surveys. This approach risks over simplifying a more systemic view of household strategies by reducing the relevance of long-term components (Azam and Imai, 2009). Resilience index, on the other hand, uses a systemic approach which incorporates both short and long term factors.

MATERIAL AND METHODS

Considering the criteria *viz.,* maximum area under cashew cultivation as well as maximum number of farmers affected by Thane storm, Panruti block of Cuddalore district was selected for the study. Considering the same criteria, the Block Development Office was also consulted to select the top three villages *viz.,* Vegakollai, Kadampuliyar and Marangur which had maximum area under cashew cultivation as well as maximum number of farmers affected by Thane storm. Employing proportionate sampling method, 194 Thane affected cashew growers were selected randomly from the three selected villages. The primary data was collected during November, 2014. Factor analysis was done to metricize the disaster resilience index.

OBSERVATIONS AND ANALYSIS

Thane, a severe cyclonic storm that took place in 2011, affected the Cuddalore district of Tamil Nadu significantly. Cashew is one of the crop in the area that was severely affected. A study was taken upto metricize the Disaster Resilience of the cashew growers affected by Thane. Considering the issue of cashew farmers and the suggestions of various authors, the disaster resilience of cashew farmers has been studied by devising appropriate measurement methodology and has been organized under the following sub sections.

– Disaster resilience index (DRI)

– Indicator wise disaster resilience

Table 1 : Indicator wise disaster resilience index (DRI) score

Sr. No.	Disaster resilience indicators	Index score
1.	Agricultural assets / Non-agricultural assets	0.55
2.	Coping with stressors	0.80
3.	Time of resilience	0.62
4.	Knowledge on disaster management	0.89
5.	Social safety net	0.67
6.	Planning ability	0.85
7.	Crisis preparedness	0.82
8.	Adopting new technology and practices	0.57
9.	Climate change	0.52
10.	Access to basic services	0.76
11.	Income and food access	0.78
12.	Sensitivity	0.74
13.	Adaptive capacity	0.87
14.	Enabling institutional environment	0.70
	Composite DRI score	0.72

– Factor analysis of cashew growers with their disaster resilience

Disaster resilience index (DRI) :

The ability to prevent disasters and crises as well as to anticipate, absorb, accommodate or recover from them in a timely, efficient and sustainable manner. This includes protecting, restoring and improving food and agricultural systems under threats that impact food and nutrition security, agriculture, and food safety/public health (FAO, 2012)." In this study, Disaster Resilience has been operationalised as the extent to which the existence of selected indicators are perceived by the respondents at a given point of time. The Disaster Resilience Index has included 14 major indicators *viz.,* agricultural assets / non-agricultural assets, coping with stressors, time of resilience, knowledge on disaster management, social safety net, planning ability, crisis preparedness, adopting new technology and practices, climate change, access to basic services, income and food access, sensitivity, adaptive capacity and enabling institutional environment. Both major and sub indicators have been identified to work out Disaster Resilience Index (DRI). Besides, indices have also been worked out for each indicator. The DRI was administered to analyse the disaster resilience of the cashew growers by combining sub indicators of all major indicators into a composite index. The responses of the respondents appropriate for fabricating DRI were carefully collected and presented in Table 1.

From the Table 1, it could be concluded that the indicator wise indexes for the 14 components were agricultural assets / non-agricultural assets (0.55), coping with stressors (0.80), time of resilience (0.62), knowledge on disaster management (0.89), social safety net (0.67), planning ability (0.85), crisis preparedness (0.82), adopting new technology and practices (0.57), climate change (0.52), access to basic services (0.76), income and food access (0.78), sensitivity (0.74), adaptive capacity (0.87) and enabling institutional environment(0.70). Finally the composite Disaster Resilience Index (DRI) worked out to be 0.72. which indicates that the cashew growers affected by Thane has the ability to cope up with the disturbances and stress created by the natural disaster "Thane" in near future.

Principle component analysis of indicators towards disaster resilience :

Further principle component analysis was carried out with all the indicators and the results are furnished in Table 2.

Table 2, provides the specifications of eigen value and percentage of variance explained by the components. The components which are having more than one Eigen value were selected. Thus, from the fourteen components, five factors were extracted and these factors together explained a total variance of 64.77 per cent towards disaster resilience. Therefore, it could be concluded that first five factors which have more than one Eigen value are contributing 64.77 per cent variation towards disaster

Table 2 : Eigen values for disaster resilience

Sr. No.	Component number	Eigen value	Percentage of variance	Cumulative variation (%)
1.	I	3.137	22.408	22.408
2.	II	2.095	14.968	37.376
3.	III	1.426	10.187	47.563
4.	IV	1.368	9.768	57.331
5.	V	1.042	7.445	64.776
6.	VI	0.895	6.391	71.166
7.	VII	0.822	5.868	77.035
8.	VIII	0.745	5.323	82.358
9.	XI	0.609	4.349	86.707
10.	X	0.569	4.067	90.774
11.	XI	0.459	3.276	94.050
12.	XII	0.348	2.489	96.539
13.	XIII	0.293	2.092	98.631
14.	XIV	0.192	1.369	100.00

resilience.

Rotated factor (Varimax) matrix of indicators :

The results of principle component analysis clearly indicated that there were five factors that explained the maximum variation (68.72%) in disaster resilience. Further, the findings on factor loading of each indicator under five factors were analysed and furnished in Table 3.

From Table 3, each factor column was scanned for identifying the indicators which are more significantly correlated with the particular factor. Thus, from each factor column, the indicators having a factor loading of more than 0.464 were selected and grouped in Table 3.

The data in Table 4 further revealed the grouping of indicators under each factor with their factor loadings.

Factor I :

This factor has been identified as 'Prime factor' as it explained 22.408 per cent of variation in disaster

Table 3 : Rotated factor (Varimax) matrix of each indicator

Sr. No.	Disaster resilience indicators	Factors					Communalities
		I	II	III	IV	V	(h^2)
1.	Agricultural assets / non-agricultural assets	0.050	0.773	-0.082	-0.041	0.046	0.611
2.	Coping with stressors	-0.151	-0.057	0.132	-0.605	0.465	0.625
3.	Time of resilience	0.528	0.455	-0.437	-0.081	-0.122	0.699
4.	Knowledge on disaster management	-0.033	-0.111	-0.320	0.464	-0.214	0.376
5.	Social safety net	0.790	0.328	-0.220	-0.052	-0.049	0.786
6.	Planning ability	-0.311	0.067	0.156	0.635	-0.034	0.531
7.	Crisis preparedness	-0.062	-0.003	-0.058	0.092	0.897	0.821
8.	Adopting new technology and practices	0.232	0.761	-0.188	0.072	-0.029	0.673
9.	Climate change	-0.248	0.614	0.098	0.108	-0.027	0.461
10.	Access to basic services	-0.055	-0.130	0.848	0.049	-0.018	0.741
11.	Income and food access	-0.094	-0.050	0.871	-0.103	-0.033	0.782
12.	Sensitivity	0.766	-0.408	0.219	0.017	0.024	0.801
13.	Adaptive capacity	-0.023	-0.056	-0.220	0.685	0.109	0.533
14.	Enabling institutional environment	0.781	-0.003	-0.081	-0.079	-0.077	0.628
	Eigen values	3.137	2.095	1.426	1.368	1.042	-
	% of variation explained	22.408	14.968	10.187	9.768	7.445	-
	Cumulative % variation explained	22.408	37.376	47.563	57.331	64.776	-

Table 4 : Factor-wise indicators with factor loadings

Factors	Indicators	Factor loadings
Factor I - Social factor	Time of resilience	0.528
	Social safety net	0.790
	Sensitivity	0.766
	Enabling institutional environment	0.781
Factor II - Technological factor	Agricultural assets / non-agricultural assets	0.773
	Adopting new technology and practices	0.761
	Climate change	0.614
Factor III - Basic needs factor	Access to basic services	0.848
	Income and food access	0.871
Factor IV - Capability factor	Knowledge on disaster management	0.464
	Planning ability	0.635
	Adaptive capacity	0.685
Factor V - Stress factor	Coping with stressors	0.465
	Crisis preparedness	0.897

resilience. From the Table 4, it could be inferred that under factor 1, social safety net was found to influence the disaster resilience to greater extent with the highest factor loading of 0.790 followed by enabling institutional environment (0.781), sensitivity (0.766) and time of resilience (0.528). The discussed indicators under Factor I primarily evoke the social fabric of the community affected by the natural disasters and hence, can be named as Social Factor.

Factor II :

From the same Table 4, it could be seen that the second factor explained a variation to the extent of 37.376 per cent. Thus, factors 1 and 2 together contributed 47.563 per cent variation to the disaster resilience of Thane affected cashew growers. It is evident from the results that three indicators in factor II *viz.*, agricultural assets / non-agricultural assets (0.773), adopting new technology and practices (0.761) and climate change (0.614) were found to influence the disaster resilience with the factor loadings of 0.924 and 0.822, respectively. The indicators expressed under Factor II are focused on technological interventions associated with climate change and assets and hence, can be rightfully named as Technological Factor.

Factor III :

From the Table 4 it is explained that the third factor explained a variation to the extent of 47.563 per cent. Thus, factors 1, 2 and 3 together contributed 57.331 per cent variation to the disaster resilience of Thane affected cashew growers. It is evident from the results that two indicators in factor III *viz.*, access to basic services and income and food access were found to influence the disaster resilience with the factor loadings of 0.848 and 0.871, respectively. Coming under the ambit of basic services and access these indicators are named as Basic Needs Factor.

Factor IV :

From the Table 4, it is explained that the fourth factor explained a variation to the extent of 57.331 per cent variation to the disaster resilience of Thane affected cashew growers. It is evident from the results that three indicators in factor IV *viz.*, adaptive capacity (0.685), planning ability (0.635) and knowledge on disaster management (0.464) were found to influence the disaster resilience of cashew growers. The indicators discussed under Factor IV predominantly deals with capacity and capability of the affected farmers and it deserved the title of Capability Index.

Factor V :

This factor has been identified from the Table 4 as it explained 64.776 per cent of variation in disaster resilience. From the Table 4, it could be inferred that under factor 5, coping with stressors was found to influence the disaster resilience to greater extent with the highest factor loading of 0.897 followed by crisis preparedness (0.465). Since the indicators directly or indirectly imply stress or preparedness to face stress the Factor V is named as Stress Factor (Table 5).

Table 5 : Indicators explained by the five factors

Sr. No.	Disaster resilience indicators	Loadings	Communality (h^2)	Rank
1.	Time of resilience	0.528	0.699	VI
2.	Social safety net	0.790	0.786	III
3.	Sensitivity	0.766	0.801	II
4.	Enabling institutional environment	0.781	0.628	VIII
5.	Agricultural assets / non-agricultural assets	0.773	0.611	X
6.	Adopting new technology and practices	0.761	0.673	VII
7.	Climate change	0.614	0.461	XIII
8.	Access to basic services	0.848	0.741	V
9.	Income and food access	0.871	0.782	IV
10.	Knowledge on disaster management	0.464	0.376	XIV
11.	Planning ability	0.635	0.531	XII
12.	Adaptive capacity	0.685	0.533	XI
13.	Coping with stressors	0.465	0.625	IX
14.	Crisis preparedness	0.897	0.821	I

The indicator crisis preparedness ranked first since it had more communality (h^2) value *i.e.*,. 0.821. It was followed by other indicators like sensitivity, social safety net, income and food access, access to basic services, time of resilience, adopting new technology and practices, enabling institutional environment, coping with stressors, agricultural assets / non-agricultural assets, adaptive capacity, planning ability and climate change with communality values of 0.801, 0.786, 0.782, 0.741, 0.699, 0.673, 0.628, 0.625, 0.611, 0.533, 0.531 and 0.461, respectively (Table 5). Knowledge on disaster management was found to be the least contributing indicator (0.376) to the disaster resilience of Thane affected cashew growers.

Conclusion :

You cannot improve what you don't measure" is a very powerful quote and has immense meaning to it. In the same lines, the study was conducted to metricise the Disaster Resilience levels of the Thane Storm affected cashew growers of Cuddalore District in Tamil Nadu. The focus on disaster resilience index has important policy implications. The Resilience levels once indexed and measured shall be of great use in effectively managing natural disasters and enabling the victims to build higher levels of resilience with almost no extra effort in management. The Disaster Resilience Index was measured as 0.72 which is an encouraging result for the rural and agricultural development professionals to prepare appropriate extension programs to build the capacity of cashew growers and empower them on social, economical and psychological dimension.

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