

## Cyclone Gaja in Tamil Nadu: Constraints faced by Coconut Growers in the Post-Disaster Phase

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**ABSTRACT:** The past decade witnessed many disasters, especially with the cyclones wreaking havoc in agriculture. Severe cyclonic storm Gaja destroyed lakhs of coconut trees in the Delta region of Tamil Nadu. The need for identifying and understand the constraints faced by the coconut growers in the post disaster phase was clearly evident and taken up for the study. A sample of 211 farmers selected based on Proportionate Random Sampling method in Thanjavur district of Tamil Nadu, were interviewed for the study. The constraints faced in disaster response and disaster recovery phases were identified through pilot study and validated among the respondents by employing Garrett ranking and Rank based quotient approaches. Lack of knowledge on disaster response was found to be the foremost constraint with a Garrett value of 58.63, while the constraints faced in disaster recovery was classified into three categories namely Operational, Economic and Socio- Psychological Constraints and ranked by the farmers with RBQ. Lack of past literature regarding the identification and discussion farm level constraints provided the much-needed impetus to attempt this particular study. The study specifically discussed the constraints in detail with possible reasons and concluded with relevant suggestions to overcome the constraints.

**Keywords:** Constraints, Cyclone, Disaster Response, Disaster Recovery.

### INTRODUCTION

Tamil Nadu is historically one of the most vulnerable states to Tropical cyclones. The State is multi-hazard prone, the major natural hazards being Cyclonic storms, Urban and rural floods and periodic droughts. The severe cyclonic storm Gaja made landfall across the Tamil Nadu coast on November 11, 2018 with high wind speeds averaging 100 to 120 kms. More than 7 districts located in the Cauvery Delta region and the surrounding areas faced heavy damage to agriculture and property (NDMA, 2019). Coconut farms were severely damaged and most of the trees were uprooted or broken due to the storm. More than four million trees were damaged and thousands of farmers were affected across the state.

Rakotobe *et al.*, (2016) observed that small holder farmers are highly vulnerable to cyclones and experience significant crop losses, food insecurity and income loss when cyclones hit. Coconut was one of the main sources of agricultural production in Thanjavur district. A whopping 85.00 per cent of coconut production in the affected areas were destroyed in the cyclone (Arumugam *et al.*, 2019). Since Coconut is a perennial crop, it created a major impact among the farmers, robbing their income for the next few years. Sathiyar and Lakshumanan (2019) reported that

almost all the fishing hamlets, plantations, settlements, electric poles, fishing boats and vehicles were severely damaged. In few areas prominent seawater inundation and run up was observed.

Relief to the tune of ₹ 409.28 crores have been provided to 57,429 farmers in Thanjavur district alone, along with compensation for damaged houses (Deccan Chronicle, 2019). Damodaran (2015) stated that cent percent of the affected farmers expected additional relief funds from the Government. Haque *et al.*, (2021) stated inadequate organizational relief on time and lack of technical knowledge on protection from disasters as the most important coping constraints encountered by the farmers during and after disaster, by employing constraints index. Balarubini *et al.*, (2017) in her study related to Thane cyclone stated that, fear regarding another natural disaster in future was the foremost psychological constraint observed among the affected farmers. Studies have been undertaken to assess the impact of the Gaja cyclone and the various disaster phases were explored. It's important to understand the hardships that farmers underwent through the disaster phase and ascertain the constraints they faced in the process. Identification of problems and constraints faced by the disaster affected farmers is important to draw suggestions and framework for policies to

overcome the problems identified. Hence, a study was undertaken to ascertain the constraints encountered by farmers in the aftermath of the Gaja cyclone.

## METHODOLOGY

Ex Post facto research design was adopted for the study, since the event had already happened and the investigator had no control over it. The study was carried out in Thanjavur district of Tamil Nadu, which faced severe damage to the coconut farms. Four blocks of the district with the highest damage *i.e.*, Pattukottai, Madukkur, Peravurani and Sethubavachatram were considered for the study. A total of 211 coconut growers were selected by Proportionate Random Sampling method. Pilot study was conducted in the non-sample area of the same district so as to frame the constraints in the form of an interview schedule, based on inputs from the farmers themselves.

The constraints faced by the coconut growers in disaster response were listed and the responses were collected. Garrett's ranking technique was used to rank the preference indicated by the respondents on different factors. As per this method, respondents were asked to assign the rank for all factors and outcomes of such ranking was converted into score value with the help of the following formula:

$$\text{Percent position} = 100 (R_{ij} - 0.5) / N_j$$

Where,

$R_{ij}$  = Rank given for the  $i^{\text{th}}$  variable by  $j^{\text{th}}$  respondents

$N_j$  = Number of variable ranked by  $j^{\text{th}}$  respondents

With the help of Garrett's Table, the percent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having the highest mean value is considered to be the most important factor.

Various constraints faced by the coconut growers in adopting the relief measures were identified through

pilot study. It was grouped and classified into three categories based on the nature of constraint. Rank Based Quotient (RBQ) developed by Sabaratnam (1998) was applied. The data obtained from the farmers regarding constraints was quantified *i.e.* the number of farmers who gave the particular rank were used for calculation of RBQ. The formula for RBQ calculation is as follows

$$\text{RBQ} = \frac{(f_i)(n+1)}{N_n} \times 100$$

Where,

$f_i$  = frequency of farmers for  $i^{\text{th}}$  rank of constraints parameters

$N$  = number of farmers

$n$  = number of ranks

## RESULTS AND DISCUSSION

**Constraints faced by the farmers in Disaster response.** Disaster response essentially includes actions taken immediately before, during or directly after an emergency occurs, to save lives and minimize the damage to property. Disaster response is a part of disaster phases where both individuals and state agencies coordinate together and instantly react before, during and immediately after occurrence of disasters. Once the cyclone forecast is announced, state agencies implement short term plans to prevent damage to life and property on priority basis. Individual farmers get awareness about the disaster through mass media, public announcements and word of mouth among fellow farmers. They interact with other farmers and get prepared for facing the disaster and ensure that their field and home face minimal damage.

The data regarding the constraints faced by the farmers in disaster response is listed in the Table 1 and discussed below.

**Table 1: Garrett ranking of Constraints faced by the coconut growers in Disaster response n=211.**

Sr. No.	Constraints	Garrett score	Garrett rank
1.	Lack of reaction time from forecast to landfall	46.39	V
2.	Lack of knowledge on disaster response	58.63	I
3.	Distance between coconut field and home	54.36	III
4.	Damaged road infrastructure	55.96	II
5.	Hindrance due to cut in power supply	51.53	IV
6.	Lack of access to the disaster war room	41.67	VIII
7.	Lack of social cohesion hampering collective decision making	44.61	VI
8.	Lack of prior communication from state agencies	42.86	VII

Table 1 indicates that Lack of knowledge on disaster response with a garret score of 58.63 was perceived as the foremost constraint among the farmers. Basically, there is no specific package to impart knowledge about disasters to the farmers. Though trainings were conducted post disaster and relief measures were undertaken, knowledge on immediate response and preparedness to disasters are still confined to the technical agencies carrying out disaster management activities. The layman knowledge base is still vague and they depend on locally known activities. Most of the farmers in this region are new generation coconut growers who were cultivating paddy earlier and hardly

faced intensive cyclones during their farming experience. This might also be the reason for their limited knowledge on immediate response to disasters. Damaged road infrastructure was ranked second among the constraints, with a garret score of 55.96. Roads are the essential means through which transportation and commuting happens. Basically, it acts as a catalyst in the development of the local economy. The Gaja Cyclone had resulted in felling of thousands of trees causing heavy blockage in most of the roads in almost every village. The access to coconut farms from residential settlements were completely cut off. As the cyclone started to batter the farms, farmers weren't able

to reach and many stayed indoors till three days after the landfall. Though the trees were cleared after a week by continuous efforts from the state agencies and local volunteers, the damage caused to the roads was phenomenal. It took months to relay the roads and bring things back to normal. This explains why damaged road infrastructure was considered as an important constraint by the farmers.

Distance between field and home was one among the most important constraints ranked third by the farmers, with a garret score of 54.36. Among the four blocks under study, only Peravurani region had coconut farms coupled with residence of the farmers. Observations among other three blocks revealed that the residential settlements were far away from the coconut farms owned by most of the respondents. This was one of the reasons why most of the farmers couldn't reach their farms when the cyclone occurred. Access to farms was difficult even after the landfall due to blockage of roads and this explains why distance between field and home was an important constraint.

The fourth ranked constraint was regarding hindrance due to cut in the power supply (51.53). As the cyclone made landfall, it caused severe damage to the power lines as electric poles were uprooted and trees fell over the lines. This resulted in immediate power disruption and there was no chance of recovery for days. The entire rural area of the district stayed in darkness for a long time making it difficult to carry out the relief operations. The immediate response was also delayed since the landfall happened at night and recovery operations were delayed till morning.

Sathya and Ragavendra (2020) revealed that, only after 40 days only the electric poles, transformers were cleared and current supply was provided to the people. Table 1 revealed that lack of reaction time from forecast to landfall (46.39) got ranked as the fifth constraint among the farmers. Though the cyclone was predicted earlier, the area of landfall and wind speeds

cannot be predicted well before. Hence it was very difficult for the state agencies to diffuse the information regarding the cyclone to all the stakeholders on time. The farmers after getting aware about the cyclone forecast couldn't prepare themselves on time. Saving their own lives and their residences were prioritised over the farms as the cyclone was expected to cause heavy damage to property as well. This explains why the lack of reaction time from forecast to landfall was considered as a constraint.

The sixth ranked constraint was reported as the lack of social cohesion hampering collective decision making (44.61) among the farmers. The respondents were of the opinion that there existed no cohesion between themselves, hampering any kind of collective decision making process. Collective action is always essential in responding to disasters as it affects everyone invariably. This also has a detrimental effect on diffusion of information and knowledge about the cyclone among the farmers.

Lack of prior communication from state agencies (42.86) and lack of access to disaster war rooms (41.67) were ranked seventh and last respectively, among the respondents. Though state agencies took valiant efforts in diffusing the information and launched war rooms with helplines, it didn't reach all the farmers. Hence it was felt as a constraint by a small section of farmers who weren't aware of it. They could be considered as a minor constraint and could be addressed accordingly.

**Constraints faced by the coconut growers in Disaster recovery.** Disaster recovery could be defined as the differential process of restoring, rebuilding, and reshaping the physical, social, economic, and natural environment through pre-event planning and post-event actions (Rodriguez *et al.*, 2007). The constraints faced by the farmers in the recovery phase were identified through pilot study and categorized into three categories namely Operational, Economic and Socio-Psychological Constraints based on their nature.

**Table 2: Rank Based Quotient of Operational Constraints n=211.**

Sr. No.	Constraints	RBQ	Rank
1.	Improper assessment of damage by the officials	77.39	IV
2.	Accumulation of debris in the field	70.19	V
3.	Difficulty in clearing the uprooted trees	87.54	II
4.	Lack of quality planting material for replanting	64.50	VI
5.	Difficulty in Intercultural operations	59.48	VIII
6.	Increased pest incidence & emergence of new pest	86.54	III
7.	Loss of coconut productivity	93.79	I
8.	Non availability of relief materials at the right time in right quantity	62.89	VII

Loss of coconut productivity was the foremost operational constraint faced by the farmers, with RBQ value of 93.79. The effect of the cyclone was so severe that most of the trees were uprooted already. The trees that were remaining on the farm were also damaged i.e. only the stem was intact and palm leaves were completely gone. Drastic yield reduction was reported in most of the farms leaving the farmers with no income from the farm produce. It took so long for the farmers to prepare their farms with necessary inputs and they could recover only a part of the earlier yield after two long years. The farmers aren't confident about bringing

the productivity back to pre-disaster average yield, with the existing trees in the farm. The loss in productivity affected the farmers psychologically in addition to economic losses.

Difficulty in clearing the uprooted trees (RBQ value: 87.54) was clearly witnessed by the farmers, after the cyclone happened. It was ranked second among the operational constraints. Many trees were uprooted, many were partially broken and everything fell in the farm space creating an adverse situation. The farmers faced immense pressure to save the remaining trees that stood against the effect of the cyclone. The tree debris in the field proved to be a major blockage since they

were finding it difficult to clear them out of the farm. There were no initial takers for the trees and the farmers had to shed a lot of money convincing the traders to procure it, even though it was the other way around before the cyclone happened. The emergency situation was used by the traders to their advantage, though they also witnessed difficulty in clearing the trees due to lack of vehicular access to the farms. Many farmers employed bulldozers to clear the trees and dumped them on the banks of local water bodies, where it was burnt subsequently.

Increase in pest incidence and emergence of new pests (RBQ value: 86.54) was one of the most important issues faced by the farmers and ranked third among the operational constraints. The debris accumulation in the farm acted as a breeding ground for the pests like rhinoceros beetles and led to increased incidence. Apart from the existing pests, the cyclone effect saw emergence of new pests like whitefly. Whitefly incidence was extensively witnessed in almost every farm affected by the cyclone. The farmers are still finding it difficult to control the damage caused by whitefly as no specific control measure was recommended by the institutions till date.

Improper assessment of damage by the officials (RBQ value: 77.39) were reported in various dimensions by the farmers and ranked fourth among the operational constraints. Under reporting of damaged tree count was reported in most of the places. Mistakes in data entry and subsequent allotment of relief amounts was also reported by many. Favouritism in reporting the assessment was also a major issue as felt by few farmers. This was one of the most important operational constraints since it hindered their recovery process by denying the justified relief.

Accumulation of debris in the field (RBQ value: 70.19) was a prime problem commonly observed in most of

the farms after the cyclone. The heavy wind brought a lot of unwanted debris into the farms and the remains of broken and uprooted trees accumulated in the field. This would create a breeding ground for the pests to emerge and the entire farm would be in a bad shape.

The farmers also reported the lack of quality planting material for replanting (64.50). After the restoration of power supply and gradual recovery in the farm status, most of the farmers opted for replanting with new planting materials. The Department of Agriculture supplied planting materials free of cost in limited quantities to the farmers as a part of the relief support. Most of the farmers were of the opinion that the planting materials provided to them were not of good quality and many saplings failed shortly. It was understood that both the farmers and institutions had no choice but to go for immediate replanting to save the farm and hence the compromise of quality in planting material was inevitable considering the emergency situation.

The next constraint was regarding the difficulty in performing the intercultural operations (RBQ value: 59.48). As already discussed earlier, the problem of accumulation of debris in the farm was witnessed largely. This also hindered the intercultural operations for a while. This problem was coupled with the non-availability of labour to perform the intercultural operations.

Non availability of relief materials at the right time, in the right quantity was one of those minor issues ranked seventh among the operational constraints. The relief materials refer to the compensation amount, basic utilities for household, quality planting material for replanting etc. The farmers opined that they were not able to avail relief at the right time due to various reasons.

**Table 3: Rank Based Quotient of Economic Constraints n=211.**

Sr. No.	Constraints	RBQ	Rank
1.	Increase in debts	75.69	IV
2.	Lack of institutional credit	61.94	VI
3.	Increased cost of replanting	77.96	II
4.	Cost involved in clearing debris	77.20	III
5.	Rise in labour charges for intercultural operations	50.47	VII
6.	Rise in labour charges for harvesting operations	75.40	V
7.	Loss of income due to low productivity	78.06	I

Loss of income due to low productivity was the highest ranked issue, with RBQ value of 78.06 among the economic constraints. As discussed earlier, the productivity was drastically reduced after the cyclone damage and almost dropped to zero for a couple of years. This resulted in heavy loss of income for the farmers, who already had incurred a lot of money in recovering the farm from cyclone damage. The farmers were finding it difficult to meet the routine expenses since they had already availed credit in addition to the relief amount, so as to repair their farms.

Increased cost of replanting was ranked second among the Economic constraints, with RBQ value of 77.96. As discussed earlier, the institutions provided coconut saplings in limited quantities for replanting. Farmers

were of a general opinion that the saplings weren't of good quality and those who tried it did not witness robust growth. Hence many farmers invested money again to procure quality saplings at a higher cost from various places. A considerable section of the farmers were actually satisfied with the saplings provided as compensation and continued to grow it. Additionally, the farmers had to incur a lot of costs in clearing the farm and preparation of pits for planting.

Cost involved in clearing the debris (RBQ value: 77.20) was one of the important issues that was ranked third among the Economic constraints, by the farmers. As discussed earlier, the tree debris remaining in the farm was either dumped in the lakes surrounding the villages and subsequently burnt or being picked by traders from various regions of Tamil Nadu. In both the cases, the

cost of clearing it with the help of bulldozers and loading for transport was borne by the farmers. Additionally, the traders charged the farmers on a tree count basis, citing the emergency situation and their difficulty in logistics.

Increase in debts (RBQ value: 75.69) is another important issue among the farmers and was ranked fourth among the economic constraints. Farming in general is always debt driven, yet the volume of debt and repayment capacity matter the most. Though the farmers had availed credit for farming operations earlier, the volume of credit increased due to the economic needs after the cyclone. The farmers had to depend upon non-institutional and local credit sources due to the emergency situation. In a nutshell, the farmers reported that their credit status had transformed from thousands to lakhs after the occurrence of cyclone. This explained the dire financial situation that existed post disaster.

The fifth ranked issue among the economic constraints was regarding the rise of labour charges for harvesting operations, with RBQ value of 75.40. Earlier, the cost of harvesting the coconut was considered per tree and if it was calculated based on the number of nuts, the charges were fifty paise/nut. It was almost doubled after the disaster and up to one rupee/ nut is being charged for harvesting. This has subsequently reduced the actual price that a farmer receives and created a negative impact on farm income.

Lack of institutional credit (RBQ value: 61.94) was one of those issues ranked sixth among the economic constraints. Though institutional credit facilities like cooperative credit and bank loans are available in most places, it is not sufficient to meet the needs of farmers. Also the crisis situation obviously forced them to rely upon local credit as they were able to avail money immediately with less document works. Though institutional credit was lacking, the state agencies had much more to offer in terms of compensation amount, free saplings and other schemes supporting financial assistance.

Rise in labour charges for intercultural operations was the last ranked issue among the economic constraints, with RBQ value of 50.47. The basic labour charges had been increasing from time to time and it was obvious that the demand increased after the disaster. The demand in turn increased their wage rates and farmers had to contribute more to hire labour for intercultural operations. This constraint was considered a minor issue since intercultural operations are minimal in case of coconut cultivation. Rakesh and Narang (2016) in their study regarding Thane cyclone observed that a vast majority of cashew farmers (98.1%) were willing to continue cultivation if provided with adequate financial support. Hence it is important to overcome the economic constraints in the process of recovery from natural disasters.

**Table 4: Rank Based Quotient of Socio- Psychological Constraints n=211.**

S. No.	Constraints	RBQ	Rank
1.	Lack of technical advisory from institutions	75.40	I
2.	Loss of interest in farming activities, post disaster occurrence	64.79	V
3.	Fear about another natural disaster in near future	74.08	II
4.	Lack of volunteerism in relief work	47.49	VII
5.	Increased risk and skepticism in decision making	71.75	III
6.	Reduced farmer-to-farmer interaction	49.24	VI
7.	Post-traumatic stress hindering routine activities	69.72	IV

Lack of technical advisory from institutions was the foremost issue for the farmers and with RBQ value of 75.40, it was ranked first among the Socio-psychological constraints. Though a number of trainings were organized by the Coconut Research Station located in the study area, farmers were hardly aware of it. The farmers were also not in contact with extension agencies and the Department of Agriculture, except for availing subsidies under state schemes. The demand for technical advisories was not observed among the farmers and in turn, shortage of extension officials and the hectic workload created issues in supply side too.

Fear about another natural disaster in near future (RBQ value: 74.08) was one of the most important issues and was ranked second among the Socio-Psychological constraints. Gaja cyclone is one of the most severe cyclones ever witnessed in Tamil Nadu state. It's obvious that the farmers continue to sustain their lives with the fear of facing another such natural disaster in near future. The trauma that they underwent during the effect of the cyclone instils permanent fear about disasters and keeps them under pressure. This may

affect their routine activities in farming, investments and leading the life in general. This finding is in accordance with the results of Balarubini *et al.* (2017).

Increased risk and skepticism in decision making (RBQ value: 71.75) is another important issue among the farmers and was ranked third among the Socio-Psychological constraints. The farmers being skeptical in decision making is bound to happen since they are not sure about the consequences after facing such a disaster. The financial situation and the negative environment surrounding the disaster occurrence always keeps the farmers under pressure and affects the decision making process.

Another important constraint was the post-traumatic stress hindering routine activities (RBQ value: 69.72) and was ranked fourth among the Socio-Psychological constraints. Several studies indicate that most people who have faced disaster undergo Post traumatic stress that affects their day-to-day activities. The farmers responded that they had to undergo a transformation in their routine so as to adapt to life after the disaster. The recovery process was gradual and it took a toll on their daily activities. The financial situation also added to the woes.

Loss of interest in farming activities after the cyclone (RBQ value: 64.79) was also one of those issues reported by the farmers and was ranked fifth among the Socio-Psychological constraints. After witnessing heavy damage due to the cyclone, the farmers had lost confidence of an early recovery as the financial, farm and property losses culminated into a dire situation. Many farmers had abandoned the farms temporarily due to zero economic outcome and went in search of jobs. Once their financial situation was better, they returned to the farms and undertook coconut replanting. It could be understood that the loss of interest in farming was a temporary one and hence considered as a minor constraint by the farmers.

Reduced farmer-to-farmer interaction (RBQ value: 49.24) and lack of volunteerism in relief work (RBQ value: 47.49) were considered minor issues and were ranked sixth and seventh respectively, among the Socio-Psychological constraints. Farmer to farmer interaction was reported to be minimal in the study area irrespective of pre or post disaster situation. Volunteerism is generally what we witness in disaster response and recovery, to a larger extent. Though lack of volunteerism was reported as a constraint, it was understood that the farmers were invariably affected by the cyclone and everyone had to face the wrath. This may be the reason why lack of volunteerism and reduced farmer to farmer interactions were considered as minor constraints.

## CONCLUSION

The constraints discussed in the study throws light on most important issues faced by the coconut growers in the aftermath of Cyclone Gaja. In case of Disaster response, the most important constraints were found to be the lack of knowledge regarding disaster response, damaged road infrastructure, distance between farm and home etc. It's understood that the farmers in disaster prone areas need to be made aware of disaster response mechanisms and training could be given regarding preparedness and immediate response to disasters. Improved all weathers roads are recommended to be laid throughout the rural areas including the approach roads from farms to arterial roads. The accuracy of the forecast could be increased and it's very important to improve the communication networks in disseminating the forecast information to farmers.

With respect to the constraints faced in adopting the relief measures, they were categorized into operational, economic and socio-psychological constraints. Loss of coconut productivity and reduction in income due to the loss were the most important operational and economic constraints respectively. The difficulty in clearing the uprooted trees and emergence of pests were also considered as important operational constraints. Though ad hoc measures were advised to farmers regarding pest control, it didn't work beyond a limit. Intensive research with inputs from farmers regarding the pest incidence and organizing training cum demonstrations regarding pest control are key to recovery. Lack of technical advisory from institutions and Fear about another natural disaster in near future were some of the

most important socio-psychological constraints. Though the technical advisories are available with the institutions, steps have to be taken to ensure dissemination of information among the farmers especially in such a crisis situation. The future research needs to be directed at understanding the role of farmers and other stakeholders during each disaster phase and betterment of disaster response mechanisms. It's essential to impart confidence among the farmers to continue farming activities and offer support both technically and financially. Once the farmers overcome the fear of disasters and continue farming with good agricultural practices with technical support, they can achieve resilience towards any such disasters in the future.

**Conflict of Interest.** None.

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