A SYSTEMS APPROACH TO THE MANAGEMENT OF CYCLONE DISASTERS IN INDIA

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Abstract

This paper represents the Cyclone disaster situation in the framework of a systems module. A model flow diagram for simulating the decision making in cyclone disaster management is depicted. The disaster physical planning measures, as taken in the past, are outlined.

1. Introduction

The disastrous features of a cyclone are associated with

i Storm surges or tidal waves.

ii Heavy rainfall

iii High velocity winds

The sudden rise of the sea level along a coastal belt is caused by the sudden pressure fall or depression in the atmosphere and this sea wave is called the storm surge or tidal wave. The destructive potential of cyclonic storms is maximum along the coastal areas and reduces as we go further in-land.

Tamilnadu, a state of India, is flanked by the Bay of Bengal and the Arabian Sea, is highly vulnerable and frequently subjected to overwhelming devastations by natural calamities due to cyclonic storms and flooding in its coastal districts. Owing to these disasters, loss of human lives, cattle, damages to huts, public buildings, crops, lands, irrigation sources, roads etc. occur almost every year. Pre disaster advance planning, community preparedness for disaster management and emergency relief organisation have been integrated and woven into the network of State Development policy in the form of a "State Anti-Disaster Plan".

Disaster Management

The objective of disaster management is to promote the prevention, control and prediction of disasters. Three important aspects of the systems are:

i. Disasters constitute a major development problem for most disaster-prone countries.

ii. Most disasters can be prevented; and

iii. The most basic preventive measures are also the least expensive.

Disaster management consists of preparedness and response at primary (the target areas, the community) and secondary (institutions and agencies, usually urban based) levels. These are further classified into activities such as forecasting, warning, evacuation, rescue, relief and rehabilitation/reconstruction. The effectiveness of disaster management would depend on:

i Physical infrastructures

ii Organisation structures

iii Culture/knowledge systems

iv Economic institutions and

v Training and research

The direct aims of disaster management (against disaster) are:

* Decreasing the level of potential risk
* Mitigating the consequences of disastrous action.
* Mitigating or preventing the development of a chain of disastrous events.
* Localising and limiting the scope of disasters.
* Facilitating rescue operations
* Facilitating organisations of general habitation during the first post-disaster period; and
* Facilitating and hastening rehabilitation and reconstruction activities.

The human being is a key figure in the disaster management system (DMS). Experience has shown that human beings are not altogether stable or predictable, and less so in times of crisis. The human being is not structured for invariant performance. The impending disaster creates an environment which contains insufficient, contradictory or redundant conditions under which man finds it difficult to function efficiently. Hence resort was made to a systems approach.

Elements of the System

Any systems analysis should first identify the elements of the system. The basic systems diagram of the Tamilnadu Antidisaster plan was identified as shown in figure 1. The elements are:

INPUT - defined as the energising or start-up component on which the system operates.

OUTPUT - defined as the result of an operation.

PROCESSOR - defined as that which makes possible the transformation of input into output.

SYSTEM PURCHASERS - those who set constraints upon objectives and hence the outputs.

FEEDBACK CONTROL - defined as the system function which compares output with a criterion.

The INPUTS of this system are:

1. Occurrence of the disaster, e.g. cyclone, floods, earthquake etc.- the resultant affected people, damage to property, etc.
2. Tools/Machinery which are required.
3. Financial Resources i.e. allocated budget.

The OUTPUTS are:

1. No. of lives saved - of people and livestock.
2. Value of property saved.
3. Minimised long-terms economic losses.

The SYSTEM PROCESSOR is the relief organisation consisting of:

1. relief personnel - trained manpower.
2. equipment to translate their efforts/commands
3. knowhow
4. departmental staff of the various govt. offices.

The SYSTEM PURCHASERS are:

1. Top management - relief commissioner's office
2. Public (for whom the organisation mainly exists)

The CONTROL which influences

both the Purchaser and the Processor consists of

1. Resource Limitations - Money, Equipment, Human
2. Time constraints
3. Uncertainty due to unpredictability of weather.

The FEEDBACK which has an impact on the control, can be identified as:

1. Public complaints
2. Death toll
3. Value of damage to property, crops, etc.
4. Future economic performance.

THE SYSTEM BOUNDARY

Every system exists in an environment separated by physical or conceptual boundaries. No system is completely autonomous and isolated from its environment. They are all inter-related in some manner or the other. For example, a university exists in a commercial, industrial and political environment and the activities of the campus are influenced not only by what is happening outside. However, the university cannot be bothered with all the activities of the outside world. Only those activities of the environment which interact with the university and affect the functioning of the system will be worth paying attention to. It is in this context that the concept of system boundary becomes important.

In the DMS, the concept of boundary restricts the scope of the relief problem to a size commensurate with the cost or time available for the relief operations and the amount of detail necessary, and including only those departments that are directly working for the relief of the people, to understand the process at a macro level. It is, of course, possible to view DMS in many ways and change the boundaries accordingly. The system designers' view should tend to relate the DMS to time state

machinery as a whole, and not see it as an operating unit ful-filling a variety of minute needs and intricate details. A boundary for a system or sub-system is essentially to limit the problem of a manageable size - to assist in determining whether output fan be produced under the gives conditions of processor and input.

SUB-SYSTEMS OF THE DISASTER MANAGEMENT SYSTEM

Figure 2 gives the various sub-systems of the DMS and their line of interaction.

When a disaster, say a cyclone, strikes a particular area (coastal/low lying/or other vulnerable area) the damage manifests itself in the form of death of people and livestock, damage to property, damage to standing crops, submergence and salination of arable land, injury and infection of people and livestock leading to death or destructive epidemics, general deprivation for the population in the affected area, dislocation of services to the community at large, scarcity of foodgrains and other farm produce in the immediate future and in the long run such large scale economic losses that the country takes years to recover from.

A cyclone disaster can neither be avoided nor diverted from its chosen path. We can at best take-pre-cautionary measures to save the people, livestock minimise property loss and damage through proper zoning and land use laws; take prompt action to drain and desalinate submerged land; avoid overflowing of water-courses by opening the locks and gates at the appropriate time; dispense medical aid and food to the sick and hungery etc. All this calls for a "preparation plan"

The various sub-systems of the DMS are:

Top Management (1) - Relief commissioner's Office, Finance (2) - Finance Secretary (Revenue Ministry), Planning Cell (5) - Directorate of Town & Country planning, Medical Relief (4) - Directorate of Medical Services and Directorate of Public Health, Transport (6) - Transport Secretary, Maintenance (8) - Public Works, Highways, Irrigation, Fisheries Departments, Utilities (9) - State Electricity Board, State Water Supply & Sewerage Board, Telephones, District Management (3) - District Collectorate, Operations (11) - Field Officers of all the operating departments.

The sub-systems of the state machinery, that form part of the environment but that which interact with the DMS and affect the functioning of the system are as follows:

Publicity (7)
Forecasting Cell (10)
Civil Supplies (12)
State Government (14)
Central Government (13)

Upon receipt of the warning of the impending disaster from the FORECASTING CELL (10), the PUBLICITY (7) dissminates the information among the people in conjuction with TOP MGMT. (1), who coordinate and control the various material and information flow. The FINANCE (2) allocates the budget as required by the severity of the situation. THE PLANNING CELL (5) which consolidates all data plans for the initiation of appropriate action by the various departments. TRANSPORT (6) prepare itself to evacuate the people to shelters, move food-water supplies where required, provides mobility to the search/rescue teams, medical personnel etc. MEDICAL RELIEF gears itself, to the expected demands by stocking up medicines and other medical aid supplies. UTILITIES (9) takes such precautionary measures as shutting off power-water supply to prevent accidents and further avoidable damage; arranges for temporary telephone connections and other modes of communication to prevent a communication breakdown and to speed up co-ordinated action. MAINTENANCE (8) ensures smooth flow of materials from supply point to user point and also takes a number of precautionary measures. DISTRICT MANAGEMENT (3) is the 'men on the spot' catering with available resources to a dynamic situation. CIVIL SUPPLIES (12) Supplies foodgrains and other essential commodities.

The CENTRAL GOVERNMENT (13) and STATE GOVERNMENT (14) provide the required overview. OPERATIONS (11) is the actual transducer of the whole system which converts from mere concept to reality.

INFORMATION FOR THE DMS

Any system should function through a good information system; the decisions making will be effective only if the necessary information is available and accurate.

Data for the DMS should consist of such information as :

1. Accurate projected population figures - talukwise, villagewise.
2. Shelter location, capacity
3. Distance from shelter to village (for evacuation)

4. Vehicle capacity available (for evacuation)

5. Food requirements

6. Fooder requirements

7. Water requirements

8. Medical aid facilities required

9. Stocks available, foodgrains/medicines/fuel/...

The list would be very long. IN fact a very comprehensive information system is necessary in order to understand the dimensions of the task. Collecting, storing, retrieving and analysing information is vital for any system. Such information processing may be computerised (it is fact necessary in this situation where enormous quantity of data is involved).

Disaster Preparedness In Tamil Nadu

The Government of Tamilnadu for prepared a state anti-disaster plan containing comprehensive planning measures and various Regional, Rural, Urban and local policies. This includes:

i. Mapping and delineating the vulnerable areas and grouping this according to degree of vulnerability.

ii Providing disaster-resistant community shelters located at high levels.

iii Providing an effective warning system through simple warning devices.

iv Construction of core units in huts to safeguard the belongings of people during their absence after evacuation.

v Organising special training programmes for educating the people in the vulnerable areas and also to train district collectors and agencies responsible for anti-disaster programmes.

Studies and research have been undertaken for each of the above action plans.

SIMCLONE for training district collectors

The author designed, developed and administered a computer simulator titled SIMCLONE (Simulated Cyclone). This was in the nature of a mock game in which the players have to make decisions under uncertainty, with partial information under stress conditions. Figure 3 is the model flow diagram of SIMCLONE and figure 4 depicts the information flow between the players, Directing staff and the computer used for the game.

CONCLUSION

In conclusion, all these exercises so far undertaken viz. identification of vulnerable areas and land use planning, setting up of cyclone shelters installation of warning devices, development of core units, Simclone exercise will all be pursued with vigour, modified and improved based on performance and acceptability characteristics, continued with more and more new developments founded on Research and investigations - all are done of course with the knowledge that though we cannot prevent disasters, atleast we can mitigate the evils, hardships and damages caused by them. We go ahead with our task with the firm belief that any amount of time, energy and finance spent on these progrmmes are bound to lead the country to economic prosperity.

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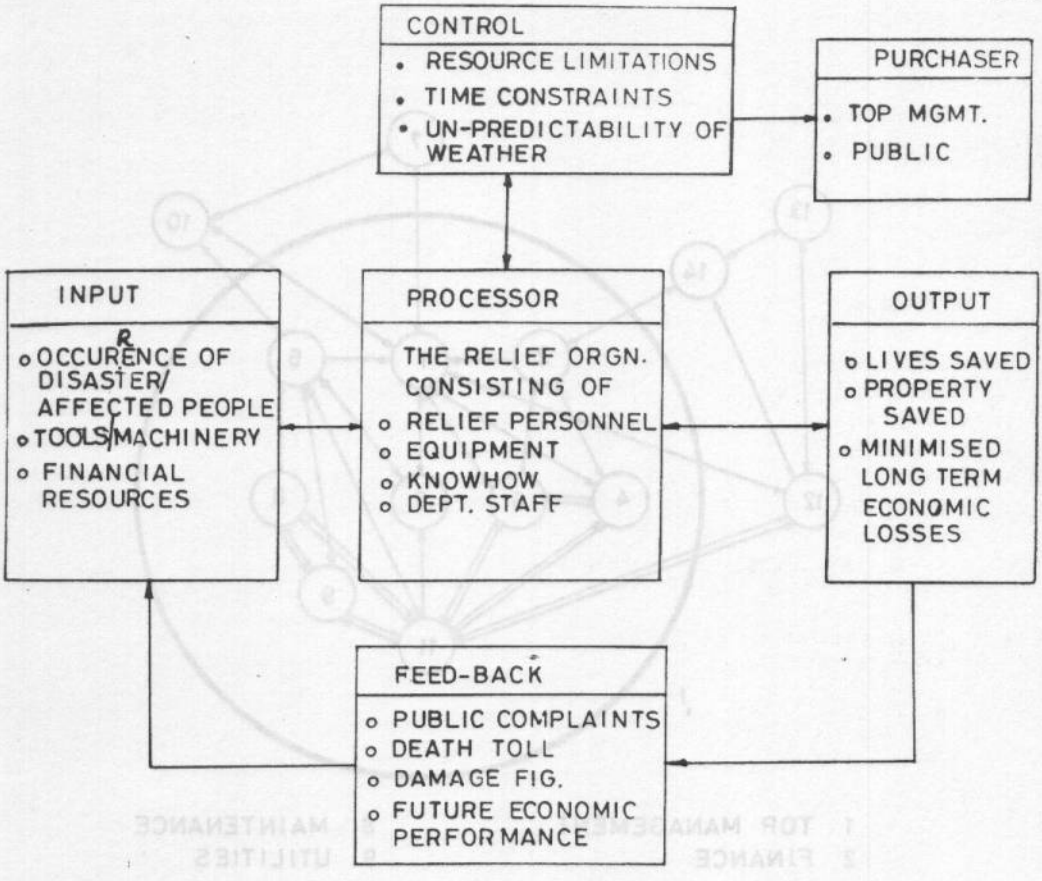
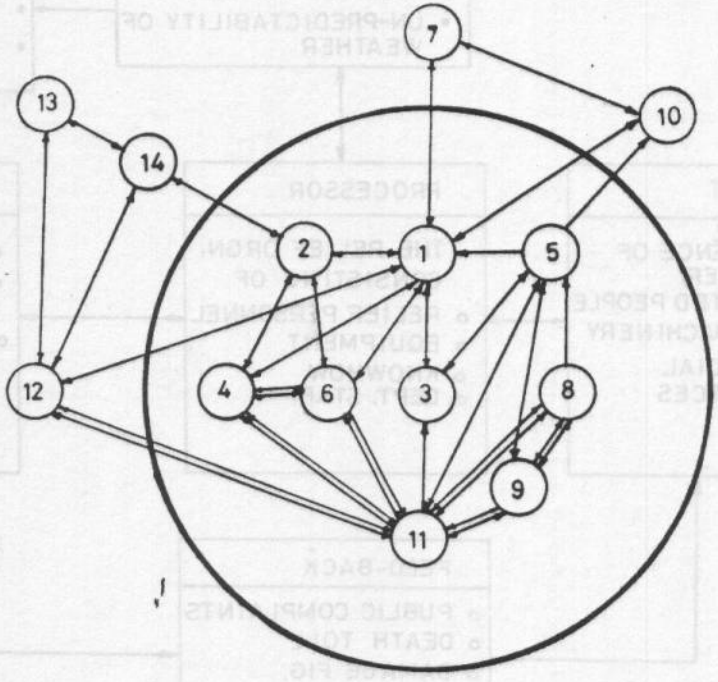


FIG.1. BASIC SYSTEMS DIAGRAM FOR DISASTER MANAGEMENT

FIG. 2. SYSTEMS CHART TO DISASTER MANAGEMENT

——— INFORMATION FLOW

═══ MATERIAL AND INFORMATION FLOW



1	TOP MANAGEMENT	8	MAINTENANCE
2	FINANCE	9	UTILITIES
3	DISTRICT MANAGEMENT	10	FORECASTING CELL
4	MEDICL RELIEF	11	OPERATIONS
5	PLANNING CELL	12	CIVIL SUPPLIES
6	TRANSPORT	13	CENTRAL GOVT.
7	PUBLICITY	14	STATE GOVT.

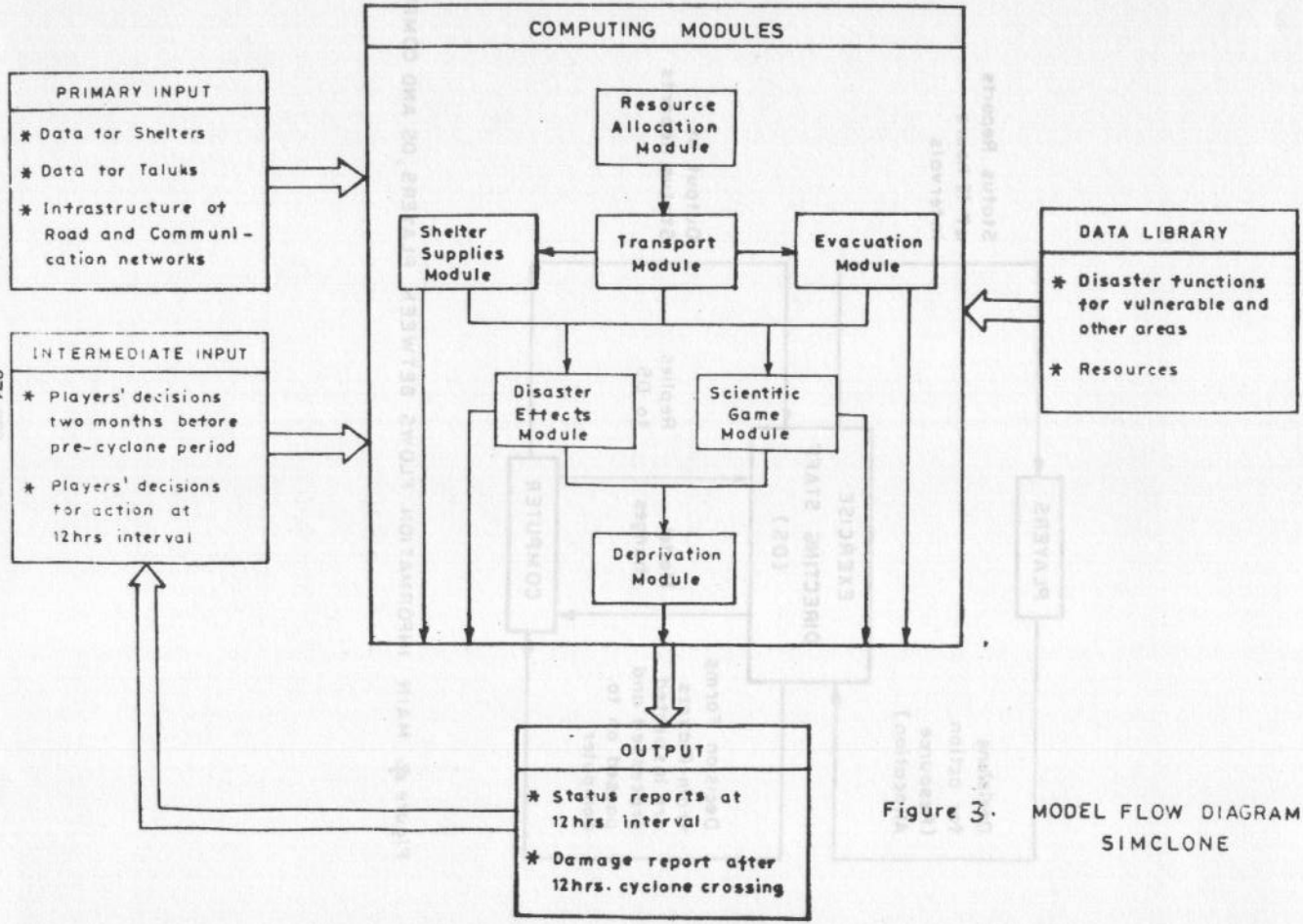


Figure 3. MODEL FLOW DIAGRAM SIMCLONE

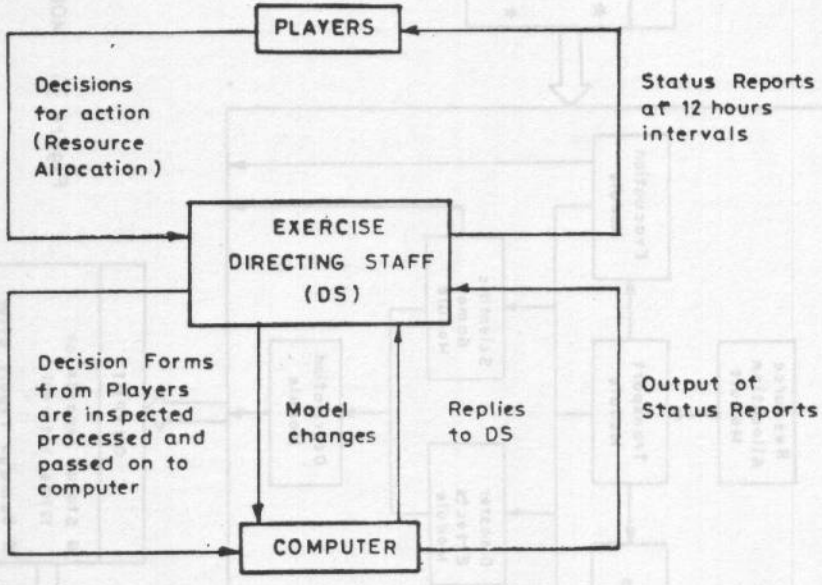


Figure 4 MAIN INFORMATION FLOWS BETWEEN PLAYERS, DS AND COMPUTER