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Toward a conceptual framework for interdisciplinary disaster research

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Introduction

Reliable information and economic studies about disasters are scarce However, some gross estimates allow them to be considered a "formidable obstacle to economic and social development."[1] The direct losses — in terms of cost in the US alone — caused by 30 common natural calamities constituted about 1 percent of the GNP in 1979[2]; and the damage caused by natural hazards between 1964 and 1970 in the countries of Centroamerican Common Market, reached, according to the estimate by the Mexican office of CEPAL, 2 3 percent of their General Domestic Product without taking into account the indirect and secondary effects.

The situation is aggravated by the increasing magnitude and frequency of disasters which are usually attributed to the growth and concentration of population in large cities and the consequent complexity and deterioration of services necessary for their maintenance. However, considerable human loss is caused by the exceptionally high vulnerability[4] of human settlements in developing countries, resulting from the poverty or marginality of the population and the overall socioeconomic conditions, which make the frequently used concept of "natural disaster" meaningless. Natural events become disasters only when human settlements are not prepared to withstand them, very often, because of lack of precautionary planning

Conditions in Mexico combine both of these factors, natural and social: geographically, the country is located in a zone prone to a variety of natural hazards — earthquakes, hurricanes, torrential rains; and socioeconomically, it is a developing nation with a rather high rate of population growth and a much higher rate of population concentration in several cities.

Over recent decades, substantial effort has been made,[5] particularly in the field of engineering, to reduce the negative impacts of natural hazards Antiearthquake precautions in human settlements have been improved by the introduction of construction codes and by the strengthening of the surveillance in their application. Major technological works such as the deep drainage system in Mexico City and other special hydraulic structures appear to be substantial measures in reducing floods [6] Furthermore, increased attention has been paid to the study of the destructive phenomena and their effects. But the practical application of many high quality studies[7,8] has been frequently impeded by the fact that they were too specialized, by the lack of a unified terminology and the absence of a general conceptual framework These weaknesses make the transference of methods and results from one area to another[9] nearly impossible, particularly when the studies do not solve problems. therefore implying the need for adaptations and interpretations in order to be of any use in dealing with disaster conditions

Frequently, disaster responses have been oriented toward the immediate necessities of rescue and relief,[10] and are restricted to corrective actions during the occurrence of a disaster This points out the necessity to give more attention to preventive and planned measures.

It has been pointed out[11,12,13] that to fortify human settlements facing disasters, it is not enough to better any of the existing means and to implement new ones. It is also necessary to plan, organize and coordinate a set of activities that has to take place systematically before, during and after the disaster.

The planning of these activities and their execution, as well as the evaluation of their success and their adaptation to changing conditions, mean the necessity to prepare a conceptual framework which will also permit the fixing of priorities and the coordination of studies and actions in order to establish and improve upon policies and strategies for the safeguarding of human settlements facing disasters

A conceptual framework

The elaboration of a conceptual framework, ie a system of basic concepts that permits the posing of problems, and a set of adequate methods to resolve them, is a crucial stage in the process of planning, developing and implementing any study in general It is particularly so when dealing with interdisciplinary research on disasters

The development of a conceptual framework is based on certain paradigms [14] ie cognitive tools, in order to recognize reality as well as identify, choose and study its relevant fragments in order to represent them by constructs and, consequently in the case of research to substitute these with models Thus the paradigms determine the whole cognitive process, searching to describe

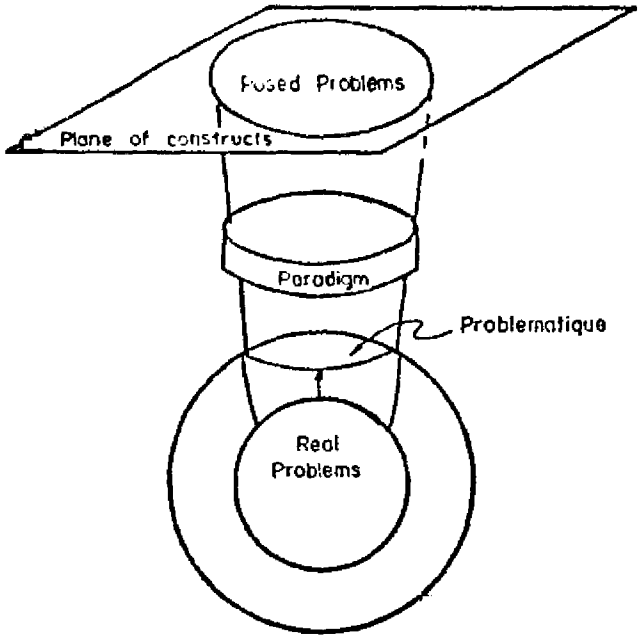

FIG 1: Distinction of the real and posed problems.

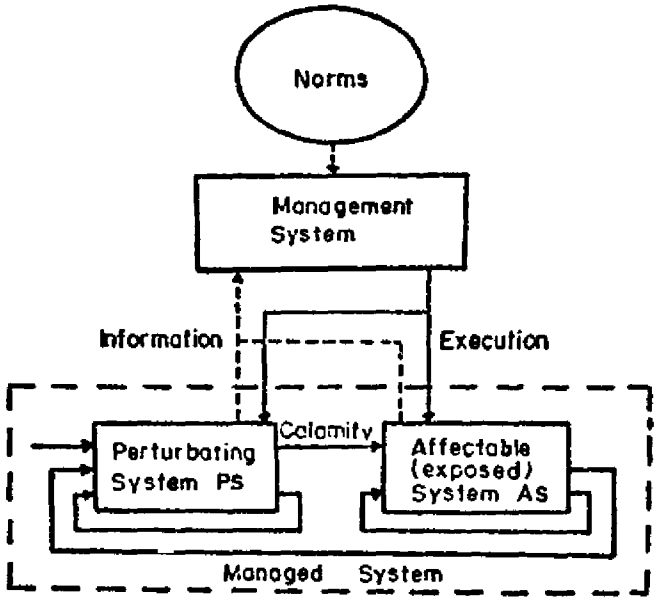

Fig. 2: Basic paradigm of the conceptual framework.

and explain the characteristic regularities of the phenomena [15,16] Among many other functions,[17,18] the paradigm also serves to pose a system of problems by considering the "problematique" as the external manifestation of certain phenomena and certain profound relations produced by real problems[18,19] (fig. 1).

Traditionally, disasters have been conceived as events that affect human settlements by producing damages Much effort has been dedicated to defining the concept of "disaster",[20] but in most cases, the event that causes the upset and damages a human settlement is mixed and confused with the state of the damage itself. The distinction between the disruptive events and the resulting "states of damage" has been taken as the central point for the elaboration of a conceptual framework with the following definitions: a calamity is any event that can provoke damage; and a disaster is reserved to characterize the consequent state of damage itself.

States of damage form a subset in the space of all possible states of the Affectable System (AS) — any man-made system and the necessary components for human survival[12] — which could be affected by its eventual interaction with the Perturbating System (PS) — the one that is able to produce calamities.

The occurrence of calamities as well as the magnitude of their impact can be modified by other calamities. For example, the liquefaction of soil can increase the damage produced by an earthquake, whereas rain can aid in extinguishing a fire Likewise, the state of an affectable system can activate the perturbating system as, for example, when bad sanitary conditions cause plague; or inhibit the perturbating system, as when the adequate safeguard measures in the vulnerable area abate the occurrence of floods In the same way, the affectable system can itself have an influence on its own states. It can, for example, consolidate, depart from or return to its normal state as well as alleviate or aggravate the disaster state.

These considerations permit the paradigm to elaborate on the interrelations between the Perturbating System (PS) and the Affectable System (AS) (fig. 2). Its analysis allows the reduction of the occurrence of disasters by two different types of activities aimed at two principal goals:

- Prevention, to be achieved by the control of the PS mechanisms directed towards impeding the occurrence of calamities,
- Mitigation, to be acquired by strengthening the AS in order to reduce its damage.

Both goals are embodied in the more general goal of protection

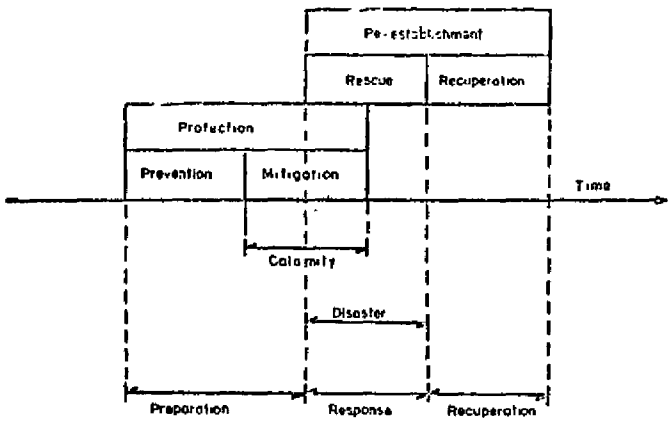

Fig. 3: Protection and reestablishment goals.

Disaster it is often not possible to prevent the occurrence of calamities or completely eliminate the damage. In such cases, facing unavoidable disasters successfully can be accomplished by pursuing two goals:

- Rescue, to be gained by saving human beings and their property as well as impeding the spreading of a disaster,
- Recuperation, to be realized by restoration, reconstruction and improvement of the AS.

As in the previous case both goals comprise a more general goal of reestablishment.

Thus the original paradigm can be enriched by distinguishing a special Regulation or Management System (RS)[13-21] in order to fulfill the established goals (fig. 3) by adequately managing the PS and AS, in particular by planning and executing the relevant actions in accordance with the information about the states of PS and AS (fig 2)

Conclusions

The paradigm on which this paper has elaborated constitutes the initial and basic element of the conceptual framework, now in a stage of development, and has been crucial for the progress of the Interdisciplinary Disaster Research (IDR) launched by the authors. It has allowed the definition of the objective of studies within the IDR as well as the differentiation and determination of its principal areas, such as a Theory and Engineering of Disasters (fig. 4) [22] In this way, it helps to distinguish, classify and plan various studies in accordance with their attributed priorities as well as to transfer, adapt and use procedures, methods and results, which are usually separated into traditional monodisciplinary fields

This conceptual framework has provided an efficient basis for studies of destructive phenomena and their effects on human settlements, on productive areas and on the environment[23-26] as well as of corresponding forecasting methods.[27-29] Moreover, the framework, despite its rudimentary state, has identified one of the main faults of the overall situation, the absence of an institution capable of systematically organizing, executing and coordinating necessary action before, during and following a disaster In this context various proposals have been presented[11-13] for the development of an institutionalized system that would bring together and integrate existing "fragments such as the Emergency Specialized Organizations, etc Specific proposals have been made for pertinent legislation to serve as a basis as well as adequate procedures and planning methodology.[10]

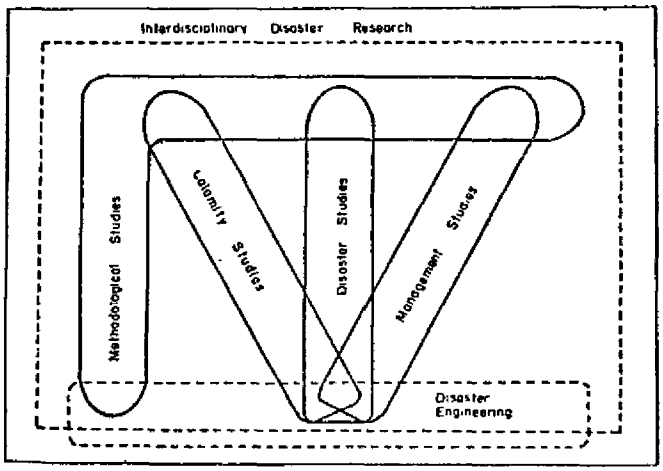

Fig. 4: Study areas of the Interdisciplinary Disaster Research

Substantial time has been needed for these ideas to mature and become widespread, as well as to find a sponsor In August, 1980, Mexico City's government sponsored a project initiated by the Interdisciplinary Disaster Research Group of the Institute of Engineering, The Mexican Autonomous University Three consecutive stages characterize the project the designed system, the general plan and the supporting components The results have been published in 33 volumes and presented at various national and international fora

"The system designed for the Protection and Reestablishment of Mexico City facing Disasters (Sistema de Protección y Restablecimiento de la Ciudad de México frente a Desastres) — SIPROR — is now in its integration stage and a "coordinating commission is being organized within the Federal District Government (Departamento del Distrito Federal) — DDF — to act as the leading organization. Thus, the validity, the efficiency and the efficacy of the "conceptual framework have been put into practice.

With proper promotion and dissemination of information, the IDR approach can become a fundamental factor in improving actual conditions in human settlements It can provide a framework and offer the terminology with which to facilitate the integration of various studies and the consolidation of all related efforts which in the case of disasters, work to safeguard and guarantee the continuity of socioeconomic development at the community, regional and national scales.

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