ARTIFICIAL INTELLIGENCE

Natural Disasters Intensity Analysis & Classification using Artificial Intelligence

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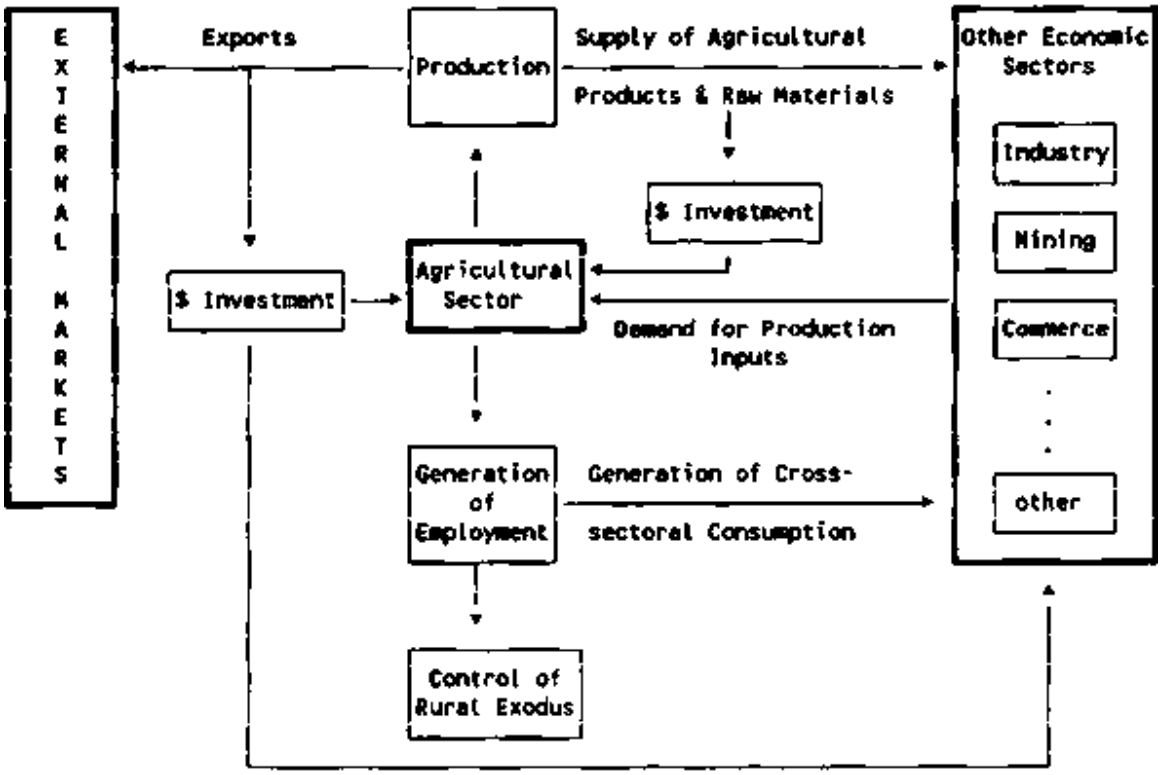
PROJECT NAME	Natural Disasters Intensity Analysis and Classification using Artificial Intelligence

1. Historical Disasters and Agricultural Losses

- Data from a variety of sources indicate that approximately 90 percent of all natural disasters worldwide occur in developing countries (Long, 1978). Recent Latin American and Caribbean examples illustrate the magnitude of the problem. When Hurricanes David and Frederick struck the Dominican Republic in 1979, they caused an estimated US$342 million in damage to the agricultural sector (UNDRO, 1980), destroying 80 percent of all crops and 100 percent of the banana crop. As a result, agricultural production fell 26 percent in 1979 and continued to be down 16 percent in 1980. Agriculture accounts for 37 percent of the country's gross domestic product and employs 40 percent of the labor force (USAID/OFDA, 1982). In 1984, the worst floods in Colombia in a decade caused an estimated US$400 million in damage to crops and livestock, while floods in Ecuador in 1982 and 1983 shrank the value of the banana crop by US$4.3 million (UN/ECLA, 1983).
- In short, from 1960 to 1989 natural disasters caused over US$54 billion in physical damage in Latin America and the Caribbean. While the information available on the amount of national and international funds committed to reconstruction in response to each disaster is limited, the need to redirect funds to post-disaster work curtailed the availability of funds otherwise targeted for new investment.

2. Economy-wide Effects of Disasters

- Besides the indirect social and economic impacts on a given region or sector, disasters can affect employment, the balance of trade, foreign indebtedness, and competition for scarce development investment funds. It has even been said that "the effect of natural disasters in disaster prone developing countries tends to cancel out real growth in the countries" (Long, 1978).
- in simplified fashion, the impact natural disasters in the agricultural sector can have on the entire economy. Internally, farm products provide food for the urban population and primary inputs to industry. Externally, they are exported and earn foreign exchange. Earnings from internal and external markets provide capital for new investment in the economy. Furthermore, the sector's operation generates an important demand for products from other sectors (e.g., fertilizers, equipment, and machinery). Finally, agricultural employment generates an increased demand for consumption goods and services from urban sectors. Urban growth and rural exodus are important considerations in the management of natural hazards, since they result in overcrowding of peripheral urban areas and increase the probability of disasters in these areas as a result of floods, landslides, earthquakes, and other hazards.



3. Natural Hazards and Development Issues

- Notwithstanding the term "natural," a natural hazard has an element of human involvement. A **physical event,** such as a volcanic eruption, that does not affect human being is a **natural phenomenon** but not a natural hazard. A natural phenomenon that occurs in a populated are is a **hazardous event.** A hazardous event that causes unacceptably large numbers of fatalities and/or overwhelming property damage is a **natural disaster.** In areas where there are no human interests, natural phenomena do not constitute hazards nor do they result in disasters. This definition is thus at odds with the perception of natural hazards as unavoidable havoc wreaked by the unrestrained forces of nature. It shifts the burden of cause from purely natural processes to the concurrent presence of human activities and natural events.
- illustrates this approach incorporating another argument into the discussion: the relationship of human and economic losses to the severity of an event and the degree of vulnerability (or survival capability) of human and economic interests.
- The survival capability of projects depends on many factors. Losses from a severe event may be no worse or even less than those from a milder event if the former occurs in an area where both the population is adequately prepared to respond and the physical structures are designed and built to withstand its impact. One of the main differences between losses suffered by industrialized and less developed countries is the extent to which natural hazards and mitigation measures have been considered in the development planning.
- Planning systems and planners in developing countries cannot always be held fully responsible for the inadequacy of the natural hazard assessment and mitigation measures implemented (see Chapter 1). There are several reasons for this. First, much development is based on already existing hazard-prone scenarios. Second, planners

depend on the availability of hazard information. And last, the planning process takes place within the prevailing economic, political, social, technological, and cultural parameters of a society. Mexico City's vulnerability to earthquakes is a good illustration. The sprawling city rests on precarious and deteriorating geological foundations. In spite of a well documented history of seismic activity, economic and technological constraints and complex political, social, cultural, and demographic elements impede the introduction of non-structural mitigation measures.

- On the other hand, planning systems and planners are responsible for some serious shortcomings of investment projects in hazard-prone areas. Irrigation systems, roads, reservoirs, dams, and other infrastructure facilities are prime examples. In these cases, where the system of constraints and parameters is less complex than in urban planning, planners should be able to incorporate more information and have greater control over decision-making. But even where sufficient hazard risk information was available, projects have been undertaken without minimum mitigation measures. It is not uncommon for an area periodically devastated by hurricanes or earthquakes to be rebuilt again and again in the same way. Other disasters occur routinely as a direct consequence of improper human intervention in areas with previously stable ecosystems. The following box lists the key elements for incorporating natural hazards into agricultural investment projects.
- Survival capability depends on many factors, and mitigation can make a substantial difference in minimizing the effects of disasters. While planners and planning systems are not responsible for some problems associated with natural hazards, they can exert influence in correcting some of the shortcomings. The following section discusses the process of integrating natural hazard information into the preparation of investment projects.

B. BASIC CONCEPTS: NATURAL HAZARDS AND INVESTMENT PROJECT

To facilitate the understanding of the subsequent sections, several key concepts are defined and explained below.

1. Probability

- Probability is the likelihood of occurrence of a particular event. This is often based on historical frequency. For example, the probability of a hurricane in any given year could be 0.1, or 10 percent, if hurricanes have struck in two of the past 20 years. For the purpose of decision-making, however, probabilities are rarely based strictly on historical information but are usually adjusted to take account of currently available information may be then referred to as subjective probabilities. For example, the observation that tropical storms have recently occurred in other parts of the world can result in the assignment of a higher subjective probability to a local storm than would be indicated by the historical frequency.

2. Risk

- Risk is generally defined as the probability of loss. In economic terms, this refers to a decline in income due to losses resulting from a natural hazard. Here risk will be used more generally to refer to uncertainty in the variables used in economic planning. For

instance, in assessing the benefits and costs of a planned irrigation project, prices and yields of agricultural crops may fluctuate during the life of the project. These fluctuations can be caused by natural hazard events, but can also be caused by changing market conditions and weather cycles.

3. Risk Aversion

- Risk aversion refers to an individual's attitude toward risk. Most people are risk-averse; that is, they are willing to incur some cost to avoid risk. But there is a wide range in degrees of risk aversion (Binswanger, 1980, and Young, 1979). In other words, to avoid a given level of risk, some people will pay more than others.

4. Risk Assessment

- Risk assessment refers to the quantification of a risk. It requires a determination of both the consequences of an event and the likelihood of its occurrence. For example, a risk assessment of the potential economic effects of an earthquake on an agricultural project would require an estimate of its impact on farming activities and structural components, and of the probability of earthquakes in the region during the life of the project.

5. Risk Management

- Risk management refers to actions taken to reduce the consequences or probability of unfavorable events. Similarly, natural hazard management refers to activities undertaken to reduce the negative effects of natural hazards. For example, a farmer may choose to plant a windbreak along a field to reduce the chances that wind will damage his sugar crops. While this may reduce his average income if he has to remove land from production, he may still do it to mitigate against an uncertain but potentially damaging storm.