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THE METHODOLOGICAL ANALYSIS OF THE MEASUREMENT OF VULNERABILITY IN MEXICO

ANÁLISE METODOLÓGICA DA MEDIÇÃO DA VULNERABILIDADE NO MÉXICO

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ABSTRACT

This paper performs an analysis based on the comparison between different methodologies that measure the vulnerability associated to hydrometeorological phenomena, in which the variables, indicators, and methods that use international methodologies offer as a result, an index that specifically measures vulnerability by integrating variables from social, economic and environmental dimensions through the Main Component Analysis Method, and if it is applied in Mexico according to methods used in the international environment would provide better results in the calculation of the vulnerability associated to hydrometeorological phenomena, with a methodology suitable to the Mexican case.

Keywords: Vulnerability, Methodology, Hydrometeorological Phenomena, risk, disasters

RESUMO

Este trabalho realiza uma análise a partir da comparação entre diferentes metodologias que medem a vulnerabilidade associada a fenômenos hidrometeorológicos, em que as variáveis, indicadores e métodos que utilizam metodologias internacionais oferecem como resultado, um índice que mede especificamente a vulnerabilidade por meio da integração de variáveis sociais, econômicas e ambientais através do Método de Análise de Componentes Principais. Se for aplicado

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no México segundo métodos utilizados no ambiente internacional, proporcionará melhores resultados no cálculo da vulnerabilidade associada aos fenômenos hidrometeorológicos, com uma metodologia adequada ao caso mexicano.

Palavras-chave: Vulnerabilidade; Metodologia, Fenômeno hidrometeorológico, risco, desastres.

INTRODUCTION

Vulnerability is a state that characterizes a certain territory in which the population and property are exposed to harm in the face of the presence of a threat by natural or social phenomena, and these factors, in turn, form a scenario of disaster risk; derived from this, there are different types of vulnerability and it is conditioned by various factors that make up it, including environmental, social, economic, institutional aspects, among others.

Disasters are a complex mix between threats and human actions, for example, in many low-income countries the result of a disaster does not only involve forces of nature, nor is it an isolated event, by the number of vulnerable people, becomes a situation that is repeated season after season, joined by economic conditions basically for slowing the recovery of previous events, that is, it has become a vicious circle to have for an art the development of natural phenomena and by other unfavorable socio-economic conditions that maintain a latent disaster risk scenario,Wisner and others,(2003:5).

The affectations or damage resulting from natural phenomena are considered disasters, these occur when forces and energy of nature are triggered that by their destructive power become threats in an environment that presents a certain weakness in the face of the onslaught of these, and the existence of some kind of human settlement generates the dangers to which goods and human beings are exposed. In this sense, it can be said that vulnerability determines the intensity of disasters, so it is essential to articulate the social, economic and environmental dimensions to identify the conditions of weakness that keep people in a state CEPAL[4], (2005).

Vulnerability is considered a state of helplessness in the face of the effect of impacts from hydrometeorological phenomena that have caused material loss and human lives throughout history, and affect in some way the growth and development of countries where Maqsood and

[4] Comisión Económica Para América Latina y el Caribe

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others, (2014:9) put it in the GAR15 Regional Vulnerability Function[5] the report, where they found an opportunity to improve the elements for disaster risk reduction through better knowledge of the components of the vulnerability and thereby reduce the rates of the vulnerability.

Since 1990, a number of socio-economic and environmental indicators have been incorporated in the global area for the calculation of vulnerability; although separately these indicators represent a form of risk from the size or scope from which they are released, combining several indicators, example for, in the case of respiratory diseases associated with exposure of air pollution by the vehicle transit, has an indicator both environmental and health and in addition to the relationship that exists between the two (Corvalán and others, 1996).

According to the U.S. National Institute of Environmental Health Sciences (NIEHS), to improve care and contribute to sustainable development in the design of indicators, Balbus's proposal, (2013) refers that a multisectoral approach to integration in an index that looks at different indicators, whether social, economic and environmental, should be applied to determine, inter alia, the precise, concise and timely vulnerability Analyzing.

The NAU[6], (2017) promotes disaster risk reduction and management by reducing the violation, and the number of people in this situation, seeking to balance the state of inequality in urban and rural centers in the face of the effects adverse impacts on climate change and have favorable results in the care of areas prone to the risks of formal and informal settlements, thus aiming to mitigate this problem throughout society.

Therefore, with the most obvious effects of climate change and the increase in population concentration, the vulnerability associated to the climate change in urban and rural areas also increases, because urbanization contributes to people's exposure to the impact of climate variability and climate change specifically with hydrometeorological phenomena, poverty, inequality, restriction of basic services, pollution and lack of urban planning, that because of this, society is in a state of persistent and constant vulnerability that is difficult to eradicate, (Aparicio, 2013).

In this context, it is of relative importance what israised by the Pan American Health Organization[7], (PAHO,2013), whose main objective is to enjoy the maximum degree of health as a fundamental right of the human being for all and particularly for the most vulnerable groups,

[5]The Role of Regional Vulnerability
[6]New Urban Agenda. 2017.
[7] Pan American Health Organization

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emphasizing that environmental justice, poverty and lack of governance are the key factors of vulnerability, so it should be focused especially on low-income groups and those where there is the risk of developing hydrometeorological phenomena to mitigate this condition, facing the challenge of formulating policies and plans that contribute to reducing vulnerabilities.

This vulnerability suffers when disasters occur whose effects are manifested in the population by the loss of life and diseases, also by the destruction of the environment, infrastructure, transport, and services; another consequence of these is the loss of heritage such as housing, livestock, and crops, among others; GAR2015, reports disaster losses of an average of between 250 billion and 300 billion U.S. dollars a year. When a human settlement is vulnerable or unprepared for a natural threat, a risk situation is generated; if people are affected the risk situation leads to disaster. In the face of this, disaster risk reduction and its consequences can be influenced through the prevention and implementation of novel proposals to measure and reduce vulnerability conditions.

Global methodologies developed by international agencies such as the United Nations Development Programme were applied to the measurement of vulnerability with its Global Assessment Report on Disaster Risk Reduction 2015 (GAR15) through the United Nations Office for Disaster Risk Reduction, the Economic Commission for Latin America and the Caribbean, the World Meteorological Organization, among others, all of them, applying the calculations with social dimensions, economic and environmental, mainly.

The methodology with which vulnerability is measured in Mexico associated to earthquakes is carried out with simplified criteria of the social, economic and environmental dimensions, assigning values to each of them and subsequently integrating them by the arithmetic sum and, of that result, is determine the ranges in equal parts of the degree of vulnerability; with this mechanic, the process is complex and squeals the results by independently calculating the number of indicators they use.

Considering the above, it arises in this research that vulnerability be addressed from this inclusive approach, aimed at linking indicators of social, economic and environmental dimensions, in which the physical, rural and together with the concept of vulnerability, be studied in relation to the current context of the country, in which derived from the development of urbanization processes that have shaped and characterized the national territory together with its social and development of hydrometeorological phenomena in Mexico, are the elements considered for the calculation and construction of vulnerability.

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The vulnerability associated with natural phenomena at the global level is measured by the integration of different indicators, in which elements of social, economic and environmental dimensions are combined mainly, with which the more representative aspects of each geographic area that will be considered for the calculation of vulnerability; the following cases illustrate at the national and international levels the exercise of the integration of different indicators to measure this vulnerability.

METHOD

The method of this study was conducted, with the characteristics of a quantitative study, in which there is a description of the case of studies and the procedures for data collection and analysis was made by documentary search of papers and methodologies about the measurement of vulnerability, and comparison between these methods and it´s components to could relate the variables by social, economic and environmental dimensions.

CONTEXT OF METHODOLOGIES FOR CALCULATING THE VULNERABILITY ASSOCIATED WITH NATURAL PHENOMENA AT THE INTERNATIONAL LEVEL

In the face of the effects of climate change, it is intended to safeguard the integrity of the human being and its built environment, taking into account disaster risk reduction, in particular, by avoiding new risks caused by threats in accordance with the Sendai Framework(UNISDR, 2015b), strategies are designed to reduce the risk of disasters, which aim to have methodological tools for risk management, with which they can be located particularly vulnerable areas than others and to influence them to reduce disasters caused by the development of hydrometeorological phenomena.

Based on the above, UNISDR's 2018 Annual Report, (2019) emphasizes the task of continuing to implement strategies to reduce the risk of disasters and reduce loss of life and damage to the environment and infrastructure; reports that approximately 60 million people at the end of 2018 were affected by extreme weather events, including floods, droughts, and storms; it is in this part that it is emphasized that it is able to have the right tools to deal specifically with the most vulnerable areas and where there is a greater concentration of people at risk, and to be able to reduce the risk of disasters caused hydrometeorological phenomena.

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The United Nations Office's climate-related disaster reduction meetings are increasingly emphasizing addressing problems at the local level and thereby strengthening regional efforts and thereby influencing truly in reducing community vulnerabilities, implementing plans and programmes of immediate action such as campaigns and reforestation, rational use of water, identification of risk zones to contain urban growth towards those areas and with outreach and prevention work.

However, there is strong resistance to implementing plans and programs that help reduce environmental deterioration and rational use of resources. Similarly, it is difficult to drive the use of appropriate tools for information collection and index generation, in this particular case, for example, that of a reliable and accurate vulnerability index, which accounts for the social aspects and associated with natural phenomena, physical or natural aspects, the degree of vulnerability of human settlements can be constructed and determined with great precision and thus being able to influence areas with a high degree of reducing lower-grade vulnerabilities.

THE METHODOLOGY USED IN MEXICO TO MEASURE THE VULNERABILITY ASSOCIATED WITH NATURAL PHENOMENA

The common purpose of the methodology for measuring the vulnerability associated to hydrometeorological phenomena is to provide information for disaster risk reduction, and supports the reduction in the degree of vulnerability of the population exposed to climate-generated threats, as expressed in the Sendai Framework for Disaster Risk Reduction 2015-2030 arising from the United Nations World Conference, UNISDR (2015a), which emphasizes promoting and strengthening the analysis and study of all the variables of people's vulnerability situations and thus be able to significantly reduce the chances of disasters by developing of natural phenomena.

This vulnerability situation becomes relevant because economic losses from disaster care in low-income countries amount to 22% of social spending, compared to 1.45% of what is spent in high-income countries (UNISDR, 2015b). In this connection, the effects of hydrometeorological phenomena in Mexico are reflected in the increase in victims due to the degree of vulnerability and the risk to which human settlements are exposed, for example, the cost of total damage caused by

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1980 to 2000 was $227 million (CENAPRED[8], 2014), so it is necessary to conduct a comprehensive analysis of the factors that affect vulnerability and to be able to influence its reduction.

Derived from a number of social phenomena such as poverty, marginalization, overcrowding, among others and the development of natural phenomena, particularly hydrometeorological phenomena that have an impact on different sectors of society, a methodology for the calculation of vulnerability through the National Center for Disaster Prevention to shape the National Risk Atlas[9], which was developed in 2013 by Gay and Conde,from which a Basic Guide for the Development of State and Municipal Hazards and Risks Atlases, and with which the Physical and Social Vulnerability Assessment was carried out, applying simplified criteria using 38 variables for estimating the vulnerability, basically and with which they were obtained partial results.

This research reviews and analyses this methodology in which it was found that various indicators have been used in a simple way for each of the dimensions (social, economic and environmental), for subsequently integrate them with the arithmetic sum and develop their ranges, however, these procedures can be improved to reduce partial results in the calculation of such vulnerability and increase their accuracy when performing the analysis of this vulnerability.

In this methodological review, a problem is observed in the integration of the variables they use, in which they apply simplified criteria such as the arithmetic sum of the result of each component and, for their representation normalize the values at scale of 0 100 and the result is divided into 5 equal parts, thus defining the degree of vulnerability; it is a method that does not truly integrate the indicators as a whole, in which, for example, the indicator of hydrometeorological phenomena is not contemplated together with social and economic indicators; to address this, some statistical method could be addressed that integrates the three types of indicators: social, economic and environmental that are more representative, such as the Main Component Analysis Method, and for the representation of the degree of vulnerability to be able to use the stratification of Dalenius and Hodges,which provides greater certainty in determining the ranges of vulnerability.

[8] Centro Nacional de Prevención de Desastres
[9] Vulnerability and adaptation to the effects of climate change in Mexico. Federal District Government Public Environmental Fund, National Governors Conference and Secretariat of the Environment of the Federal District Government. Available in:http://atlasclimatico.unam.mx/VulnerabilidadalCC/Vulnerabilidad/

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In addition to the above, in the National Risk Atlas prepared for Mexico, a form has been adopted for the calculation of the social vulnerability associated with natural events that use only physical factors (hydrometeorological or geophysical phenomena) or typology to determine which areas are vulnerable to the development of such an event, and on the other hand, estimate social vulnerability with a number of socio-economic indicators that both cases show a degree of vulnerability, either physical or social, in strict sense, with partial results by the use of simplified criteria for estimation.

This methodological description, in the correct sense of variable integration, falls short in scope, in which, a conjunction or amalgamation would be expected between the different indicators with which the vulnerability index presented in Mexico has been built; and only shows, yes an index, but elaborated with a very simple method and with which, it creates an unreliable index, lend elaborated without using high-level statistical techniques and international order, taking into account, that there are the tools to do so, and the necessary information is available to achieve this.

In summary, it is proposed to integrate specific indicators of the social, economic and environmental dimensions for the calculation of an index of urban and rural vulnerability associated with hydrometeorological phenomena in Mexico, which is accurate and reflects the situation the degree of vulnerability thereby decreasing, generating partial results and being able to contribute accurate information to disaster risk care in the country in the face of the adverse climate change scenario.

RELATIONSHIP OF VARIABLES IN THE GLOBAL FIELD OF MEASURING VULNERABILITY ASSOCIATED WITH NATURAL PHENOMENA

The vulnerability associated with natural phenomena is measured by the integration of different indicators, in which different elements of social, economic and environmental dimensions are combined mainly, with which the most important aspects are identified representatives of each geographical space that will be considered for the calculation of vulnerability; the following cases illustrate at the national and international levels the exercise of the integration of different indicators to measure this vulnerability.

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The first methodology being analyzed is the work presented by Wolf and McGregor (2013:59), with their paper on the development of a Heat Wave Vulnerability Index in London, in which they express the intention to be able to generate information with that index, which represents both the health implications of emerging heat conditions integrated alongside the conditions of vulnerable population groups considering their social characteristics that affect the increase in vulnerability to heat; they consider that if heat and health (various indicators) are located within the framework of risk reduction, this information is of paramount importance to decision-makers in preparing and responding to extreme heat events.

Being able to integrate information from the social and economic dimensions in addition to climate, is a process of great importance for the real estimation of the vulnerability existing in a certain geographical area, thereby being able to truly influence the reducing and mitigating the negative effects of climate events on the most vulnerable groups, and this can be done through the use of appropriate information and methods of integrating exposure and sensitivity indicators, Wolf and McGregor, (2013:60).

Table 1 shows the variables of the indicators used for the calculation of the heatwave vulnerability index, based on the risks from climate and socioeconomic factors integrated with the Main Component Analysis Method of the exposure and sensitivity, with Census data for social and economic variables.

Table 1. Variables for the Heat Wave Vulnerability Index in London

Factor	Risk factors	Censados socioeconomic variables
Exhibition	Live in the interior of cities that have been exposed to urban heat islands (UHI).	Population density (inhabitants per hectare).
	Thermal insulation in the home.	Homes for rent.
	Live on a second floor or more.	Homes in an apartment.
	High population density.	Homes without heat control.
	No air conditioning.	

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Sensitivity	Seniors.	Population over 65
	Pre-existing, disabled, psychiatric and mental illnesses.	Population with permanent limiting diseases.
	Low economic level, low levels of education.	Population with "not good" health report
	Living alone, social isolation.	People who receive some social benefit.
	Bedridden.	Pensioners
	People living in institutions.	Belonging to some ethnic group
		Population living in some kind of communal settlement.

Source: Own elaboration based in Wolf and McGregor, 2013.

According to Wolf and McGregor (2013), with the knowledge that these variables adequately respond to the Main Component Analysis method to estimate a rate of heatwave breach, it is then very useful to apply these methods for estimating vulnerability conditions, and with results, being able to design appropriate measures to reduce damage caused by natural events in the most vulnerable groups of people.

Another document presenting an analysis of vulnerability based on various factors that build it, was developed by Ponce and others (2018), called "Assessment of the Vulnerability of Health to Climate Change", in which they warn of the different ways in which climate factors directly or indirectly affect people's health, so that by identifying the most vulnerable areas, the appropriate means can be designed to reduce the health impacts of natural phenomena caused by climate.

Table 2 shows the indicators for Ponce and others (2018:2-13), from sensitivity, which together with exposure to heatwaves or temperature changes, and adaptive capacity, including number of hospitals, shelters, fire stations, together, all these indicators can be integrated into the Geographical Information System (GIS), to place places where violation is related by physical health conditions of people and exposure of human with this information, propose measures that reduce people's vulnerability conditions.

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Table 2. Sensitivity variables in the Climate Change Health Vulnerability Assessment

% of population below the poverty line
% of the population without a finished high school
% of the indigenous population
% of the population living alone
% of the population over 65 years old
% of the population over 65 living alone
% of uncovered plant surface
% of the population diagnosed with diabetes
% of homes without air conditioning
% of homes without some kind of air conditioning

Source: Own elaboration based in Ponce and others, 2018.

The results of Ponce and others, (2018:16-17) showed that the most vulnerable areas extend beyond the urban areas with the highest population concentration, in which the high number of people over 65 years of age stand out, in areas with the highest population difficult access to hospitals and people living alone; they further conclude that this method of integrating different indicators for the calculation of vulnerability is very useful in order to be able to identify those areas that are most vulnerable, with one or more socio-economic indicators, including climate factors to be able to design specific actions in mitigating vulnerability conditions.

Another example of these indices, which measure vulnerability and adaptation to the effects of climate change in Mexico, is the one mentioned above and was coordinated by Gay and Conde in 2013, in which an Interactive Virtual Atlas was developed that integrates and relates climate and social information, and also addresses public policies with the aim of identifying areas vulnerable to the effects of climate change in the national territory, taking into account historical data of the factors: precipitation, extreme temperatures and hydrometeorological phenomena.

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To carry out their vulnerability construction they group various variables, within exposure, sensitivity and adaptive capacity. For exposure, it uses 13 variables, grouping frequency of extreme events, environmental issues and climate along with climate change; for sensitivity, they manage 9 variables in the components of population, health, and productive sector; finally, to consider adaptive capacity, they include 16 variables within four dimensions called human, social, financial and natural capital; these three areas from which the vulnerability is built are recorded as follows in Table 3.

Table 3. Variables considered for the calculation of CENAPRED violations

Factor	Indicator	Variable
Exhibition	Frequency of Extreme Events	Total Floods Reported in 1980-2005
		Total Frosts Reported in the Period 1980-2005
		Total heavy rains reported in the period 1980-2005
		Total Slippages Reported in 1980-2005
		Total other problems reported in the period 1980-2005
	Problem Environmental	Total Reported Environmental Problems
		Municipal area without vegetation (%)
		U.P. (%) in a municipality that reported climate losses
		U.P. (%) in a municipality that reported losses from lack of fertility
	Climate and Change Climate	Change ratio (C) between average temperature and Hadgem A2 al2050
		Change ratio (mm) between average precipitation and Hadgem A2al 2050
		Rate of change (C) between average temperature and Echam A2 al2050
		Change ratio (mm) between average precipitation and Echam A2 to 2050
Sensitivity	Population	% municipal population with a female head of household

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		% of the indigenous municipal population
		Municipal population in food poverty
		Municipal percentage of low-size children at birth
	Bless you	Municipal percentage of children with low birth weight
		% of people without access to health services
		% of the municipal area in primary activities
	Productive	% of the municipal area that does not have irrigation
		% of the municipal population engaged in primary activities
Adaptive capacity		% change in population by 2030
	Human Capital	% of the population in the municipality that knows how to read
		% of population aged 5 to 14 who attend school
		% of total literacy population in the municipality
		% of municipal U.P. that is organized
		% of municipal U.P. who have no land dispute
	Capital Social	% of Municipal Production Units that reported lack of training
		% of the municipal U.P. who reported having no problems producing
		% of the municipal U.P. who reported having no difficulty accessing credits
		% of municipal U.P. receiving remittances from a foreign country
	Financial Capital	% of the municipal U.P. who reported having savings
		% of municipal U.P. who reported having credit
		% of the population receiving more than 2 monthly minimum income wages
		Percentage change in GDP in 2000 to project in 2030

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Capital	Municipal surface relationship with forest or forest
Natural	The ratio of hectares reforested in the municipality in 2005

Source: Own elaboration based in Gay and Conde, 2013.

Notes: U.P. Production Units

With the variable data, the simplified criteria were applied and the results were standardized and integrated by the arithmetic sum in each indicator, obtaining three subscripts that were reintegrated with a sum and normalized the results in scale 0 to 100 by dividing the index into five equal parts to define Mexico's municipal degrees of vulnerability. The method used to calculate the vulnerability was with the following formula:

$$Vulnerabilidad = f[(exposición + sensibilidad) - capacidad\ de\ adaptación]$$

Where exposure and sensitivity factors represent impacts of climate change and adaptive capacity, it is the undercutting factor for the calculation of vulnerability. They thus generated several recommendations for each particular entity, based on the results of the estimated vulnerability rate.

The method of applying the simplified criteria, to obtain the degree of Social Vulnerability is done with the Methodology (Gay and Count, 2013), in which a weight of 50% is given to the set of socioeconomic indicators, of which the living conditions of the populationdetermine the degree of vulnerability;the second part-framed with the capacity to prevent and respond quantifies with aweight of 25% and finally, the third part of its methodology responds to the local perception of risk of the population with a value of 25%,to which it is applying an arithmetic sum as follows:

$$GVS = (R1 * .50) + (R2 * .25) + (R3 * .25)$$

Where:

GVS: is the degree of social vulnerability associated with disasters

R1- Sum result of indicators

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R2- Prevention and response capacity outcome

R3- Result oflocalrisk perception

With the result obtained, this methodology yields results that are contained in different ranges of the degree of vulnerability as follows, Table 4:

Table 4. Social Vulnerability Ranges

Final value	Degree of Disaster-Associated Social Vulnerability
0 to .20	Very Low
.21 to .40	Under
From .41 to .60	Middle
From .61 to .80	High
More than .80	Very High

Source: Own elaboration based in Gay and Conde, 2013.

It is considered, therefore, after reviewing the type of variables and indicators of which it is used to perform the calculation of indices associated with the development of some hydrometeorological phenomenon, that these must be integrated to provide a complete index and which is possible to determine as shown in the international cases presented above. And, while, in the Mexican case, the information required for the construction of the vulnerability index is available, only the appropriate statistical calculations need to be performed by replacing the simplified criteria with the Main Component Analysis for reduce partial results and obtain accurate, reliable data that integrates the different indicators proposed in this research work.

RESULTS

The methodologies for calculating vulnerability are evolving by including a number of variables and indicators that comprise a set of associated factors with each other, in order to generate an appropriate and specific index to understand and give a very explanation the behaviour of a phenomenon involving the dimensions, social, economic and environmental, and thus being

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able to propose the necessary measures to reduce the risk of disasters associated with natural phenomena, in the particular case of this hydrometeorological phenomena.

The task of generating vulnerability indexes associated to natural phenomena, has great results in international cases, particularly in developed older countries, where they do apply the statistical techniques and methods appropriate for estimation of their indices, and which also serve as an example for less developed countries looking for alternatives for information management and their treatment in building accurate and appropriately developed vulnerability indices.

Applying the IBM Core Component Analysis Method, SPSS Statistics, Version 22, will allow you to integrate the values of indicators of social, economic and environmental dimensions, assigning them a standardized value that can adjust to determine their degree of confidence and by relying on this tool to reduce the partial results achieved with the simplified criteria that have been used for the Mexican case

The Mexican case presents a major step forward in measuring indicators for the construction of the vulnerability index that is used in risk atlases, and methodological guidelines for the elaboration of them, however, the method they use, is based on the application of simplified criteria such as arithmetic sum and it is in this part that you can intervene with the integration of indicators through the method for exampleAnalysisof Main Components and with the most current technological tools to be able to perform the specific calculations that give it a higher degree of certainty and reliability than it presents today and become an instrument to be used in reducing the risk of disasters associated with the development of some hydrometeorological phenomenon in Mexico, and what can become a model for other countries in which this method can be applied.

The cases presented in the international order show the effectiveness of being able to integrate both social, economic and natural or physical indicators for the construction of vulnerability rates associated with the development of some phenomenon hydrometeorological measures, in which the most appropriate statistical methods were used for such calculations, and the mechanics of their integration respond appropriately when making the estimates of their indices; they are not considered to be countries with high levels of development, but are using the right techniques and methods to make their estimates.

In this sense, this example can be followed, being able to apply the appropriate methodologies to perform the calculations of a vulnerability index associated with the development of hydrometeorological phenomena in Mexico that meets international standards, starting with feasibility of doing so, because there are sufficient means and the right information to apply quality

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methods and techniques that can be compared with international work and from which, the necessary measures can be generated to reduce the risk of disasters by having accurate information from the areas most vulnerable to the onslaught of a problem related to hydrometeorological phenomena.

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