The Need for Rethinking the Concepts of Vulnerability and Risk from a Holistic Perspective: A Necessary Review and Criticism for Effective Risk Management[1]

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The importance of terminology

Human development has led humankind to idealise the elements of its own habitat and environment and the possibilities of interaction between them. In spite of confused perceptions about the notion of *vulnerability*, this expression has helped clarify the concepts of *risk* and *disaster*. For a long time, these two concepts were associated with a single cause: an inevitable and uncontrollable physical phenomenon However, the conceptual framework of vulnerability was borne out of human experience under situations in which it was often very difficult to differentiate normal day-to-day life from disaster. Vulnerability may be defined as an internal risk factor of the subject or system that is exposed to a hazard and corresponds to its intrinsic predisposition to be affected, or to be susceptible to damage. In other words, vulnerability represents the physical, economic, political or social susceptibility or predisposition of a community to damage in the case a destabilizing phenomenon of natural or anthropogenic origin. A series of extreme, and often permanent, conditions exist that make livelihood activities extremely fragile for certain social groups. The existence of these conditions depends on the level of development attained, as well as the success of development planning. In this context, development has begun to be understood as a process that involves harmony between humankind and the environment, and vulnerability in social groups could thus be understood as the reduced capacity to 'adapt to', or adjust to, a determined set of environmental circumstances.

In general, the concept of 'hazard' is now used to refer to a latent danger or an external risk factor of a system or exposed subject. This can be expressed in mathematical form as the probability of occurrence of an event of certain intensity in a specific site and during a determined period of exposure. On the other hand, vulnerability may be understood, in general terms, as an internal risk factor that is mathematically expressed as the feasibility that the exposed subject or system may be affected by the phenomenon that characterises the hazard. Thus, risk is the potential loss to the exposed subject or system, resulting from the convolution of hazard and vulnerability. In this sense, risk may be expressed in a mathematical form as the probability of surpassing a determined level of economic, social or environmental consequence at a certain site and during a certain period of time.

'Convolution' is a mathematical concept that refers to concomitance and mutual conditioning – in this case, of hazard and vulnerability. Stated differently, one cannot be vulnerable if one is not threatened, and one cannot be threatened if one is not exposed and vulnerable. Hazard and vulnerability are mutually conditioning situations and neither

[1] Chapter 3 of the book 'Mapping Vulnerability: Disasters, Development and People', 2003, G. Bankoff, G. Frerks, D. Hilhorst (Ed), Earthscan Publishers, London.

can exist on its own. They are defined conceptually in an independent manner for methodological reasons and for a better comprehension of risk. Thus, when one or two of the components of risk are altered, we are meddling with risk itself. However, due to the fact that in many cases it is not possible to modify the hazard in order to reduce the risk, there is nothing left to do except modify the conditions of vulnerability of the exposed elements. This is precisely why emphasis is frequently made in technical literature to the study of vulnerability and to vulnerability reduction as a measure of prevention-mitigation. However, what is really intended by this is risk reduction.

The term vulnerability has been employed by a large number of authors to refer directly to risk, and they have even used it to refer to disadvantaged conditions, especially in the social sciences. For instance, people refer to vulnerable groups when they talk about the elderly, children or women. However, as discussed above, it is important to ask ourselves: vulnerable to what? In other words, hazard and vulnerability are concomitant and lead to risk. If there is no hazard it is not feasible to be vulnerable, when seen from the perspective of the potential damage or loss due to the occurrence of an event. In the same way, there is not a situation of hazard for an element or system if it is not 'exposed' or vulnerable to the potential phenomenon. Even though this might seem to be an unnecessary subtlety, it is important to make this distinction since at a certain moment in time the adjective vulnerable might be employed in different ways in problem areas other than the field of disasters (for example, in psychology or public health). A population might be vulnerable to hurricanes, for example, but not to earthquakes or floods. Regarding the use of the term vulnerability, Timmerman had, in the early 1980s, already indicated that 'vulnerability is a term of such broad use as to be almost useless for careful description at the present, except as a rhetorical indicator of areas of greatest concern' (Timmerman, 1981). In his work on vulnerability and resilience he concludes with a touch of irony that real vulnerability may lie in the inadequacy of our models of the social systems and concepts (Liverman, 1990).

In the same way that for many years the term risk was used to refer to what is today called hazard, currently, many references are made to the word vulnerability as if it were the same thing as risk. It is important to emphasise that these are two different concepts and their definition obeys a methodological approach that facilitates the understanding and possibility of risk reduction or mitigation.

Approaches and evolution of the concepts

Despite efforts by social scientists undertaken since the mid 20th century (Kates, 1971; White, 1942; White, 1973; Quarantelli, 1988), the issue of risk assessment seen from the perspective of disaster risk has only been treated fairly recently. Its systematic conception and analysis was practically assumed by experts and specialists in the natural sciences with studies regarding geodynamic, hydrometeorological and technological phenomena such as earthquakes, volcanic eruptions, mudslides, flooding and industrial accidents. In other words, emphasis was centred on the knowledge of hazards due to the existing investigative and academic biases and the efforts of those who first reflected on these issues (Cutter, 1994). It is important to point out here that this emphasis still remains, particularly in the

highly developed countries, where due to their technological development people try to find out in greater detail the generating phenomena of the threats. This was an evident trend during the first years of the 'International Decade for Natural Disaster Reduction' declared by the United Nations (UN) General Assembly.

If what is intended is the estimation of risk, there is no doubt whatsoever that the study and evaluation of hazard is a very important step; however, in order to fulfil such an aim it is equally important to study and analyse vulnerability. Due to this fact, various specialists subsequently promoted the study of physical vulnerability, which was essentially related to the degree of exposure and the fragility of the exposed elements to the action of the phenomena. This last aspect allowed amplification of the work in a more multidisciplinary environment due to the need for involving other professionals such as architects, engineers, economists and planners. In time, they found the consideration of hazard and vulnerability to be fundamental when considering standards for constructing buildings and infrastructure (Starr, 1969).

However, the approach is still very technocratic in the sense that it remains focused upon the hazard and not upon the conditions that favour the occurrence of crisis: ie global vulnerability – a far more holistic and encompassing concept that goes well beyond issues of physical vulnerability. In developing countries, social, economic, cultural and educational aspects are, in most cases, the cause of the potential physical damage (physical vulnerability). In contrast to the hazard, global vulnerability is a condition that is constructed, accumulates and remains over time and is closely linked to social aspects and to the level of development of the communities.

During the past few years, a considerable number of social scientists have renewed interest in the field, inspired by the yawning gaps that impede a fuller understanding of the problems of risk and the possibilities for real mitigation. The reading of vulnerability and risk by, amongst others, geophysicists, hydrologists, engineers and planners can be a very different reading or representation than that of people in general, the exposed communities and the government authorities in charge of the decision-making on reduction or mitigation of risk. That is the reason why it is currently accepted that there is a need for greater study of individual and collective perceptions of risk and for research on the cultural characteristics, development and organization of the corporations that favour or impede prevention and mitigation. These are aspects of fundamental importance in order to find efficient and effective means to achieve a reduction in the impact of disasters worldwide (Maskrey, 1994).

Collective risk management involves three public policies: risk identification (which includes individual perceptions, social representations and objective assessment); risk reduction (or prevention/mitigation); and disaster management (response and recovery). Risk transfer (insurance and financial protection) comprises an additional policy measure, but significant advances have only been achieved in developed contexts. These different public policies imply different disciplinary approaches, values, interests and strategies and involve different social actors. In terms of most scientific disciplines, risk is a transversal notion, and without such an interdisciplinary and comprehensive approach an

effective risk management is not possible. Risk reduction implies intervention in causal factors. Disaster management signifies an efficient response to risk that has materialized as disaster. Risk transfer implies risk evaluation of economic units. Therefore, risk management inevitably requires an understanding of how risk is perceived by society, how it is represented (models, maps and indicators) and how it is measured or dimensioned.

Approach of the natural sciences

The term 'natural disaster' is very frequently used to refer to the occurrence of severe natural phenomena. Events such as earthquakes, tsunamis, volcanic eruptions, hurricanes, floods and landslides have been considered direct synonyms for disaster. Unfortunately, this interpretation has favoured the belief that there is nothing to be done when faced with disasters since, given the fact that they are natural phenomena they are considered unavoidable. This interpretation has also led to disasters being considered events of destiny or bad luck, or even the result of supernatural or divine causes. This could help to explain why certain communities adopt a religious viewpoint, consider that these events are unalterable and become resigned to their occurrence. In the same way, vestiges of this kind of interpretation can be found in the legislation of certain countries, where the definition of fortuitous acts or of *force majeure* are still used along with statements such as 'the occurrence of a natural disaster, such as an earthquake or a volcanic eruption'. In some cases, these kinds of events are specifically called 'acts of God', as in certain legislation of Anglo-Saxon origin.

Nevertheless, the interest of, for example, geophysicists, seismologists, meteorologists and geologists has favoured the idea that disasters are a topic exclusively associated with the physical phenomena that generate these natural events. Unfortunately, people often view disasters as if they were the same things as the phenomena that caused them. Despite technological advancement and geophysical, hydrological and meteorological instrumentation, it is generally not possible to predict with certainty and precision the occurrence of a future event. As a result, some people justify themselves to those affected by suggesting that the damages and losses are unavoidable. Some political authorities have also appealed to the religious fanaticism of certain communities in order to elude responsibilities for things that have happened due to negligence or omission.

During the second half of the 20th century, a period during which technological advancement contributed enormously to our knowledge of natural phenomena, it was commonplace to define risk as being the estimation of the possible occurrence of a phenomenon. It is still commonplace to find this idea held by specialists who study phenomena such as earthquakes, landslides and storms. During the 1970s and even the 1980s, if someone wished to refer to the probability of an earthquake they would have indicated that they were estimating the seismic risk. Towards the end of the 1980s and, particularly, in the 1990s the concepts of seismic hazard and threat became more common in referring to what was previously referred to as seismic risk

The UN General Assembly's declaration of the 1990s as the International Decade for Natural Disaster Reduction (IDNDR) was, without doubt, directly influence by the natural sciences. In fact, the need for this initiative was first promoted by Frank Press, a well-known specialist of Earth sciences, in the US to specifically foster the study of natural hazards.

Approach of the applied sciences

The works of Whitman in Boston and of Fournier d'Albe in Europe during the 1970s provided new elements for estimating the damages and losses due to earthquakes. Emphasis on the notion that damage was not only due to the severity of the natural phenomenon, but also to the fragility or the vulnerability of the exposed elements allowed a more complete understanding of risk and disaster.

On the other hand, the 'risk-transfer' approach employed by insurers (understood as feasible loss and the analysis of the probability of failure or 'accident' in mechanical and industrial systems) favoured the consolidation of a new paradigm with regard to risk analysis, security and trustworthiness of systems. From that moment onwards, particular attention was given to the physical properties of the system that could suffer damage or harm due to an external phenomenon or to the idea that a failure or disaster could occur in the system due to the technology employed. This could be called the epoch of the contribution of engineering and the hard sciences. The concept of vulnerability was explicitly promoted and, when seen from the perspective of disaster studies using probabilistic modelling methods, was clearly established in the report published on *Natural Disasters and Vulnerability Analysis* by the UN Disaster Relief Organisation (UNDRO) in 1980.

Disciplines such as geography, physical, urban or territorial planning, economics and environmental management helped to strengthen what can be called an applied science approach to disasters. 'Maps' became more and more common due to the ever greater participation of geologists, geotechnical engineers, hydrologists and other experts. They were able to contribute raw materials for the adequate identification of the danger or hazard zones, according to the area of influence of the natural phenomena. Computer science tools such as geographic information systems (GIS) have facilitated this type of identification and analysis.

The employment of damage matrixes, loss functions or curves, or fragility or vulnerability indices, relate the intensity of a phenomenon to the degree of harm or damage allowed for the correct estimation of scenarios of potential loss in case of future earthquakes in urban centres. This type of study or analysis of risk has increasingly been presented with the intention of contributing data on threats or risks to physical and territorial planning specialists as an ingredient within the decision-making process.

In this approach, risk calculations are the result of the probabilistic modelling of the hazard and of the estimation of the damage that a system might suffer. This may also be obtained in an analytical way or based upon empirical data. This possibility favours the

fact that the results may be easily translated into potential losses and may then be applicable, under the concept of the cost-benefit ratio, in the elaboration of building codes, security standards, urban planning and investment projects. The possibility of quantifying and obtaining the results in terms of probability has made it easier to consolidate this approach given the idea that risk is an objective variable and may be quantified.

Approach of the social sciences

From the point of view of the social sciences, the issue of disasters gained special attention during the mid-20th century as a result of the interest of the US government in the behaviour of the population in case of war (Quarantelli, 1988). From that time on, we can state that a social theory of disasters came to life. This approach primarily involves a series of studies about reactions and individual and collective perceptions (Drabek, 1986; Mileti, 1996). Generally speaking, in the US, the social science studies and research have focused upon the reaction or response of the population in case of emergencies and not strictly on the study of risk. However, the contributions from geography and the so-called 'ecologist school' from the 1930s onwards (Burton et al, 1978) could also be considered conceptions from a social–environmental perspective (Mileti, 1999) that subsequently inspired the approach of the applied sciences. Its emphasis on the fact that disaster is not a synonym of natural events, and on the need to consider the capacity for adaptation or adjustment of a community when faced with natural or technological events, was, without any doubt, the springboard for the concept of vulnerability.

On the other hand, since the 1980s and, especially, the 1990s in Europe and certain developing countries, both in Latin America and Asia, social science researchers have critically discussed natural and applied science approaches. In general, their approach suggests that vulnerability has a social character and is not limited to the potential physical damage or to demographic determinants. It is stated that a disaster only takes place when the losses exceed the capacity of the population to support or resist them, or when the effects impede easy recovery. In other words, vulnerability cannot be defined or measured without reference to the capacity of a population to absorb, respond and recover from the impact of the event (Westgate and O'Keefe, 1976). This being so, for experts in political sciences, similar losses or physical effects in two separate countries with different economic and institutional conditions could have very different implications. An event that could pass relatively unperceived in a large country could mean a catastrophe in a small one due to the differential absorption capacity of each of the involved social systems. Similar damages in rich and poor countries have more serious social implications in the poor countries, where the underprivileged social groups are usually the most affected (Wijkman and Timberlake, 1984). According to Susman et al (1984), vulnerability 'is the degree to which the different social classes are differentially at risk.' This definition determines that vulnerability is established according to the political, social and economic conditions of the population. From this perspective, what is suggested is that the conditions that characterize underdevelopment (social discrimination, expropriation, exploitation, political oppression and other processes that are related with colonialism and capitalism) have made the poorest

communities more vulnerable to disasters and have forced them to deteriorate and degrade their own environment.

Other researchers, such as the members of the Red de Estudios Sociales en Prevención de Desastres en América Latina (La RED) – the Network for Social Studies in Disaster Prevention in Latin America – have stated that vulnerability is socially constructed and is the result of economic, social and political processes. Therefore, it is necessary to model vulnerability, taking into account – as well as the physical aspects – social factors, such as the fragility of the family and the collective economy; the absence of basic social utilities; lack of access to property and credit; the presence of ethnic and political discrimination; polluted air and water resources; high rates of illiteracy; and the absence of educational opportunities (Wilches-Chaux, 1989; Lavell, 1992; Cardona, 1993; Maskrey, 1994; Lavell, 1996; Cardona, 1996; Mansilla, 1996).

Some conceptual models of risk have appeared from the environment of political economics or neo-Marxism, such as the model of 'pressure and release' in which risk is presented as the result of the concurrence of some conditions of vulnerability and of some possible threats. Vulnerability is obtained from identifying the social pressures and relations from a global to local level. At the global level, they are called 'root causes', such as social, political and economic structures. At an intermediate level, they are called 'dynamic pressures', such as population growth, urban development and population pressures, environmental degradation, and the absence of ethics. At a local level, they are called 'unsafe conditions', such as social fragility, potential harm or poverty. In this approach, prevention mitigation should be conceived of as 'releasing' the pressure of what is global over what is local. Risk reduction signifies intervention at each level: conditions of insecurity, the dynamic pressures and the root causes (Wisner, 1993; Cannon, 1994; Blaikie et al, 1994).

There are other conceptual models, such as the 'access model', which suggests that risk is generated as a result of the difficulties that some social groups or families have in accessing certain resources over time. What is intended here is to identify the limitations and facilities through which accumulation is achieved or the decrease in important capacities when faced with potential disaster (Sen, 1981; Chambers, 1989; Winchester, 1992). Its argument is based upon the fact that when faced with an equivalent hazard, or when facing the same potential for physical damage, the risk could be different depending upon the capacity of each family to absorb the impact. Even though there are some who consider vulnerability a synonym of poverty, those who propound the model indicate that poverty refers to basic unsatisfied needs and restrictions of access to resources, while vulnerability refers to the lack of capacity to protect oneself and to survive a calamity (Chambers, 1989). These definitions have led to some researchers affirming a link between the concepts of tropicality, development and vulnerability that, since the 17th century onwards, have made up part of the same essentializing and generalizing cultural Western discourse that denigrates large regions of world as disease ridden, poverty stricken and disaster prone (Bankoff, 2001).

On the other hand, seen from the social communication viewpoint and considering the processes by which concepts are built individually or collectively, other authors have assumed a critical position with reference to the different approaches considered earlier. They point out in general that there exists a positivist and performative character in the different conceptual proposals, given that concepts come from experts and are subject to subjective alteration or manipulation. Most of these ideas emphasize the active role that people play in constructing the meaning of risk and in the role of communication as a transforming power, indicating the need to consider risk as an appreciation, a reading or a 'imaginary' and not as something external to people. It is important to consider perceptions, attitudes and motivations both individually and collectively (individual perception and social representation) that can vary notoriously from one context to another (Johnson and Covello, 1987; Slovic, 1992; Luhmann, 1993; Maskrey, 1994; Adams, 1995; Muñoz-Carmona, 1997).

Critique of the different approaches

Although researchers and professionals working in the disaster area may believe they use the same basic notions, serious differences do exist that impede successful, efficient and effective risk reduction. The conceptual frameworks used to understand and interpret risk, and the terminologies associated with these, have not only varied over time, but also differ according to the disciplinary perspective considered. This means that in spite of disciplinary refinement, there is in reality no single conception that unifies the different approximations or that is able to bring these together in a consistent and coherent manner.

Scientists of the social sciences such as historians, psychologists and sociologists generally draw on ‘constructivist’ postulates, considering risk as a ‘social construction.’ From this perspective, the risk notion is only graspable taking into account the analysis of the individual and collective perceptions, representations and interactions of social actors. However, engineers, geologists, geographers, economists and epidemiologists generally adopt an approach that some describe as ‘realist’, based on the hypothesis that risk can be quantified or objectively assessed.

The natural sciences approach is a partial view, which has undoubtedly contributed to knowledge of one main component of risk: the hazard. However, the fact that there are still those who confuse the term risk with the concept of hazard could have unsuspected implications. An intense natural event is not a synonym of disaster and, thus, risk cannot be understood exclusively as the possible occurrence of a natural phenomenon. This type of conception has contributed to a misreading or false ‘imaginary’ of risk and disaster by the exposed population and has been used to good effect by political authorities in order to avoid blame.

The applied sciences approach differs in the fact that it focuses on the effects of the event and not on the event itself. There is no doubt whatsoever that the contribution of engineering signified a big change of paradigm with respect to risk. Even though a more complete concept of risk is provided, the approach remains partial and physicalist. Curiously the methodologies developed through this approach offer real risk estimations

only in a few cases. In practice, the evaluation of physical vulnerability tends to replace risk evaluation, which is left as a secondary result. Through these techniques risk is evaluated in economic terms by estimating the replacement cost of the deteriorated part of the affected vulnerable system. It is even common to find, in the case of future loss scenarios, that the term 'social impact' is used for the global estimation of possible victims - the dead and injured. Despite the fact that this information is important, for instance, for emergency preparedness and response, it confirms the restricted vision and the ignorance of the applied sciences of social, cultural, economic and political aspects that should also be reflected in the estimation of vulnerability and risk.

It is important to point out here that, except in the case of seismic hazard, the vulnerability referred to in this approach has been considered a constant when used for territorial planning purposes. This is based on the notion that the elements are located in hazard-exposed zones and are thus vulnerable. Many hazard maps have unconsciously been converted into and referred to as risk maps, and vulnerability is taken as a constant and a mere function of the exposition of the elements. Thus, this approach continues to give over-riding importance to the hazard and the hazard is considered the sole origin or the cause of disaster. The use of GIS has favoured this situation and the view or vision of risk as something 'photographic' or 'frozen'. In the best of cases, the concept of vulnerability proposed by this approach is merely used to explain the physical damage and other direct side effects. Risk, seen from this perspective, has been interpreted in general as a potential loss taking into account possible damage. The disaster – by this I mean the materialisation of the risk – has been restricted to a consideration of the loss represented in physical damage and not, in a more comprehensive fashion, as the overall consequences for the society. Without doubt, this approach has been fostered by the notion that vulnerability can be conceived as simply 'exposure' or in the best of cases as the susceptibility to suffer damage, without really making any reference to resilience; ie the capacity for recovery or to absorb the impact.

With respect to the so-called social sciences approach, its contribution to the idea of disaster risk was initially timid, due to the marked tendency to study the behaviour of the population in situations of emergency or imminent emergency. In the developed world, social scientists have given considerable emphasis to the study of risk from the day-to-day life and human security perspectives when faced with technological incidents that could affect their health. In a few cases there has been special interest in the perception of individuals or groups regarding possible disasters, and even less interest has been shown when it comes to the implications or to the processes that contribute to the social gestation of disaster. However, some works have placed emphasis on the capacity of communities to absorb the impact or to recover after an event. These works have the merit of questioning the restricted vision of the applied sciences, indicating that vulnerability should not be considered exclusively as the possibility of physical damage.

Only towards the end of the 20th century did we increasingly witness how more theoretical constructions concerning the topic of risk consider vulnerability and hazard, at times, as the result of social, economic and political processes. Even though this approach might seem to be the more complete, on many occasions it has given such emphasis to

the understanding and social modelling of vulnerability that it has omitted or ignored the fact that environmental impact and potential physical damage are very important when it comes to conceiving and estimating risk. Vulnerability has tended to be interpreted as a 'characteristic' or as a 'feature' and not as a condition, circumstance or predisposition to damage, where this is the result of susceptibility, frailties and a lack of resilience or capacity for recovery. Some authors forget completely about the hazard and the fact that this has to be taken into account in order to establish the notion of risk. It is also important to remember that the concept of risk is linked to decision–-making. This means that it has be dimensioned in time in order to make decisions on the feasibility and convenience of doing something or not. But without hazard, without a trigger phenomenon and with vulnerability interpreted as if it were a characteristic, even though the vulnerability is ongoing, there would not be any risk and, thus, no possible future disaster. In this respect, it is not so strange that some authors have the tendency or the bias to consider poverty as equivalent to vulnerability and not as a factor of vulnerability. Some researchers who try to distance themselves from this conception say that poverty is determined by historical processes that restrict the access of people to resources, and that vulnerability is determined by historical processes that restrict people from having the resources to face hazards or to access protection or security. However, in general terms, very few works refer to risk, or they limit themselves to treating vulnerability as its synonym. Perhaps their greatest defect is that with the argument that risk is something subjective, no attempt is made to estimate it, or the techniques that are used for estimation are not very consistent.

It is necessary to transcend the epistemological antagonism between 'objectivist-positivist' and 'subjectivist/constructivist' paradigms and rely as much upon qualitative as quantitative methods for risk conceptualisation and estimation. Action and decision, implicit in the definition of risk, require the establishment of relationships between subjective risk perception and the scientific need for objective measurement. Due to scientific specialization, various notions of risk exist. For this reason it has been argued that a common language and a comprehensive or holistic theory of risk is needed. The clash between 'positivism' and 'constructivism' is inoperative. Conceptually and pragmatically it is very unsatisfactory to maintain a situation where each individual subjectively defines and assumes risk in their own particular way. This position is totally inoperable when intervention in risk becomes indispensable from the public policy perspective.

From the above, we can deduce that despite the notorious advances that have been made in the understanding of risk, there is a very high level of fragmentation that has not allowed a consistent and coherent theory seen from the perspective of disasters. It is obvious that there will always be different approaches and it would be wrong to think otherwise. However, part of the difficulty of reaching an effective management of risk has been the absence of a comprehensive conception of it in order to facilitate its assessment and reduction from a multidisciplinary perspective (Cardona, 1999; 2001). In other words, the absence of a holistic theory of risk, from a disasters' point of view, has favoured, or at least partially contributed to, the problem growing faster than solutions can be found.

Vulnerability and risk from a holistic perspective

Risk is a complex and, at the same time, curious concept. It represents something unreal, related to random chance and possibility, with something that still has not happened. It is imaginary, difficult to grasp and can never exist in the present, only in the future. If there is certainty, there is no risk. Risk is something in the mind, closely related to personal or collective psychology. But, a sense of objectivity invoked in its analysis (Elms, 1992). Moreover, it is a complex concept and a composite idea. In a more integral notion of risk, three separate aspects converge: eventuality, consequence and context. These three aspects all contribute to attempts to estimate or grade risk. In risk analysis, the context (management capacity and related actors) determines the limits, the reasons, the purpose and the interactions to be considered. Analysis has to be congruent with the context and this must be taken into account when analysing the sum of the contributing factors. If not, the analysis would be totally irrelevant or useless.

Throughout history, risk analysis has been used informally in innumerable human situations. Risk has always been associated with decision-making, with something that has to be done, with the execution of an action that ranges from the most trivial to that of utmost important. The notion of risk has a performative character. In all cases, an action must be chosen. The results of these actions are in the future and these imply uncertainty. The selection of a future line of action implies possible adversity or contingency. For this reason, the risk should be evaluated so that a decision can be taken. Discussions regarding risk touch the ground roots of society, knowledge, values, emotions and even its very existence. These include reflections on the nature of scientific knowledge, an understanding of the visions that substantiate different arguments and rationalization as to what we fear and as to the ways we should act. The ability to comprehend, despite uncertainties in the analysis of physical systems, is one of the circumstances that define whether a given model provides an adequate representation of the problem under consideration. This means moving from the concept of truth to the concept of control or management. This decreases the need to obtain true predictions of future scenarios, with or without the estimation of uncertainties, and encourages a move in favour of the control of future events, accepting the existence of unavoidable uncertainties. Thus, despite the fact that engineering science can make certain predictions about risk, such predictions will unavoidably be partial or incomplete. As a result, the emphasis should be placed on managing or handling security (Blockley, 1992).

During the past few years, attempts to dimension disaster risk for management purposes have been based on the calculation of the possible economic, social and environmental consequences of a physical phenomenon in a specific place and time. However, risk has not been conceptualized in a comprehensive way. Rather, fragmentation has been common and risk has been estimated or calculated according to different disciplinary approaches. In order to estimate risk on a multidisciplinary basis we need to be aware not only of the expected physical damage and the victims or the economic losses, but also social, organizational and institutional factors that relate to community development. At the urban scale, for example, vulnerability seen as an internal risk factor must be related not only to exposure of the material context or to the physical susceptibility of the exposed elements,

but also to the social frailties and lack of resilience of the prone communities. This means looking into the capacity to respond or absorb the impact. Deficient information, communications and knowledge among social actors; the absence of institutional and community organisation; weaknesses in emergency preparedness, political instability; and the absence of economic health in a geographic area, all contribute to greater risk. This is why the potential consequences are not only related to the impact of the event but also to the capacity to withstand the impact and their implications in the considered area.

Vulnerability and lack of development

It is certainly true that some social circumstances may be associated with vulnerability, but at the same time these aspects may not be considered the same as vulnerability. One example is the case of poverty, which may well be considered a factor or contributing cause of vulnerability but is certainly not vulnerability in itself. For this reason, it becomes necessary to closely study the factors that make populations vulnerable when faced with hazards. There is no doubt that many disasters are the result of economic and political factors, which are sometimes exacerbated by pressures that concentrate populations in prone areas. In most cases, the reduction of vulnerability is closely linked to the provision of the basic needs. Conversely, there is a relation between social and economic marginality or exclusion and vulnerability. But, poverty is not vulnerability and the ways in which poverty contributes to vulnerability must be studied in different contexts and cases.

The vulnerability of human settlements is intrinsically tied to different social processes. It is related to the fragility, the susceptibility or the lack of resilience of the exposed elements. On the other hand, vulnerability is closely tied to natural and manmade environmental degradation at urban and rural levels. Thus, degradation, poverty and disasters are all expressions of environmental problems and their materialization is a result of the social construction of risk, brought about by the construction of vulnerability or hazard, or both simultaneously. From a social point of view, vulnerability signifies a lack or a deficit of development. Risk is constructed socially, even though it has a relationship to physical and natural space. In developing countries, increases in vulnerability are related to factors such as rapid and uncontrollable urban growth and environmental deterioration. These lead to losses in the quality of life, the destruction of natural resources, the landscape and genetic and cultural diversity. In order to analyse vulnerability as part of wider societal patterns we need to identify the deep rooted and underlying causes of disaster vulnerability and the mechanisms and dynamic processes that transform these into insecure conditions.

The underlying causes of vulnerability are economic, demographic and political processes that affect the assignation and distribution of resources among different groups of people. These reflect the distribution of power in society. Some global processes require more attention than others. These include population growth, rapid urban development, international financial pressures, degradation of the environment, global warming and climate change and war. For example, urbanisation processes have contributed greatly to severe damage during urban earthquakes; population increase helps

explain increases in the number of affected persons by floods and prolonged droughts and deforestation increases the chances of flooding and landslides (Blaikie et al, 1994). Adhering to the hypothesis that lack of development and vulnerability are correlated Cardona (2001) suggests that vulnerability originates in:

a) physical fragility or exposure: the susceptibility of a human settlement to be affected by a dangerous phenomenon due to its location in the area of influence of the phenomenon and a lack of physical resistance;
b) socio-economic fragility: the predisposition to suffer harm from the levels of marginality and social segregation of human settlements, and the disadvantageous conditions and relative weaknesses related to social and economic factors; and
c) lack of resilience: an expression of the limitations of access and mobilization of the resources of human settlement, and its incapacity to respond when it comes to absorbing the impact.

This kind of thinking attempts to integrate in a holistic way the contributions of the physical and social sciences with the idea of obtaining a more complete vision of the factors that create or exacerbate vulnerability. This approach takes into account aspects of physical resistance and the prevalent aspects of individual and collective self-protection.

Limitations and perspectives

Collective risk means the possibility of future disaster. It announces the possibility that a dangerous phenomenon or event will occur and that exposed elements are predisposed or susceptible to being affected. Therefore, reducing hazard or vulnerability contributes to risk reduction. And, reducing risk means reducing the possibility of future disaster. However, risk and disaster are ever-increasing problems. The impact of natural or social–natural phenomena is ever greater due to the styles or models of development in vogue in many countries. Population growth and the urban development process, trends in land occupancy, increases in poverty levels, the employment of inadequate organizational systems and pressure on natural resources have continuously increased the vulnerability of populations. In general, efforts have focused on the study of natural hazards and the proposal of technical solutions. Until now, no major advances have been achieved given that these solutions are often not socially, culturally or economically applicable or adequate. Despite important technical advances, most suggested solutions have not been applied in real life due to the restrictions of available resources and the ignorance of local rationales that allow for an alternative technological handling of the situation. Sometimes, people simply reject the solutions because they do not correspond to their own reading of risk or to their image of disasters.

Disasters should be understood as unsolved development problems since they are not events of nature *per se* but situations that are the product of the relationship between the natural and organizational structure of society. Policies for urban and regional development and social and economic policies, in general, do not take into account the risk problematic; on many occasions, they increase vulnerability. Only in a few cases have the concepts of

prevention and mitigation (risk reduction) been duly considered in the planning of development in poor countries.

In many places, government systems or organizations in charge of reducing risks and of drills and preparedness for disasters have not obtained effective results. This is due to the absence of political will and feasibility or the fact that their approach has focused more upon the response and aid in case of an emergency, and less on the execution, in a systematic and organized fashion, of actions that would prevent or mitigate the disaster. These agencies are mostly centralized hierarchies that do not adequately incorporate local power bases, such as municipal governments, community organizations or other expressions of civil society.

Within the context of the UN International Decade for Natural Disaster Reduction during the 1990s, the prevention of disasters, or the idea that risk management should be a fundamental strategy for sustainable development, was promoted quite explicitly. However, despite these efforts, there are still enormous gaps in risk management and in articulating prevention and reduction activities in light of managing and protecting the environment. This is despite the fact that, clearly, in order make society's exploitation of its natural ecosystems sustainable, it is necessary to moderate and guide human actions concerning the environment, and vice versa.

The initiative of the IDNDR at least had the virtue of catching the attention and interest of a wide number of countries, international organizations and donor agencies in the field of disasters. As a result of the initiative, different governments, organizations and institutions around the world supported projects and programmes that have already provided positive results in fields such as health and education in reducing the vulnerability of productive infrastructure. Results can be seen in the formation of institutions of a national and subregional character and in the production and diffusion of technical and scientific information. We are left with the preoccupation of what the future holds, since these advances are pretty feeble, faced with worsening conditions and factors that favour the occurrence of more frequent and more severe disasters than ever before.

Conclusions

All concepts of risk have a common element: a distinction between reality and possibility. If the future were predetermined or independent of present human activities, the term risk would have no significance. If the distinction between reality and possibility is accepted, then the term risk signifies the possibility that an undesirable state of reality (adverse effects) will occur as a result of natural events or human activities. This definition means that humans can and do make causal connections between actions (or events) and effects, and that undesirable effects can be avoided or reduced if the causal events or actions are avoided or modified.

An obvious concern exists due to the separation of risk evaluation and risk reduction; between science and political decision. There are serious grounds for doubt regarding the effectiveness of risk management. The increase in, and accumulation of, vulnerability are

truly alarming, as is the lack of consciousness and responsibility regarding this issue on the part of decision-makers, political authorities and the communities themselves. This could explain why – despite many different disciplinary studies of hazard vulnerability and even risk in many places around the world – risk reduction has not been achieved. Among other factors that contribute to this lack of effective risk management, the inadequate form in which risk has been estimated or valued is very important. Some important technical contributions have been made regarding evaluation purposes, but in a specialised or fragmented way. The absence of a holistic approach to risk – in other words, the absence of a comprehensive and multidisciplinary evaluation of risk that assesses its different characteristics – seems to have contributed to a decrease in the effectiveness of risk management.

A holistic approach of risk that is both consistent and coherent could guide decisions taken within a geographic area. It should be founded on a theoretic basis of complexity that takes into account not only geological and structural variables, but also those of an economic, social, political and cultural nature. An approach of this type could assess, in a more consistent manner, the non-linear relations of the contextual parameters and the complexity and dynamics of social systems. It would also help to improve the effectiveness of management and to identify and prioritize factual and efficient measures for the adequate reduction of risk by authorities and communities, who are undoubtedly the fundamental actors in achieving a preventive attitude.

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