IMPACTS OF NATURAL DISASTERS ON ENVIRONMENTAL AND SOCIO--ECONOMIC SYSTEMS: WHAT MAKES THE DIFFERENCE?[1]

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Introduction

Natural disasters are caused by hydro-meteorological, climatological, geophysical and biological phenomena which adversely impact on the natural and built environment of affected regions. Their effects in terms of victims and material damage exceed the capacity for self-recovery of local communities, making external assistance necessary (vide GUHA-SAPIR *et al.*, 2012; NOY, 2010; ALCÁNTARA-AYALA, 2002, p. 109-110).

The World Bank & United Nations report (2010) states that disasters expose the cumulative effects of decisions (individual and collective) previously taken in terms of land management (including unregulated growth of urban areas), construction techniques,

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implementation of sanitation infrastructure and low investment in educational programs, poverty reduction and social integration, among others. Such decisions combined with high intensity natural events (e.g. floods, landslides, storms and earthquakes) provoke an array of socioeconomic and environmental impacts.

A trans-disciplinary approach to the underlying concept of natural disasters suggests that they are characterized by naturally occurring events whose consequences are often aggravated by man-made actions which surpass the capacity of man's built infrastructure to contain. They result in tragic disturbances in the social and environmental sphere together with socioeconomic impacts of extreme severity, such as high levels of material damage, the loss of life and means of subsistence for affected communities, and the spread of infectious diseases[1] due to the degradation of sanitary conditions. They are consequently responsible for a series of adverse environmental and socio-economic impacts due to the way they cause disturbances (or imbalances) in the *environmental* (CHINO *et al*., 2011; McENTIRE, 2001; ADRIANTO & MATSUDA, 2002), *economic* (DAVIS *et al*., 2012; FREITAS *et al*., 2012; LOAYZA *et al* 2012; NOY & VU, 2010; UN, 1999) and social (GUHA-SAPIR *et al*., 2012; TAKAHASHI *et al*., 2012; O'BRIEN *et al*., 2006; YODMANI, 2001) aspects of sustainability.

In the last two decades many studies have consistently presented forecasts and demonstrations of an increase in the frequency and intensity of natural disasters (e.g. hurricanes, floods, droughts and associated forest fires, earthquakes, tornadoes, among others), above all those related to climate factors (*vide* GUHA-SAPIR *et al*., 2012; IPCC, 2007; VINK *et al*., 1998) and the relation between natural disasters and the macro-economic indicators of different countries (SCHUMACHER & STROBL, 2011; LOAYZA *et al*. 2012; NOY, 2010).

This issue has taken on particular importance as the Intergovernmental Panel on Climate Change (IPCC, 2007) report states that one of the consequences of global warming is the likely increase in the frequency and intensity of extreme climatic events (above all in tropical regions), which together with disasters caused by geophysical factors (e.g. earthquakes, tsunamis, volcanic eruptions) comprise a strong threat to developing countries (NAUDE, 2010; IFRC, 2003, 2010; O'BRIEN *et al*., 2006). As is well known, these countries have low resilience in face of disasters (EBEKES & COMBES, 2013; CUARESMA, 2010; WORLD BANK & UNITED NATIONS, 2010).

Natural disasters, even when they are classified as small or moderate (DATAR *et al*., 2013), are responsible for adverse socio-economic and environmental impacts (GUHA-SAPIR *et al*., 2012), particularly in underdeveloped regions (or regions in development) (TOYA & SKIDMORE, 2007; WORLD BANK & UNITED NATIONS, 2010). This is due to both a lack of preventive action plans and resources and to low resilience, inherent to low levels of social capital[ii] (*vide* TOYA & SKIDMORE, 2007, p. 20-21; JACOBI & MONTEIRO, 2006, p. 27; ALCÁNTARA-AYALA, 2002, p. 108), which contribute to the prolongation of the adverse effects on the environment and society. This prolonged duration causes a greater spatial dispersal of environmental impacts where natural agents (e.g. water, wind) transport the problem beyond its source and aggravate socio-economic impacts by disturbing economic activity (e.g. agriculture, trade, tourism) and increasing social vulnerability.

As an example of the influence of social capital it is worth emphasizing Alcántara-Ayala (2002, p.108) who argues that one of the causes of natural disasters in poor or developing countries is:

> …related to the historical development of these countries, where the economic, social, political and cultural conditions are poor and consequently lead to increased vulnerability to natural disasters (economic, social, political and cultural vulnerability) [our translation].

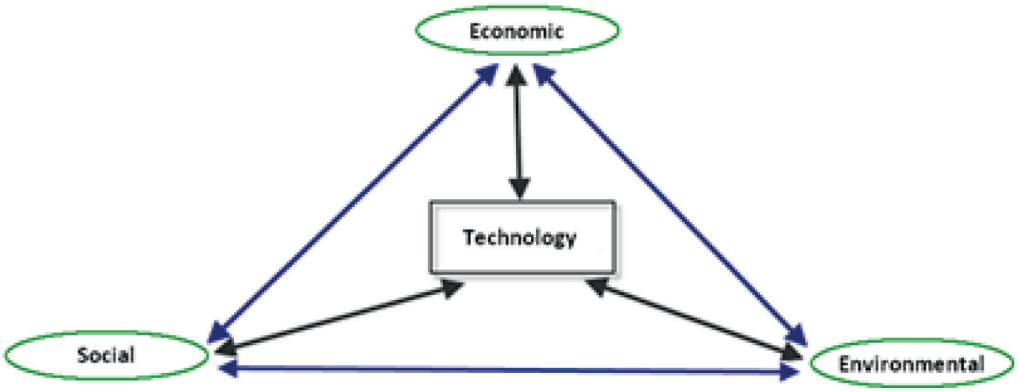
This paper addresses natural disasters whose origin and scale are not limited to natural causes, in other words where the causes and the effects are also closely related to demographic and industrial growth, something inherent to the socio-economic growth of contemporary societies. The industrial and demographic growth, which encompasses the combined effects of population in a biological sense and the effects of production-consumption in a technological sense (ALVINO-BORBA & MATA-LIMA, 2011; WETZEL, 1996), is normally associated to an increase in density whether in terms of population or infrastructure (built environment), where both factors have aspects and impacts (environmental and socio-economic) which contribute to an increase in the scale of natural disasters and to the worsening of vulnerabilities of affected communities.

It is important to stress that in accordance to the ISO 14001 norm: (i) *environmental aspect* is the element of an organization's activities, products and services which may interact with the environment; while (ii) *environmental impact* is any change to the environment, adverse or beneficial, which is a result, fully or partly, of environmental aspects of the organization.

In this context, the environmental aspect is related to the cause of the problem or to an environmental improvement, while the environmental impact is related to the effect of the problem or to an environmental improvement. Therefore, environmental aspects should be identified based on the following factors (*vide*, e.g., MARAZZA *et al.*2010; UNIVERSITY OF STRATHCLYDE, 2000): (i) social inclusion; (ii) economic development; (iii) use of resources; (iv) transport; (v) environmental and ecological protection.

The aspects addressed above are a list of variables which must be considered in the production of development programs and the implementation of disaster prevention plans. Sustainable development, as is well known, must address environmental, social and economic aspects in a transversal and balanced way, always using the best available technology to achieve stated objectives, as presented in Figure 1.

Figure 1. Dimensions of the sustainability triangle



The sustainability triangle allows us to leave aside many considerations which have been widely addressed in previously published studies, such as that of MAUERHOFER (2008, p. 498).

Natural Disasters

Origin and occurrence

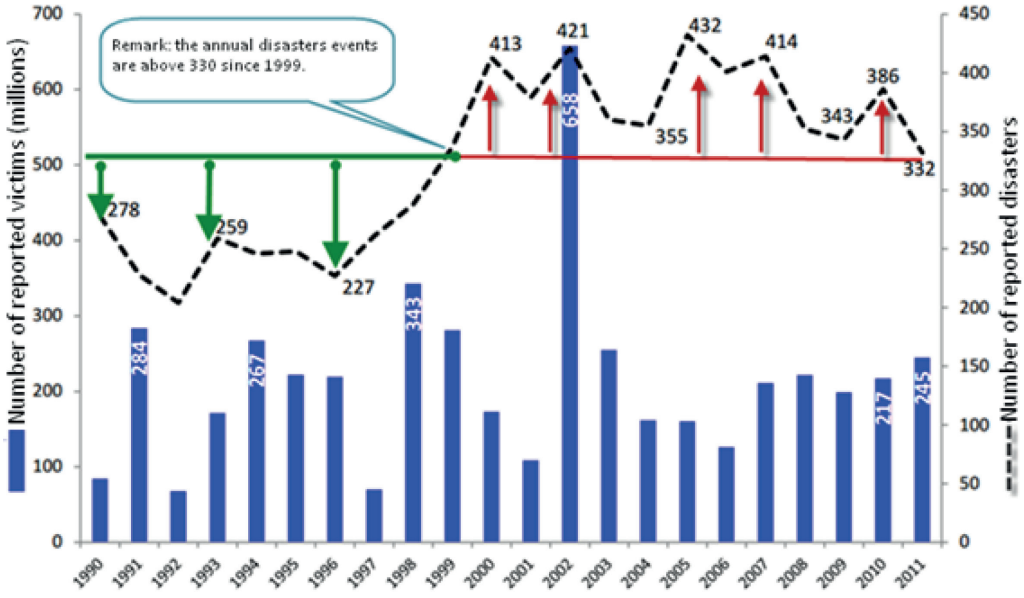
Natural disasters are generally classified as having hydrological, meteorological, climatic, geophysical or biological causes/origins (GUHA-SAPIR *et al.*, 2012). In this paper natural disasters caused by hydrological and meteorological phenomena will be grouped in one category denominated hydro-meteorologic, and will not include disasters with a biological origin (these are less common), as presented in *Table 1*.

Figure 2 (modified from GUHA-SAPIR et al., 2012, p. 3) shows the global occurrence of natural disasters from 1990 to 2011 and their respective victims.

Table 1. Main natural disasters caused by hydro-meteorologic, climatic and geophysical phenomena

Disasters			Relevant observations
Origin	Hydro-meteorologic	Hurricane	Most frequent natural disasters, accounting for 77.4% of the total in 2011(GUHA-SAPIR *et al*., 2012, p.2); floods is the category which has caused most deaths in history and Brazil stood out globally in 2011 with 900 deaths. Hydro-meteorological disasters cause the most concern for *Small Island Development States* (SIDS), and also *Small Islands Economies* (SIE) which are part of an archipelago (e.g. Japan) (cf. UN, 1999) They occur in all continents, but predominate in Africa and the Americas, including Brazil, according to NEDEL (2012, p.120)
		Floods	
		Tornado	
	Climatologic	Drought	These types of event occur from time to time throughout the world though, with the exception of some sub-Saharan countries (e.g. Ethiopia, Somalia and Kenya), they result in fewer victims (GUHA-SAPIR *et al*., 2012, p. 15). According to the same authors, from 2001 to 2010 climatic disasters represent an average of 12.9% of all natural disasters. It is the only natural disaster that does not predominate in Asia; it is more common in Europe. However, in Europe and Australia there are fewer victims of climatic disasters. The main consequences of this type of event are: destruction of forests, increased susceptibility of land to erosion and degradation of surface waters due to transport of waste through surface run-off.
		Fire	
		Extreme Temperatures	
	Geophysic	Earthquake	Geophysical disasters were responsible for 69,098 deaths from 2001 to 2010 (GUHA-SAPIR et al., 2012, p.2). The same authors state that in 2011 geophysical disasters were responsible for 68.1% of total deaths caused by natural disasters. These disasters predominate in Asia.
		Tsunami	
		Volcanic Eruption	
		Mass Movements	

Figure 2. Evolution of occurrences of natural disasters and associated victims



The approach taken in terms of addressing natural disasters is separated into four (4) disaster paradigms (cf.FRERKS *et al*., 2011, p. 106): *Hazard–Risk–Vulnerability–Resilience. Table 2 is a descriptive summary of these paradigms where a distinction is made for those disasters where, in terms of intervention plans, an effort is made to reduce* (↓) *and increase* (↑).}

Table 2. Description of disaster paradigms

Paradigms	Description
Hazards (↓)	The probability of a potentially damaging natural phenomenon occurring in a specific place and in a specific period of time (TOMINAGA *et al*., 2009, p. 151). REBELO (2008) presents a comprehensive explanation of the concepts of hazard and risk.
Risk (↓)	A combination of the probability of an event occurring and its severity (negative consequences) TOMINAGA *et al*. (2009, p. 149), frequently expressed as a product of hazard in terms of its consequences for man.
Vulnerability (↓)	The combination of processes and conditions which result from physical, social, economic and environmental factors, increasing the susceptibility of a community (exposed to the risk) to the impact of dangers (TOMINAGA *et al*., 2009, p. 151). Vulnerability refers to the capacity of a community to anticipate, confront, resist and recover from the impacts of natural disasters and it comprises a variety of factors which determine the degree of exposure of both people and material goods to risk (INGRAM *et al*., 2006, p. 607).

Resilience (↑)	Resilience is defined as the capacity of a community to resist and recover from adversity, both in the short and long-term (NHHS, 2009 *apud* FRERKS *et al*., 2011, p. 112). However, the definitions in GIBBS (2009, p. 324) and KLEIN *et al.*(2003, p. 35) seem to be better suited to the reality in that they consider resilience to be a simple attribute related to the level of disturbance that a system can absorb without losing its capacity and ability to re-organize itself. Here, resilience is only considered as one of the factors which influence the adaptive capacity of the system.

Environmental and socio-economic aspects of disasters

Environmental aspect

The environmental aspect (stricto sensu) of natural disasters has been widely addressed in the specialized technical bibliography (vide, e.g., SRINIVAS & NAKAGAWA, 2008, p. 6; AERTS & BOTZEN, 2011) and a summary is presented in Table 3.

This section aims to highlight the strong relationship of interdependence which exists between protection and conservation of bio-physical factors (e.g. land, water, atmosphere, fauna and flora) and socio-economic development. The growth in the development of rural tourism[iii] (HAVEN-TANG & JONES, 2012) which essentially exploits activities inherent to rural regions is an example which underlines this affirmation (HAVEN-TANG & JONES, 2012; SRINIVAS & NAKAGAWA, 2008). On the other hand, it is known that natural disasters are closely related to coastal zones (YASUHARA et al., 2012; COSTANZA & FARLEY, 2007), fundamental elements in providing a competitive advantage to seasonal summer tourism in developing countries (in Africa, Latin America and Asia).

Table 3 synthesizes the environmental aspects of a man-made nature which exacerbate natural disasters. The table highlights a number of conspicuous examples of environmental aspects (causes of impacts) connected to engineering mega-projects which are likely to cause large-scale population movements, among many other significant negative environmental impacts with a wide variety of consequences. These projects are usually supported by viability studies which point to the generation of multiple positive socio-economic externalities for the regions where they are implemented, such as economic growth resulting from the revitalization of existing activities, the creation of new investment opportunities and, above all, employment for the local population (*vide*, e.g., MATA-LIMA, 2009).

Table 3. Examples of the relationship between aspects of economic growth and natural disasters

Environmental Aspect	Relationship with natural disasters (environmental and socio-economic impacts)
Road networks	Frequently worsen the impacts of flash floods and landslides as the location of road networks in relation to the hydro-graphic network changes the balance between the intensity of the flood (and the flow of residues) and the resistance of water lines (including riverside zones) (*vide* JONES *et al*., 2000, p. 80). The destruction of roads during a disaster causes problems for the movement of people and goods between, for example, urban and rural zones.
Building in flood prone areas	Makes communities more vulnerable to floods, transforming a phenomenon, which in a situation where good land use and planning practices have been adopted would be less catastrophic, into a disaster with elevated levels of material damage and loss of life (AERTS & BOTZEN, 2011, p. 8). It is worth emphasising that more than half the world's population live in urban areas which has increased the density of the built environment, caused traffic chaos and, naturally, leading to heightened difficulties in evacuating in emergency situations
Dam reservoirs	In the case of earthquakes the water stored in reservoirs is launched downstream as the dam wall breaks, causing high levels of material damage and victims, as well as destroying lake and riverside zones. A disaster of this type occurred in the southeast of China (Sichuan) in 1786, causing more than 100,000 deaths (DAI *et al*., 2005, p. 205).
Nuclear power plants	Earthquakes and subsequent tsunamis may cause the destruction of nuclear plants, releasing radioactive substances into the environment (e.g. *Fukushima Daiichi Nuclear Power Plant* in 2011 – Japan) (*vide* CHINO *et al*., 2011), as well as spreading infectious diseases (TAKAHASHI, *et al.* 2012).
Oil exploration	Earthquakes may cause the collapse of oil-producing infrastructures (SKOGDALEN & VINNEM, 2012, p. 62) resulting in the release of oil into the sea or on land, depending on whether it is an offshore or onshore platform.

Table 3 helps to clarify the assertions made by other authors (TOYA & SKIDMORE, 2007, p. 20; ALCÁNTARA-AYALA, 2002, p. 108; YODMANI, 2001, p. 2) that natural disasters are not extreme phenomena exclusively caused by nature. Indeed, given that vulnerability is a determining factor in the impact of disasters it can be argued that the development model adopted by the human race also significantly contributes to disasters taking place.

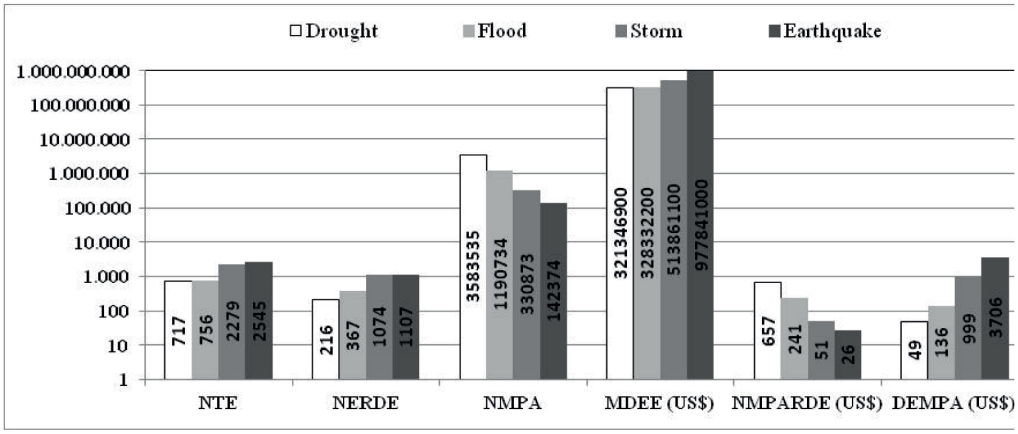
Socio-economic aspect

The growth in socio-economic aspects of disasters has shown an increase (*vide Figure 3*) due to the direct impacts on vulnerable communities. These often conceal

environmental impacts and therefore are deserving of special attention on the part of agents, politicians and researchers who are responsible for finding solutions to mitigate their effects.

Loayza *et al.* (2012, p. 1317) recently stressed that natural disasters cause significant economic and physical damage whose effects can spread beyond the immediate locality. They also observed that the impact of disasters on economic growth is not always negative and that developing countries are more vulnerable to these disasters as more sectors are affected. This is intrinsically related to the heightened degree of vulnerability and the low resistance of these countries. The WORLD BANK & UNITED NATIONS (2010) draws attention to the fact that in underdeveloped regions economic growth rarely occurs after natural disasters as the intensity of the negative effects depends on the structure of the economy. Moreover, it is known that regions with low social capital also have weak economic structures and experience difficulties in securing adequate resources to address the problems caused by disasters.

Figure 3. Social and economic costs of natural disasters from 1961 to 2005 (taken from the EM-DAT database and summarized by LOAYZA *et al.* 2012, p.1318)



Key: NTE - Total number of events**; NERDE -** Number of events with a record of economic damage; **NMPA -** Average number of people affected; **MDEE -** Average of economic damage per event; **NMPARDE -** Average number of people affected when records exist of economic damage; **DEMPA -** Average of economic damage per person affected .

It is also important to account for the following peculiarities of socio-economic aspects:

- Remittances significantly mitigate the impacts of natural disasters in terms of the number of victims in developing countries, accounting for between 8% and 17% of Gross National Product (GNP) (cf. EBEKE & COMBES, 2013);

- As natural disasters affect the poorest countries more than others, the most vulnerable and marginalized populations have to deal with the most serious consequences (FREITAS *et al.*, 2012; IFRC, 2003, 2010).
- Table 4 is a good illustration of how the vulnerability of poor regions contributes to a significant increase in the negative impacts of natural disasters. Furthermore, based on data from the *Center for Research on the Epidemiology of Disaster* (CRED), globally there are more deaths from disasters and higher economic costs as time progresses, as O'BRIEN *et al.* (2006) emphasizes;

Table 4. Basic characteristics and consequences of earthquakes in Haiti and Japan

Country	General data (2010)	Year and basic characteristics	Consequences: human victims and economic cost	Source
HAITI (poor country)	Population: 9,993,247 inhabitants GNP per capita (US$): 664 Annual growth of GNP per capita:7% Life expectancy at birth: 62 years	**2010**: Earthquake of 7.0 to 7.3 on the Richter scale, lasting 35 seconds	Approximately 230,000 deaths and 2 million people affected (15% of population). Economic cost equivalent to 120% of GNP	FREITAS et al. (2012)
JAPAN (developed country)	Population: 127,450,459 inhabitants GNP per capita (US$): 43 063 Annual growth of GNP per capita:5% Life expectancy at birth: 83 years	**2011**: Earthquake of 9.0 on the Richter scale, followed by a tsunami which caused water levels to rise 35 m	Approximately 19,000 deaths. Economic cost more than 5.4% of GNP	LIN et al. (2012); WORLD BANK*

* Available at: <http://databank.worldbank.org>. Accessed: July 2012.

- The increase in the number of disasters and their consequences is related to an increase in the vulnerability of communities throughout the world as a result of the development model adopted. The increase of vulnerability is not uniform, as there are significant variations between regions, nations, provinces, cities, communities, socio-economic classes, castes and even gender (cf. YODMANI, 2001);
- Urban areas benefit from having better physical infrastructure (e.g. hospitals, civil protection services, sanitation systems and other logistics) and administrative support systems (e.g. emergency plans); indeed, prevention and intervention plans are more likely to exist in urban areas (IFRC, 2010). However, the fact that the largest cities in the world are in poor and developing countries - such as São Paulo, whose problems are highlighted by JACOBI & MONTEIRO (2006, p. 32-33) and which is located in a country where hydro-meteorological disasters predominate - makes the scenario extremely worrying as these cities lack the above mentioned infrastructure.

Management of environmental and socio-economic impacts associated to natural disasters

In the previous sections we concentrated on establishing a relation between the environmental aspects and impacts of the most common natural disasters (e.g. floods,

landslides), demonstrating the interdependence between the social, economic and environmental aspects of sustainability. This approach aims to make clear the complicit relationship between these three aspects of sustainability and the four disaster paradigms as a starting point in order to draw up and implement a management plan for preventing disasters. This effort is fundamental, as already mentioned, since reducing vulnerability depends on systematically tackling the complex interactions between inherent physical, environmental and social factors (*vide, e.g.*, INGRAM et al.2006).

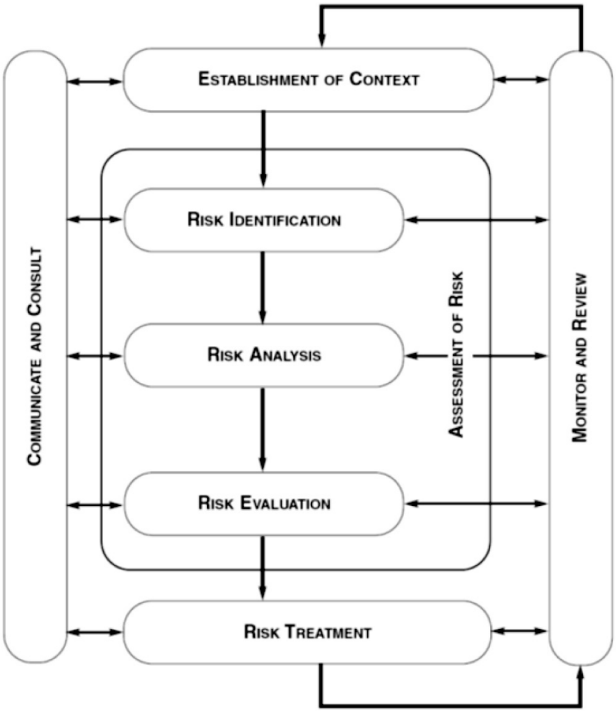
Preventive management

Though it is not humanly possible to adopt measures to eliminate the extreme phenomena which cause natural disasters, preventive planning is vital in mitigating impacts on socio-economic and environmental systems, particularly those which are the most vulnerable, as a way of increasing the degree of resilience of local communities. In this context it is worth stressing the words of McENTIRE (2001, p. 189): "The central argument to be made is that vulnerability is, or should be, the key concept for disaster scholarship and reduction". This concern reflects the final recommendation of the *World Summit on Sustainable Development* (WSSD) which emphasizes the need for an integrated approach to include vulnerability, risk evaluation and disaster management by focusing on the prevention and mitigation of impacts (UNISDR, 2003; WORLD BANK & UNITED NATIONS, 2010).

The management approach should be flexible and preventive, adopting the following stages. It is important to emphasize that often efficient preventive management may require cross-border cooperation (e.g. involving a number of countries) in cases where the scale and nature of the disaster demand it (e.g. floods in shared water basins, forest fires in border areas).

Identifying environmental aspects and impacts is fundamental in managing risks, and this should be the first step in a risk management study. This first stage is called *establishment of context* as Pojasek's flowchart shows (2008, p.97) in Figure 4.

Figure 4. Procedures for Risk Management



It is clear that *establishment of context* is of paramount importance in evaluating the degree of severity of impacts, in that these are more pronounced (and socially visible) when dealing with urban and populous regions where a considerable amount of infrastructure is built in risk zones, drastically affecting socio-economic aspects. As risk analysis is essentially based on the probability of a given event occurring and the degree of severity of the resulting consequences (*vide*, e.g., KORTENHAUS E KAISER, 2009; TOPUZ *et al*., 2011), it is evident that the local bio-physical and socio-economic context must be assigned a determining role in the contextualization and evaluation of the risk.

Summary and recommendations

The answer to the question contained in the title (what makes the difference?) can be found, above all, in social capital, as this has a determining influence as a factor of vulnerability given that the developed nations (e.g. Japan, USA) - despite having significantly fewer victims of natural disasters - are no less affected by extreme phenomena (e.g. hydro-meteorological) capable of provoking disasters than the poorest nations, as underlined by other authors (e.g. GUHA *et al*., 2012; KAHN, 2005).

The following aspects which play a key role in the mitigation of natural disasters should be emphasized:

- Natural disasters should be approached from a trans-disciplinary perspective as their prevention and mitigation requires technical-scientific cooperation between different areas of science, engineering, economics, health, social studies and law. In addition, stakeholder participation (e.g. local community) is a *sine-qua-non* in reducing their socio-economic and environmental impacts.
- Vulnerability must be dealt with by increasing the social capital of communities which are located in regions of heightened risk of disasters. This can be achieved through education/training and by fostering citizenship which advocates participation in collective actions; reducing isolation by creating networks which encourage contact and exchange of experiences between different communities with concerns in common in terms of the risk management of disasters; among other actions aiming at building social capital.
- Natural disasters in developing countries cause impacts, particularly in terms of the degradation of health (DATAR *et al*., 2013), due to diseases related to a worsening of environmental sanitation conditions, as Takahashi, *et al.* (2012) has emphasized;
- Globally, greater attention and more proactive intervention is necessary (in terms of prevention planning) on the part of governments and NGOs, as set out by the World Bank & United Nations (2010);
- There needs to be investment and natural disaster prevention subsidies as well as authorities and organizations who are directly responsible for preventing disasters, as this can significantly reduce the number of victims and extent of material damage;
- Lessons must be learnt from disasters and the post-disaster period should be an opportunity to implement good practices in terms of land use and integrating flexible measures instead of rushing to rebuild on a huge scale which, in some cases, may increase the vulnerability of local communities to future events.

Among aspects which help to mitigate disasters, social capital is fundamental in creating the conditions to reduce vulnerability, and consequently, the dependency of communities (or nations) on external initiatives.

This is because social capital is paramount in creating the necessary social, economic and political structures (including cooperation and inclusion in international networks) to foster socio-economic development based on an agreed path of sustainable development. This in turn contributes to a reduction of the level of risk communities are exposed to.

Furthermore, it is important to stress that an analysis of the spatial-temporal evolution of the data on disasters shows that nations which have a higher gross national product (GDP), a more educated population, more social and political freedom providing the conditions for effective and active citizenship, and a more comprehensive financial system suffer fewer losses when extreme phenomena occur which provoke natural disasters (*vide*, e.g., OXLEY, 2013; TOYA & SKIDMORE, 2007).

In terms of preventing natural disasters it is extremely important to create an appropriate context involving pro-active measures where community adaptation to climate

changes and to reducing exposure to risk leads to both a reduction in vulnerability and, consequently, a reduction in the scale of the socio-economic impacts which are evident today in poverty-stricken regions where disasters occur.

Notes

i Concerning infectious diseases TAKAHASHI *et al.* (2012) emphasise the fact that the affected community is exposed to infectious contamination agents during the initial post-disaster phases, such as rescue and recovery in provisional camps.
ii Social capital is the result of structural characteristics of social organization which encourage the formation of networks, standards, value systems, relations of trust and participative engagement so as to facilitate coordination and cooperation for the common good. (*vide*, e.g.PARK *et al*., 2012, p. 1512).
iii Tourism should not only be interpreted as activities related to the agricultural sector, as it encompasses various activities, such as engaging with Nature (e.g. ornithology), adventure activities, sport, health (e.g. ethnomedicine), education, art and heritage (*vide*, e.g., SU, 2011, p. 1438).

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IMPACTS OF NATURAL DISASTERS ON ENVIRONMENTAL AND SOCIO-ECONOMIC SYSTEMS: WHAT MAKES THE DIFFERENCE?

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Resumo: Este artigo aborda os impactos ambientais e socioeconômicos associados aos desastres naturais e apresenta os fatores que contribuem para a redução da magnitude dos danos materiais e humanos. Realiza-se uma análise reflexiva, baseada em abordagens qualitativas e quantitativas, integrando as dimensões ambiental, econômica e social da sustentabilidade, assim como as relações com os paradigmas dos desastres (Perigo-Risco--Vulnerabilidade-Resiliência) de origem hidro-meteorológica, climatológica e geofísica. Procura-se identificar os fatores-chave para redução da vulnerabilidade, bem como para prevenção e mitigação dos impactes dos desastres naturais.

Palavras-chave: Desastres naturais; Impactos ambiental e socioeconômico; Vulnerabilidade; Resiliência; Gestão do Risco.

Abstract: This study addresses the environmental and socioeconomic impacts of natural disasters and focuses on the factors that can contribute to reducing damage both in material terms and in terms of loss of human life. A reflective analysis was carried out – based on a qualitative and quantitative approach – integrating environmental, economic and social dimensions of sustainability as well hydro-meteorological, climatological and geophysical paradigms of disasters (Hazard-Risk-Vulnerability-Resilience). Our objective is to identify key variables in the reduction of vulnerability and the prevention and mitigation of the impacts of natural disasters. The results stress that social capital, related to social and economic structures, exerts a significant influence as a factor which reduces the vulnerability of affected communities.

Key-words: Natural disasters; Environmental and socioeconomic impacts; Vulnerability; Resilience; Risk Management.

Resumen: En este artículo se describen los impactos ambientales y socioeconómicos de los desastres naturales y los factores que contribuyen a la reducción de la magnitud de los daños materiales y humanos. Se realiza un análisis reflexivo, basado en un enfoque cualitativo y cuantitativo, integrando las dimensiones

ambiental, económica y social, de la sostenibilidad asimismo sus relaciones con los paradigmas de los desastres (Peligro-Riesgo-Vulnerabilidad-Resiliencia) de origen hidro-meteorológico, climatológico y geofísico. El objetivo es identificar los factores clave en la reducción de la vulnerabilidad, prevención y mitigación de impactos de los desastres naturales. La reflexión llevada a cabo ha hecho posible destacar la influencia determinante del capital social como factor de reducción de vulnerabilidad de las comunidades afectadas.

Palabras-clave: Desastres naturales; Impactos ambientales y socioeconómica; Vulnerabilidad; Resiliencia; Gestión de Riesgo.