SPECIFIC VULNERABILITY AS A RESULT OF SCIENCE AND TECHNOLOGY NOT BEING INTEGRATED INTO INTERNATIONAL COOPERATION DEVELOPMENT POLICIES. Here in the case of the earthquake in Haiti on 12th January 2010.

Zango Pascual, Marga[1]; Marín Hidalgo, Isabel[2]; Asencio Barragán, Claudia[2]

[1]Area: Environmental Technologies. Department: Chemical, Physical and Natural System. Universidad Pablo de Olavide, Seville, Spain.
[2y3]Graduates of Environmental Science from Universidad Pablo de Olavide, Seville (2013).

IT WAS POSSIBLE TO PREVENT THE EXTREMELY SERIOUS CONSQUENCES OF THE EARTHQUAKE IN HAITI?
TILL WHAT DEGREE HAITI SISMIC RISK WAS KNOWN AND TILL WHAT DEGREE WAS IT INTEGRATED. IN THE INTERNATIONAL DEVELOPMENT COOPERATION POLICIES.

ABSTRACT: While much was known about the vulnerability of Haitian society at the time of the earthquake in 2010, this paper aims to focus on a specific aspect of this vulnerability. With hindsight, recommendations will be made with a view to increasing resilience in the face of disasters to come, and vindication will be made of the positive role that science and technology can play in risk management of disasters. Five types of vulnerability are normally considered: financial, natural, human, physical and social. It is essential to study the damage caused by the lack of integration of scientific knowledge and good technological practice since it can contribute to the mitigating the magnitude of a disaster. UN, EU and the Spanish government's cooperation policies with Haiti, both before and after the earthquake, have been closely analyzed in order to assess whether or not the seismic hazard and the measures put into place to mitigate and prepare for it had been taken into consideration in these policies. This research comes from the co-authors' B.A in Environmental Science dissertations, supervised by Dr. Marga Zango-Pascual. The conclusion was drawn that not only was scientific knowledge about seismic risks easily obtained, but that it already existed before the earthquake ever occurred. However, many of the policies that were analyzed were biased and therefore could not be used because they were lacking both scientific and technological information. Consequently, Haiti's vulnerability increased because seismic building codes were not compulsory in most of the development cooperation projects.

WHY WEREN'T SCIENTIFIC KNOWLEDGE AND GOOD TECHNOLOGICAL PRACTICES TAKEN INTO ACCOUNT?

STATE OF THE QUESTION

WAS IT FORESEEABLE TO THINK THAT HAITI HAD SISMIC RISKS?

YES

WAS IT TAKEN INTO ACCOUNT IN THE INTERNATIONAL COOPERATION POLICIES THAT THE SISMIC RISK WAS IMPORTANT?
A product of the work developed:

NOT

MORE OR LESS

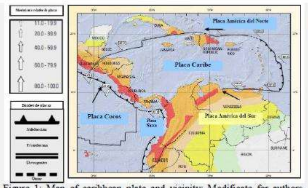


Figure 1: Map of caribbean plate and vicinity: Modificate for authors. Source: Tarr, C, Rhea, S, Villaseñor, A, Furlong, K.P, Benz, H, USGS 2007.

Table 3: Source: Bulletin of the Seismological Society of America, Vol. 102, N°, 1, pp. 18-30, February 2012, DOI: 10.1785/0120110077

Significant Enriquillo Fault System Earthquakes			
Date	Lat (° N)	Long (°)	M_I*
9 November 1701	18.41	72.65	6.6 ± 0.3
18 October 1751	18.36	70.84	7.4-7.5 ± 0.2§
21 November 1751	18.54	72.32	6.6 ± 0.2
3 June 1770	18.50	72.86	7.5 ± 0.3
8 April 1860	18.55	73.54	6.3 ± 0.3
12 January 2010	18.45	72.54	M 7.0

EARTHQUAKE HAITI. Tuesday, January 12, 2010 at 21:53:10 UTC

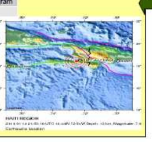
Top 10 most important Earthquake (seismic activity) disasters for the period 1900 to 2014 sorted by numbers of killed at the country level:

COUNTRY	DATE	N° KILLED
CHINA	27/07/1976	242000
HAITÍ	12/01/2010	222570
CHINA	22/05/1927	200000
CHINA	16/12/1920	180000
INDONESIA	26/12/2004	165708
JAPAN	1/09/1923	143000
SOVIET UNION	5/10/1948	110000
CHINA	12/05/2008	87476
ITALY	28/12/1908	75000
PAKISTÁN	8/10/2005	73338

Fuente: http://www.emdat.be

Magnitude	7.0
Date-Time	Tuesday, January 12, 2010 at 21:53:10 UTC Tuesday, January 12, 2010 at 04:53:10 PM at epicenter Time of Earthquake in other Time Zones
Location	18.443°N, 72.571°W
Depth	13 km (8.1 miles) set by location program
Region	HAITI REGION
Distances	25 km (15 miles) WSW of PORT-A[...] PRINCE, Haiti 130 km (80 miles) E of Les Cayes, [...] 150 km (95 miles) S of Cap-Haitien, [...] 1125 km (700 miles) SE of Miami, Fl[...]
Location Uncer[...]	horizontal +/- 3.4 km (2.1 miles); de[...] fixed by location program
Parameters	NST=312, Nph=312, Dmin=143.7 [...] Rmss=0.93 sec, Gp= 25°, M-type=teleseismic moment magnit[...] (Mw), Version=9
Source	USGS NEIC (WDCS-D)

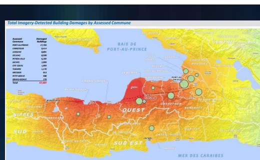
Fuente: USGS. http://neic.usgs.gov/neis/eq_depot/2010/eq_100112_rja6/neic_rja6_l.html



Total Number of damaged houses grouped in EMS-98 Damage classes by evaluated communes	EMS-98 Damage Classes 5	4	3	2	1	
CARREFOUR	2768	5905	5920	3220	35219	53032
CITE SOLEIL	1012	549	1073	576	6403	9613
DELMAS	5012	2814	5064	2882	29479	45251
GRAND-GOAVE	148	541	422	277	2175	3563
GRESSIER	565	289	567	319	3436	5176
JACMEL	214	1785	1489	857	8799	13144
LEOGANE	2220	5985	4139	2360	24735	39439
PETION-VILLE	2027	906	1693	708	10614	15948
PETIT-GOAVE	173	104	167	116	770	1330
PORT-AU-PRINCE	9902	15257	12351	6700	62694	106904
TABARRE	532	365	664	382	3914	5857
Total	24573	34500	33549	18397	188238	299257

Table 2: Summary table of the international planning for the development of Haiti in agreement management disaster risk, before and after the earthquake of 2010. *(Asencio Barragán, 2013)*

AÑO	UNITED NATIONS	EUROPEAN UNION	SPAIN GOVERN	GRD	SEISMICITY
2001	MANUD 2002-2006			×	×
2005			DEP Haiti 2006-08	✓	×
2007		DEP 2008-13		✓	...
2008	MANUD 2009-2011			✓	×
2012	Haiti CPAP PNUD 2013-2016 CSI 2013-2016			✓	✓



MORE OR LESS

YES

RESEARCH

Research was therefore carried out with a view to understanding whether the actors involved at all levels of the Seismic Risk Management in Haiti were aware of the chance of a major earthquake with the breadth and intensity of that occurring on12 January 2010.

A survey was designed for NGOs that had worked with Haiti before as well as after the earthquake. There was prior consultation among different government and non-governmental sources to ascertain which NGOs had been present, and specifically which, due to the activities they performed, should have been aware of the chance of a major earthquake occurring. To facilitate communication, mainly Spanish NGOs or international NGOs with offices in Spain were chosen given that all of them, regardless of their nationality, obtained national and international funding. The sectors chosen included any of those that needed to build, manage, or outsource the building of infrastructure, be it housing for rural development, schools, water and sanitation infrastructure, health centers, or community centers, as part of their main activity.Forty-five NGOs were selected, of which 15 responded (33%).

In parallel, public policy for International Development Cooperation to Haiti both before and after the earthquake was examined, as were the main sources of funding, i.e. the United Nations System, the European Union, and the Spanish Development Cooperation Agency. Also examined was the Haitian government's legislation to ascertain the potential mandatory nature of seismic building codes and the type of buildings to which they applied. A thorough examination was also done of the reports and scientific publications making reference to Haiti's history of earthquakes in order to evaluate the extent to which this information existed and was available to the public for use.

Analysis IDCP International Development Cooperation Policies	BEFORE 2010 MAEC Spain	BID	PNUD	GOH	AFTER 2010 MAEC	BID	PNUD	GOH
DISASTER RISK MANAGEMENT	YES	YES	YES	YES	YES	YES	YES	YES
SEISMIC RISK MANAGEMENT	No	No	No	No	No	YES	YES	YES
DISASTER RISK REDUCTION	YES	YES	YES	No	YES	YES	YES	YES
FHASES PREVIOUS DISASTERS	YES	YES	YES	YES	YES	YES	YES	YES
HUMANITARIAN AID	YES	YES	YES	YES	YES	YES	YES	YES
SISMORESISTANCE CODES	No	No	YES	No	No	No	YES	_

CONCLUSIONS

The main conclusion is that the risk was only partially not every effectively assessed and appreciated. It did not impact the requirements of the projects to be carried out. There was no prior building policy requiring seismic building codes in the country despite that fact that there are several such codes in Latin America that orientate those building their own homes using various materials present in developing areas, and that can be easily accessed and implemented under technical supervision. These codes were developed following the earthquakes in the Republic of El Salvador in January and February 2001. To understand why the normal risk management and disaster reduction methodologies failed, one could think of subjective causes preventing resilience and involving factors included in the bias that we use when analyzing problems if we come from technical, scientific, legal, or emergency management backgrounds *(Zango-Pascual, M. 2011)*. Other issues to consider have to do with governance and the subjective causes affecting each situation and context. It is the relationship between public policies and science and technology in Spain that has been researched by the author. Her conclusion is that the risk management responsibility does not always come hand in hand with the necessary interdisciplinary and trans-disciplinary knowledge, or with the appropriate legal instruments for this knowledge to be correctly materialized. There may be differing levels of management and responsibility in decision-making, be the decisions political, technical or operational, and cooperation, including the division of tasks, is not always appropriate. *(Zango-Pascual, M. 2012)*

One of the best known, cited and successful articles worldwide on Risk Management and Disaster Reduction is *Wisner et al, "At Risk"*, and the PAR model, (Presure, Action, Reaction), which has even been included in certain manuals compiled in Spain by organizations specialized in Humanitarian Action and Development Cooperation. This vision is based mostly on including the population's perceptions on risk and their participation in the process. While this is absolutely legitimate, if it does not come hand in hand with information from science, technology, appropriate legal instruments, a significant element of vulnerability can arise. This has proven to be the case in Haiti. The population at seismic risk was barely a priority amid others such as poverty, violence, covering basic needs such as health or education, and so forth. The last earthquake had occurred 200 years prior and was far from the forefront of people's minds. Some of the NGOs participating in thecountry documents of international programs prior to the earthquake confirmed that they had not taken the seismic risk into account, that it was not a priority.

For technical experts seismic resistant building codes were nothing at all new and could even be adapted to situations as complex as those in Haiti. The Colombian Association of Seismic Engineering (Asociación de Ingeniería Sísmica Colombiana) has adopted several such techniques for houses built by their residents out of adobe, cemented coated barahaque, and barahaque.

For science the risk was evident and information was easy to obtain for any scientist or actor involved who resorted to scientists for correct interpretation

WHAT IT FORGOT TO MENTION THE SCIENCIE AND TECHONOLOGY

Table 1: A survey of more than 45 Non Governmental Organizations that worked in Haiti both before and after the earthquake

DATE	DRM	SEISMICITY	Construction	Afectad
1994	No	No	No	No
2003	yes	yes	yes	No
2004	yes	yes	yes	No
2005	yes	yes	No	No
2009	N/C	N/C	yes	yes
2010	yes	yes	yes	No
2010	yes	yes	yes	yes
2010	No	No	No	No
2010	yes	yes	No	No
2010	yes	yes	No	No
2010	yes	yes	N/C	N/C
2011	yes	yes	yes	No
2011	yes	yes	No	No

PHASES OF RISK MANAGEMENT (variables according to country and context, but basically similar)	
PREVENTION MITIGACTION PREPARATION FOR EMERGENCY ATTENTION	Phases that are taken on as Risk-Hazard Management to prevent-minimize the disaster, including emergency attention which could either minimize or aggravate the disaster.
POST-EMERGENCY	
POST-IMPACT RECOVERY	
The role of training and education for preventing disasters is fundamental and although it can be applied in all phases, it is the prevention and preparation phases where it plays a crucial role. In post – impact recovery, it can be used as a means of conveying lessons learned in further preparation phases. In many places, disasters are recurring. Many populations are forced to live with the associated risk.	
Risk transfer is increasingly important, particularly so in developing countries. Spain's Insurance Compensation Consortium (*Consorcio de Compensación de Seguros*) is a publically owned insurance company that intervenes in the event of natural disasters, regardless of whether other types of aid or specific subsidies apply	

TABLE 1: Normal Phases of Risk Management Applicable to Natural. Zango-Pascual, M. 2012. *"El papel de la mujer en la trasmisión de valores y competencias en la Reducción de Riesgos de Desastres. ¿Se trata de un rol diferente o peculiar? Algunas reflexiones"*. Publicación en línea de 5 pp. CONFERENCIA VIRTUAL IBEROAMERICANA SOBRE: LA MUJER EN LA REDUCCIÓN DE DESASTRES. Disponible en línea: http://www.proteccioncivil.org/catalogo/guiastecnicas/conferencia-virtual-mujer-reduccion-desastres/presentaciones/p4.pdf

	COMPONENTS OF RESILIENCIE
1	GOVERNANCE
2	ASSESMENT OF RISK
3	KNOWLEGDE AND CAPATIBILITY
4	RISK MANAGEMENT AND REDUCTION VULNERABILITY
5	PREPARATION AND RESPONSE DISASTER

RESILIENCE: "THE CAPACITY OF A SYSTEM, COMMUNITY OR SOCIETY POTENTIALLY EXPOSED TO HAZARDS TO ADAPT, BY RESISTING OR CHANGING IN ORDER TO REACH AND MAINTAIN AN ACCEPTABLE LEVEL OF FUNCTIONING AND STRUCTURE.
This is determined by the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures."
UNISDR. Geneva 2004

IT`S IMPOSSIBLE TO OBTAIN RESILIENCIA WHEN WE IGNORE SCIENTIFIC ADVANCES AND BEST PRACTICES AVAILABLE FOR MDR AND DRR.

MAP SEISMICITY OF CARIBBEAN- 1900-2013
Source: USGS. Earthquakes. Last visit 1-June 2 013. http://earthquake.usgs.gov/earthquakes/world/caribbean/seismicity.php

THIS WORK CONFIRMS THE CONCLUSION OF THE HAF 2005-2015. *The Mid-Term Review highlighted the fact that the implementation of the Hyogo Framework for Action over the past five years has generated significant international and national political momentum and action around disaster risk reduction. The analysis presented in this report underscored areas where further work is necessary to ensure that the positive gains of the past five years can be consolidated and built upon to achieve the expected outcome of "substantial reduction of disaster losses, in the lives and in the social, economic and environmental assets of communities and countries". Paying attention to areas in need of adjustments and accelerating the overall implementation of the HFA is now critical to ensure that the ambitious agenda set out in the Hyogo Framework for Action can come to full fruition by 2015.*

National and international institutions, including bilateral aid organizations and the United Nations, must integrate disaster risk reduction in their development, climate change adaptation, environmental and humanitarian planning, execution and accountability frameworks to safeguard development gains and investments. Governance for the implementation of the HFA at the national and international level should be improved.

HYOGO FRAMEWORK FOR ACTION 2005-2015
Building the Resilience of Nations and Communities to Disasters. MID-TERM REVIEW 2010-2011

THE ROLE OF SCIENCE AND TECHONOLOGIE

COLLECTIVE SECURITY
PERSONS/LIVE
HUMAN RIGHTS

REFERENCES

Acuerdo de Cotonú, de 23 de junio de 2000. 2005/483/CE (ACP-CE).
Asensio Barragán, Claudia, Zango-Pascual, Marga (2013). *Valoración de la gestión del riesgo de desastres por sismicidad en proyectos de cooperación internacional al desarrollo.* PFC. Universidad Pablo de Olavide. Sevilla. Spain. 151 pp.
BID (2004) Estrategia de Transición del BID, Haití 2005-2006. Banco Interamericano de Desarrollo, informe 204.
BID (2010) and (2007). Banco Interamericano de Desarrollo. Estrategia de País, Haití 2011-2015 and 2007-2011.
BID. PARNDH. (2010). *Plan de Acción para la Recuperación y el Desarrollo de Haití. Grandes tareas inmediatas para el futuro*. Gobierno de Haití.
Bulletin of the Seismological Society of America, Vol. 102, Nº, 1, pp. 18-30, February 2012, DOI: 10.1785/0120110077
Conferencia Haití. http://www.haiticonference.org/
Gobierno de Haití (2007). Estrategia Nacional para el Crecimiento y la Reducción de la Pobreza 2008-2010.
Gobierno de Haití y Comunidad Europea. 2008. Estrategia de país, Haití 2008-2013.
MAEC (2001) Estrategia de Acción Humanitaria de la Cooperación Española para el Desarrollo; Estrategia de Medio Ambiente y Desarrollo Sostenible de la Cooperación Española. (2002);
MAEC (Ministerio de Asuntos Exteriores y Cooperación. Gobierno de España) (2006). Estrategia de País, Haití 2006-2008.
MAEC. (2006 and 2012) Plan Director de la Cooperación Española 2009-2012 and 2013-2016.
Marín Hidalgo, Isabel, Zango-Pascual, Marga (2013). *El riesgo sísmico en Haití: la memoria olvidada: acercamiento a la percepción por la amenaza sísmica en Haití previamente al terremoto de enero de 2010:* Proyecto Fin de Carrera. Universidad Pablo de Olavide. Sevilla. Spain. 127 pp.
Ministerio de Economía y Finanzas. Instituto Haitiano de Estadística e Informática. http://www.ihsi.ht/index.htm
Plan de Acción del Programa de País del Gobierno de la República de Haití y del PNUD 2009-2011 and 2013-2016.
Plan Nacional de Gestión de Riesgo de Desastres. Haití, 2001. Reducción de Riesgo Sísmico en Haití. Sistema Nacional de Gestión de Riesgo de Desastres.
Tarr, A. C., A. Villaseñor, K. P. Furlong, S. Rhea, and H. M. Benz (2010). *Seismicity of the Earth 1900–2007*, U.S. Geological Survey, Scientific Investigations Map 3064, 1 sheet, scale 1:25,000,000.
UNITAR. (2010) *Informe de Evaluación de Edificios Dañados. Terremoto de Haití, 12 de enero de 2010.* Marco de Evaluación y Recuperación de Necesidades Post-Desastres (PDNA). Versión 0.3. Marzo 2010
Wisner, B., Blaikie, Piers, Terry Cannon Terry, Davis Ian. (2004). *At risk: natural hazards, people's vulnerability, and disasters.* Routlegde. 2nd edition London. 124 pp, on line.
Zango-Pascual, Marga. (2011). *La Gestión Integral de los Riesgos Naturales en el marco de los Derechos Humanos de Tercera Generación. El caso de los efectos inducidos por la sismicidad en El Salvador (Centroamérica).* Doctoral Thesis. Universidad Pablo de Olavide, Sevilla, 530 pp.
Zango-Pascual, Marga. (2012). *Estudio de las causas subjetivas que contribuyen a la generación de desastres en el ámbito local. Análisis de la toma de decisiones sobre gestión de reducción de riesgos en un municipio ficticio.* CONAMA 2012. Congreso Nacional de Medio Ambiente. España. 30 pp. ISBN: 978-84-695-6377-9.

Specific Vulnerability as a Result of Non-integration of Science and Technology into International Development Cooperation Policies The case of the 12th January 2010 Haiti Earthquake.

Zango-Pascual, Marga[1], Marín Hidalgo, Isabel[2], Asencio Barragán, Claudia[3]

[1]*Area: Environmental Technologies. Department: Chemical, Physical and Natural System. Universidad Pablo de Olavide, Seville, Spain.* mzanpas@upo.es
[2y 3]*Graduates of Environmental Science from Universidad Pablo de Olavide, Seville (2013).*

ABSTRACT: While much was known about the vulnerability of Haitian society at the time of the earthquake in 2010, this paper aims to focus on a specific aspect of this vulnerability. With hindsight, recommendations will be made with a view to increasing resilience in the face of disasters to come, anda vindication will be made of the positive role that science and technology can play in risk management of disasters. Five types of vulnerability are normally considered: financial, natural, human, physical and social. It is essential to study the damage caused by the lack of integration of scientific knowledge and good technological practice since it can contribute to the mitigating the magnitude of a disaster. UN, EU and the Spanish government's cooperation policies with Haiti, both before and after the earthquake, have been closely analyzed in order to assess whether or not the seismic hazard and the measures put into place to mitigate and prepare for it had been taken into consideration in these policies. This research comes from the co-authors' B.A in Environmental Science dissertations, supervised by Dr. Marga Zango-Pascual. The conclusion was drawn that not only was scientific knowledge about seismic risks easily obtained, but that it already existed before the earthquake ever occurred. However, many of the policies that were analyzed were biased and therefore could not be used because they were lacking both scientific and technological information. Consequently, Haiti's vulnerability increased because seismic building codes were not compulsory in most of the development cooperation projects.

Keywords: governance, Haiti, international aid, seismic codes, public policies on cooperation

1. INTRODUCTION

This researchaims to answer questions such as whether or not the extremely serious consequences of the earthquake in Haiti could have been prevented.To what extent was Haiti's seismic risk known and to what extent was it integrated in international development cooperation policies? Why weren't scientific knowledge and best technological practice taken into account? And, were Haiti's seismic risks foreseeable?

The estimates published by theUnited States Geological Survey (USGS) on the population exposed to the earthquake in the most heavily affected areas (11 human settlements) were that up to five million people could be affected with a likelihood of at least 34%, that more than 100,000 persons could be killed, and that there was a likelihood of more than 43% of losses of between 1 and 10 million US dollars. The PARNDH (*Plan de Acción para la Recuperación Nacional y el Desarrollo de Haití BID, Banco Interamericano de Desarrollo*) speaks of 7.9 million US dollarsin losses and damageamounting to 120% of the country's 2009 GDP, 2.5 trillion in physical lossesamounting to 55% of the total cost of the disaster,and 3.6 million US dollars (45% of losses) as collateral costs due to loss of employment and salaries, production, reduction in the volume of business, increase of production costs, 6% in education and health, and so forth. According to official estimates published by the USGS, the earthquake caused 316,000 deaths, and left 300,000 injured and 1.3 million displaced persons. A total of 97,294 houses were destroyed, and 188,383 homes were damaged in Port au Prince and a large portion of southern Haiti. The PARNDH published that 105,000 homes were destroyed and 208,000 damaged, and that more than 1,300 centers of education and more than 50 hospitals and health centers had suffered from collapse or were inoperable. The main port could not be used and a great number of public buildings such as the Parliament, the Palace of Justice and most of the Ministries had been destroyed.

2. RESEARCH

Research was therefore carried out with a view to understanding whether the actors involved at all levels of the Seismic Risk Management in Haiti were aware of the chance of a major earthquake with the breadth and intensity of that occurring on12 January 2010. A survey was designed for NGOs that had worked with Haitibefore as well as after the earthquake. There was prior consultation among different government and non-governmental sources to ascertain which NGOs had been present, and specifically which, due to the activities they performed, should have been aware of the chance of a major earthquake occurring.To facilitate communication, mainly Spanish NGOs or international NGOs with offices in Spain were chosen given that all of them, regardless of their nationality, obtained national and international funding. The sectors chosen included any of these that needed to build, manage, or outsource the building of infrastructure, be it housing for rural development, schools, water and sanitation infrastructure, health centers, or community centers, as part of their main activity.Forty-five NGOs were selected, of which 15 responded (33%).

In parallel, public policy for International Development Cooperation to Haiti both before and after the earthquake was examined, as were the main sources of funding, i.e. the United Nations System, the European Union, and the Spanish Development Cooperation Agency. Also examined was the Haitian government's legislation to ascertain the potential mandatory nature of seismic building codes and the type of buildings to which they applied. A thorough examination was also done of the reports and scientific publications making reference to Haiti's history of earthquakes in order to evaluate the extent to which this information existed and was available to the public for use.

3. RESULTS

3.1 Stakeholder Perception of Seismic Risk in Haiti.

Table 1: A survey of more than 45 Non Governmental Organizations that worked in Haiti both before and after the earthquake

DATE	DRM	SEISMICITY	Construction	Afectad
1994	No	No	No	No
2003	yes	yes	yes	No
2004	yes	yes	yes	No
2005	yes	yes	No	No
2009	N/C	N/C	yes	yes
2010	yes	yes	yes	No
2010	yes	yes	yes	yes
2010	No	No	No	No
2010	yes	yes	No	No
2010	yes	yes	No	No
2010	yes	yes	N/C	N/C
2011	yes	yes	yes	No
2011	yes	yes	No	No

3.2. Seismic Risk in Haiti in Public Development Cooperation Policy.

Analysis of policies in Development Cooperation in various international institutions, United Nations System, European Union and the Spanish Cooperation Agency.

Table 2: Summary table of the international planning for the development of Haiti in agreement management disaster risk, before and after the earthquake of 2010. *(Asencio Barragán, 2013)*

AÑO	UNITED NATIONS	EUROPEAN UNION	SPAIN GOVERN	GRD	SEISMICITY
2001	MANUD 2002-2006			×	×
2005			DEP Haiti 2006-08	✓	×
2007		DEP 2008-13		✓	…
2008	MANUD 2009-2011			✓	×
2012	Haiti CPAP PNUD 2013-2016			✓	✓
	CSI 2013-2016			✓	✓

3.3 The Seismic Situation in Haitiand Building Codes.

The January 2010 earthquake in Haiti occurred on the boundary between the Caribbean and North American Plates, whose interaction spans 100-250 km, and which have a direct impact on the islands of La Hispaniola, Cuba, Jamaica and Puerto Rico, spanning a total of more than 2,000 km from the Lesser Antilles to the Central American Arc. The data of the epicenter, depth, and rupture model indicate that the earthquake was triggered in the Enriquillo-Plantain Garden (EPFGZ) fault system on the south of the island, although Professor of Geography at Purdue University (Indiana) Eric Calais, (led the first team that went to after the earthquake. This Geophysicall studied system failures and Northern Enriquillo from 1989). Asserts that the earthquake "was due to a non-assigned fault running virtually parallel to Enriquillo fault", which is called the "Léogâne fault". The main collision between the plates did not generate any observable displacement on the surface, but did contribute to breaking the secondary faults and to an elevation of the Léogânes delta (Port au Prince). This leads to the conclusion that the tension generated in the area was not duly released and therefore remains a considerable threat. A similar situation could occur in the not too distant future.The earthquake occurred at 9:53:10 p.m. UTC (4:53:10 p.m. local time at the epicenter), at a depth of 13 km (hypocenter) and 25 km west of Port au Prince (epicenter 18.443ºN 72.571ºW), and had a magnitude of 7.0 on the Richter scale and an intensity of up to X degrees on the Modified Mercalli (MM) scale.

The lack of a building code, licenses for architects, engineers and contractors, or even spontaneously built homes in spontaneous settlements, made this earthquake all the more catastrophic. The codes potentially used were the French BAEL code (limit state design for reinforced concrete) that does not include measures for seismic design, and the American ACI-318 (American Concrete Institute) code for building with concrete structures and whose building and inspection requisites are neither mandatory or revised. Added to this is the use of poor materials such as sand from the beach that is corrosive to concrete, coupled with poor labor and poor maintenance giving rise to houses that are fragile and weak and cannot withstand even the slightest of tremors. It seems it was the historical buildings built between 1890 and 1925 that withstood the earthquake the best thanks to the building materials and techniques used at the time. There was, however, local damage due to topographical amplification that contributed to the destruction of 'firm and relatively well built structures". *(EMS, European Macroseismic Scale, 98).*

Prior to 2010, the government of Haiti had plans and national strategies that considered Earthquakes and Risk Management for Disaster Reduction. However, the lack of interest on the part of the Haitian Administrationenabled unbridled proliferation of infrastructure lacking control and urban planning.Haiti has one of the lowest Human Development Indexesin the world, and the same holds for its governance capability. Likewise, International Development Cooperation Policy regarding actions performed in the field has not taken seismicity into account or the application of pre-disaster phases of Risk Management. It is Humanitarian Aid that has prevailed due to Haiti's social and political situation with tremendous economic losses year by year.

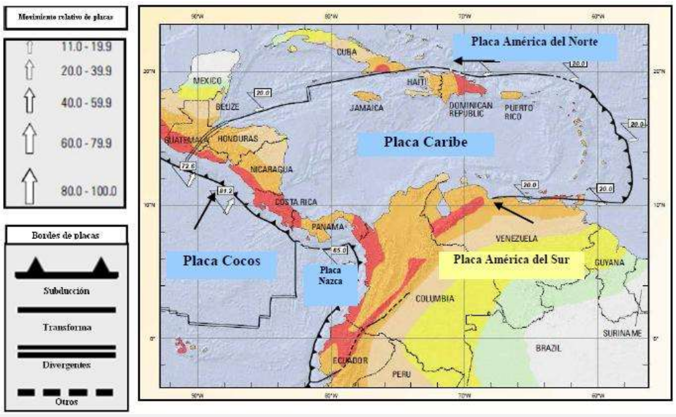


Figure 1: Map of caribbean plate and vicinity: Modificate for authors. Source: Tarr, C, Rhea, S, Villaseñor, A, Furlong, K.P, Benz, H, USGS 2007.

Table 3: Source: Bulletin of the Seismological Society of America, Vol. 102, Nº, 1, pp. 18-30, February 2012, DOI: 10.1785/0120110077

Significant Enriquillo Fault System Earthquakes			
Date	Lat (º N)	Long (º)	M_I*
9 November 1701	18.41	72.65	6.6 ± 0.3
18 October 1751	18.36	70.84	7.4-7.5 ± 0.2§
21 November 1751	18.54	72.32	6.6 ± 0.2
3 June 1770	18.50	72.86	7.5 ± 0.3
8 April 1860	18.55	73.54	6.3 ± 0.3
12 January 2010	18.45	72.54	**M** 7.0

4. CONCLUSIONS

The main conclusion is that the risk was only partially not every effectively assessed and appreciated. It did not impact the requirements of the projects to be carried out. There was no prior building policy requiring seismic building codes in the country despite that fact that there are several such codesin Latin America that orientate those building their own homesusingvarious materials present in developing areas, and that can be easily accessed and implemented under technical supervision. These codes were developed following the earthquakes in the Republic of El Salvador in January and February 2001. To understand why the normal risk management and disaster reduction methodologies failed, one could think of subjective causes preventing resilience and involving factors included in the bias that we use when analyzing problems if we come from technical, scientific, social, legal, or emergency management backgrounds*(Zango-Pascual, M. 2011).* Other issues to consider have to do with governance and the subjective causes affecting each situation and context. It is the relationship between public policies and science and technology in Spain that has been researched by the author. Her conclusion is that the risk management responsibility does not always come hand in hand with the necessary interdisciplinary and trans-disciplinary knowledge,or with the appropriate legal instruments for this knowledge to be correctly materialized. There may be differing levels of management and responsibility in decision-making, be the decisions political, technical or operational, and cooperation, including the division of tasks, is not always appropriate. *(Zango-Pascual, M. 2012)*

One of the best known, cited and successful articles worldwide on Risk Management and Disaster Reduction is *Wisner et al, "At Risk",* and the PAR model, (Presure, Action, Reaction), which has even been included in certain manuals compiled in Spain by organizations specialized in Humanitarian Action and Development Cooperation. This vision is based mostly on including the population's perceptions on risk and their participation in the process. While this is absolutely legitimate, if it does not come hand in hand with information from science, technological progress and best available practice, a significant element of vulnerability can arise. This has proven to be the case in Haiti. The population at seismic risk was barely a priority amidst others such as poverty, violence, covering basic needs such as health or education, and so forth. The last earthquake had occurred 200 years prior and was far from the forefront of people's minds. Some of the NGOs participating in thecountry documents of international programs prior to the earthquake confirmed that they had not taken the seismic risk into account, that it was not a priority.

For science (see figure 1 and table 3) the risk was evident and information was easy to obtain for any scientist or actor involved who resorted to scientists for correct interpretation.For technical experts, seismic resistant building codes were nothing at all new and could even be adapted to situations as complex as those in Haiti. The Colombian Association of Seismic Engineering (*Asociación de Ingeniería Sísmica Colombiana*) has adopted several such techniques for houses built by their residents out of adobe, cemented coated barahaque, and barahaque.

5. ADDED VALUE FOR THE POST 2015 DISASTER RISK REDUCTION FRAMEWORK

The second strategic goal of the 2005-2015 Hyogo Framework for Action (HFA), Building the Resilience of Nations and Communities to Disasters,is "Developing and strengthening institutions, mechanisms and capabilities, particularly at community level, that can systematically contribute to building resilience to hazards". The disaster in Haiti is a clear example of how science and technology were not considered to be important capabilities. Nor were they addressed. They were not included in cooperation programs and the investments made were not at all resilient as called for in the post 2005-2015 HFA-2. While the country's funding capacity was minimal, the funding it obtained to progress in its development was not accompanied by policies sufficiently permeable to scientific knowledge, technological progress and best practice. Seismic building codes were not factored in to most of the projects in which critical infrastructure was built, nor was the population given capacity-building for erecting their own houses.

Often, those who design these policies and those who make Risk Management and Disaster Risk Reduction policies do not have scientific or technical training or experience, and it is assumed that proper legislative strategies suffice. But any legislation and planning must take science and technology and progress into account so that knowledge can be transferred to society purposefully to contribute to facing the challenges generated day by day.

6. REFERENCES

Acuerdo de Cotonú, de 23 de junio de 2000. 2005/483/CE (ACP-CE).

Asensio Barragán, Claudia, Zango-Pascual, Marga (2013). *Valoración de la gestión del riesgo de desastres por sismicidad en proyectos de cooperación internacional al desarrollo.* PFC. Universidad Pablo de Olavide. Sevilla. Spain. 151 pp.

BID (2004) Estrategia de Transición del BID, Haití 2005-2006. Banco Interamericano de Desarrollo, informe 204.

BID (2010) and (2007). Banco Interamericano de Desarrollo. Estrategia de País, Haití 2011-2015 and 2007-2011.

BID. PARNDH. (2010). *Plan de Acción para la Recuperación y el Desarrollo de Haití. Grandes tareas inmediatas para el futuro*. Gobierno de Haití.

Bulletin of the Seismological Society of America, Vol. 102, Nº, 1, pp. 18-30, February 2012, DOI: 10.1785/0120110077

Conferencia Haití. http://www.haiticonference.org/

Gobierno de Haití (2007). Estrategia Nacional para el Crecimiento y la Reducción de la Pobreza 2008-2010.

Gobierno de Haití y Comunidad Europea. 2008. Estrategia de país, Haití 2008-2013.

MAEC (2001) Estrategia de Acción Humanitaria de la Cooperación Española para el Desarrollo; Estrategia de Medio Ambiente y Desarrollo Sostenible de la Cooperación Española. (2002);

MAEC (Ministerio de Asuntos Exteriores y Cooperación. Gobierno de España) (2006). Estrategia de País, Haití 2006-2008.

MAEC. (2006 and 2012) Plan Director de la Cooperación Española 2009-2012 and 2013-2016.

Marín Hidalgo, Isabel, Zango-Pascual, Marga (2013). *El riesgo sísmico en Haití: la memoria olvidada: acercamiento a la percepción por la amenaza sísmica en Haití previamente al terremoto de enero de 2010:* Proyecto Fin de Carrera. Universidad Pablo de Olavide. Sevilla. Spain. 127 pp.

Ministerio de Economía y Finanzas. Instituto Haitiano de Estadística e Informática. http://www.ihsi.ht/index.htm

Plan de Acción del Programa de País del Gobierno de la República de Haití y del PNUD 2009-2011 and 2013-2016.

Plan Nacional de Gestión de Riesgo de Desastres. Haití, 2001. Reducción de Riesgo Sísmico en Haití. Sistema Nacional de Gestión de Riesgo de Desastres.

Tarr, A. C., A. Villaseñor, K. P. Furlong, S. Rhea, and H. M. Benz (2010). *Seismicity of the Earth 1900–2007*, U.S. Geological Survey, Scientific Investigations Map 3064, 1 sheet, scale 1:25,000,000.

UNITAR. (2010) *Informe de Evaluación de Edificios Dañados. Terremoto de Haití, 12 de enero de 2010*. Marco de Evaluación y Recuperación de Necesidades Post-Desastres (PDNA). Versión 0.3. Marzo 2010

Wisner, B., Blaikie, Piers, Terry Cannon Terry, Davis Ian. (2004). *At risk: natural hazards, people's vulnerability, and disasters.* Routlegde. 2nd edition London.124 pp, on line.

Zango-Pascual, Marga. (2011). *La Gestión Integral de los Riesgos Naturales en el marco de los Derechos Humanos de Tercera Generación. El caso de los efectos inducidos por la sismicidad en El Salvador (Centroamérica).* Doctoral Thesis. Universidad Pablo de Olavide, Sevilla, 530 pp.

Zango-Pascual, Marga. (2012). *Estudio de las causas subjetivas que contribuyen a la generación de desastres en el ámbito local. Análisis de la toma de decisiones sobre gestión de reducción de riesgos en un municipio ficticio.* CONAMA 2012. Congreso Nacional de Medio Ambiente. España. 30 pp. ISBN: 978-84-695-6377-9.