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# Disaster risk reduction in Haiti

Case study. Good practices and lessons learned on the setup and implementation of National Systems of Innovation

This document is part of a collection of six case studies selected from the work conducted by the Technology Executive Committee (TEC) on "Good practices and lessons learned on the setup and implementation of National Systems of Innovation". It specifically focuses on the disaster risk reduction system in Haiti.

The Summary for Policymakers of the TEC's work presented in June 2023<sup>1</sup> explains that the primary objective of an innovation system is to produce, diffuse, and use innovations. To accomplish this objective, the Summary for Policymakers document identifies specific activities or functions that should be carried out to facilitate the innovation process. Based on empirical evidence, innovation studies identify seven main functions as outlined in Table 1. However, the function 3, Market formation, is not applicable to the Haiti study case. Evaluating to what extent an innovation system can perform these functions is necessary to identify and assess the innovation system's achievements, failures and gaps or barriers.

Table 1. Haiti case of innovation system

Country	Haiti	Focus	Adaptation
Scope	Disaster risk reduction in all sectors	Key innovation system functions (F) <sup>a</sup>	<p><b>Key functions:</b></p> <ul style="list-style-type: none"> <li>F1 Knowledge development and diffusion</li> <li>F2 Entrepreneurial experimentation</li> <li>F4 Influence on the direction of the search</li> <li>F5 Resource mobilization</li> <li>F6 Legitimation</li> <li>F7 Development of positive externalities</li> </ul> <p><b>Non-key functions:</b></p> <ul style="list-style-type: none"> <li>F3 Market formation</li> </ul>
Approach	Top-down and bottom-up	Starting year	2001

<sup>a</sup> See the Summary for Policymakers of "Good practices and lessons learned on the setup and implementation of National Systems of Innovation",<sup>2</sup> and table 2 for the description of functions.

1 TEC (2023). Summary for Policy makers: Good practices and lessons learned on the setup and implementation of National Systems of Innovation, UNFCCC Technology Executive Commission, Bonn. Available at <https://unfccc.int/tclear/tec/NSI.html>.

2 TEC (2023).

This document begins with a general introduction of the case study, followed by a description of the legislative framework and an examination of its context within the national innovation system. This provides a foundation for a more detailed exploration of the Haitian case. These sections serve as the basis for assessing the case by analysing its functions. The last sections include additional analysis of the case's role within the national system of innovation, key success factors and lessons learned, and good practices that might be replicable in other countries.



# 1. Introduction of the case

The focus of this case study is Haiti, a small island developing State in the Caribbean that is highly vulnerable to the impacts of climate change, and how it aims to reduce the risks associated with natural disasters. From 1900 to 2010, Haiti was hit by 59 natural disasters, including cyclones, tropical storms, flooding, droughts and earthquakes.<sup>3</sup> It is one of the world's most affected countries in terms of economic losses from natural disasters, amounting to 17.5% of gross domestic product (GDP) over the 20-year period between 1998 and 2017.<sup>4</sup>

For example, the earthquake in 2010 resulted in the loss of about 230,000 lives and the displacement of two million people<sup>5</sup> and hampered the country's development. Damages amounted to 120% of Haiti's GDP, and the country fell from a ranking of 145<sup>th</sup> in the United Nations Human Development Index (HDI) just before the disaster to 168<sup>th</sup> in 2013.<sup>6</sup> The earthquake also undermined human capital and infrastructure within the Government,

as up to 20% of federal employees were killed or injured and around 25% of public buildings were devastated. Damages from Hurricane Matthew in 2016 cost around 33% of Haiti's GDP and pushed many residents further into poverty.<sup>7</sup>

Since 2001, multiple measures have been undertaken to strengthen the ability to anticipate, face and resist natural disasters in Haiti and to recover from their impacts. Haiti's economy relies heavily on agriculture, forestry and fishing, which are highly vulnerable to the impacts of climatic events.<sup>8</sup> With the frequency and scale of these events expected to increase with climate change, measures to reduce the risks of natural disasters are important. Understanding the effectiveness of such measures and the lessons that can be learned from them is crucial.

Disaster risk reduction (DRR) involves a systemic approach to disaster risk management in order to limit loss and damage from natural disasters. It aims to avoid, mitigate or transfer the adverse effects of risk through activities related to prevention, preparedness and response.<sup>9</sup> DRR is a combination of political and administrative policies and activities involving various actors and technologies,<sup>10</sup> as elaborated in the text box below.

3 Joseph (2010). Recurrence des catastrophes en Haïti: réflexion sur leurs causes et sur la gestion des risques de catastrophe. University of Geneva, Switzerland.

4 Reliefweb, 2021, Haiti approves a new Risk and Disaster Management Plan, <https://reliefweb.int/report/haiti/haiti-approves-new-risk-and-disaster-management-plan>.

5 International Federation of Red Cross and Red Crescent Societies (IFRC) (2015). How law and regulation support disaster risk reduction: Haiti case-study report. Available at [https://disasterlaw.ifrc.org/sites/default/files/media/disaster\\_law/2020-09/HAITI%20DRR%20Report.pdf](https://disasterlaw.ifrc.org/sites/default/files/media/disaster_law/2020-09/HAITI%20DRR%20Report.pdf).

6 IFRC (2015).

7 Green Climate Fund (2019) Readiness and Preparatory Support Proposal for Republic of Haiti. Adaptation planning. Available at <https://www.greenclimate.fund/document/adaptation-planning-support-haiti-through-undp>.

8 Green Climate Fund (2019).

9 Joseph (2010).

10 Lettieri et al (2009). « Disaster management: findings from a systemic view » in Disaster Prevention and Management, Vol. 18, No. 2, Emerald Group Publishing Limited.

## Factors influencing vulnerability to natural disasters

Vulnerability to natural disasters is determined by geographical and meteorological situations and involves social, anthropological, economic, environmental, technical and engineering factors that influence a group's ability to anticipate, face and resist a natural disaster and to recover from its impacts. Risk exposure to natural disasters is hence a combination of vulnerability factors that includes the (in)ability to adapt, the characteristics of the natural disaster itself (cyclones, flooding, earthquakes, etc.) and the chance of occurrence.<sup>a</sup>

Several factors increase vulnerability to natural disasters:

- Deep causes that affect the allocation and distribution of resources among population groups, including economic, demographic and political processes, as well as legal institutions;
- Dynamic pressures that transform the deep causes into conditions that are temporally and spatially dangerous, including a lack of local institutions, capacity, investments, local markets, press freedom and ethical standards;
- Dangerous conditions relating to the specific forms in which the vulnerability of a population is manifested, including placement in dangerous zones, lack of building codes and lack of financing for housing that is resistant to natural disasters.

From the perspective of Haiti's national innovation system, several structural elements can influence the vulnerability of Haiti's population. Weak institutions may not provide strong enough regulations for building codes, and sustainable and low risks settlements, or clear guidance on acting when facing a disaster. The inability to access finance and knowledge may affect the population's ability to prepare for a disaster, including building safer homes and knowing how to react in different situations. The ability to cope in the aftermath of a natural disaster, for instance to organize rescue activities and humanitarian support, requires communication between actors. Weak communication between actors is expected to pose a challenge. Lack of reliable and disaster-resistant infrastructure, such as telecommunication networks and roads, also influence the ability of the population to prepare and respond to a disaster. Strengthening the functions of Haiti's national innovation system can help the country overcome systemic issues related to disaster risk reduction, for instance by increasing knowledge development and diffusion about risk exposure and management of natural disasters, mobilizing finance for resilient infrastructure and creating legitimacy by establishing guidelines and protocols.

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<sup>a</sup> Wisner et al (2004). « At risk, second edition: Natural hazards, people's vulnerability and disasters ». Routledge, London and New York.

## 2. Legislative framework

Until 1997, actions related to natural disasters in Haiti dealt mainly with disaster response, with little focus on preparedness.<sup>11</sup> After Hurricane Georges in 1998, the focus began to change, and disaster prevention and risk management received more attention, including from international partners who provide support in the aftermath of disasters. Around the same time, the Government of Haiti started to prepare the first national plan for disaster risk management, called the National Risk and Disaster Management Plan and abbreviated as PNGRD, in French (Plan National de Gestion des Risques et des Désastres),<sup>12</sup> adopting it in 2001 and raising disaster risk management to the highest priority.<sup>13</sup>

The 2001 PNGRD had two main objectives:

- To address the factors that increase vulnerabilities and risk in order to reduce the possibility of a disaster occurring<sup>14</sup> because, at the time, there was an understanding that managing the country's vulnerability and risk to natural disasters was a fundamental requirement to achieving sustainable development and fighting poverty;<sup>15</sup>
- To strengthen the capacities of actors at all levels – national, regional and local – to respond to needs in the event of a disaster.<sup>16</sup>

The 2001 PNGRD established the National System for Disaster Risk Management (Système National de Gestion des Risques et des Désastres – SNGRD) as the main coordination mechanism for disaster risk management in Haiti. The SNGRD includes actors who engage in all aspects of the prevention and mitigation of, and response to, disasters, including the public sector, civil society, the private sector, non-governmental organizations (NGOs) and international donors, to represent multiple levels of governance and to decentralize the management of disaster risks.<sup>17</sup> In 2004, the Government, with support from the United Nations Development Programme (UNDP), used the 2001 PNGRD to prepare a national report on the prevention of natural disasters, in the context of the 2005 World Conference on Disaster Reduction,<sup>18</sup> but the impacts of the 2010 earthquake increased the prominence of DRR and disaster risk management nationally.<sup>19</sup>

The PNGRD 2019–2030, adopted in 2021, included four key frameworks:

- Strategic Development Plan of Haiti;<sup>20</sup>
- Sectoral policies and plans;
- Regional strategy for disaster risk management under the Caribbean Disaster Emergency Management Agency;
- Sendai Framework for Disaster Risk Reduction 2015–2030.

11 Joseph (2010).

12 République d'Haiti (2001). Plan National de Gestion des Risques et des désastres. Available at [https://www.preventionweb.net/files/29734\\_plannationaldegestionrisquesetdesas.pdf](https://www.preventionweb.net/files/29734_plannationaldegestionrisquesetdesas.pdf).

13 République d'Haïti (2019). Plan national de gestion des risques de désastre 2019 – 2030. [https://www.preventionweb.net/files/72907\\_plannationaldegestiondesrisquesdeds.pdf](https://www.preventionweb.net/files/72907_plannationaldegestiondesrisquesdeds.pdf).

14 Joseph (2010).

15 République d'Haïti (2019).

16 Joseph (2010).

17 Joseph (2010).

18 Joseph (2010).

19 IFRC (2015).

20 Reliefweb, 2021.

### 3. The Haitian national system of innovation: actors, institutions, drivers and gaps

A low HDI often correlates to a weak national system of innovation (NSI), reflecting an increased vulnerability to risks of natural disasters due to difficulties in terms of the lack of available financial resources, poor housing conditions and decreased access to education and health care.<sup>21,22</sup> In 2000, Haiti had an HDI of 0.470, with mean years of schooling of only 3.8 years. In 2021, the country's HDI had improved to 0.535, but Haiti still ranked 163th out of 191 countries and was in the low human development category.<sup>23</sup> A weak education system, together with a lack of learning from previous events, led to insufficient knowledge among the Haitian population about the risks of natural disasters faced. Lack of access to finance, as well as insufficient knowledge (e.g. about building codes), means that people cannot sufficiently implement measures to limit damage caused by natural disasters (e.g. families cannot build more resilient homes).<sup>24,25</sup>

There are also factors that affect the ability of public institutions to prepare for and manage risks associated with natural disasters. The country has experienced political instability, including a conflict in 2004 that led to the establishment of the United Nations Stabilization Mission in Haiti.

Moreover, the centralization of the administration and services in the capital Port-au-Prince has led to people living in vulnerable conditions in urban slums while undermining the public administration's ability to provide support and services to the rural population in the country's interior.<sup>26</sup>

Non-State actors engaging in DRR and relief activities (e.g. United Nations agencies, bilateral agencies, NGOs) operate in the country and often increase their presence in the aftermath of a natural disaster, which increases the need for effective coordination. Coordinating support during and after a disaster is challenging in the absence of established protocols for rescue and relief operations and clear communication structures, which increases the risk of duplicating actions, leading to the inefficient allocation of scarce resources and high transaction costs for actors.<sup>27</sup>

Infrastructure issues that increase the country's vulnerability include the fact that all main cities, electrical cables and gas and fuel storage facilities are located on the coast, which exposes residents to both direct flood risks and the safety risks of flooded wiring.<sup>28</sup> In addition, structural engineers are mostly involved in designing high-rise buildings, as such projects are financially attractive. Thus, the design and construction of low-rise buildings is left to small-scale contractors, who do not always have the technical knowledge to build infrastructure that is resilient to natural disasters.<sup>29</sup> High rates of deforestation, which includes biomass used for cooking, also increase risk exposure to certain natural disasters.

21 Joseph (2010).

22 World Bank's Climate Risk and Adaptation Country Profile (2011).

23 UNDP (2020) The Next Frontier: Human Development and the Anthropocene. Briefing note for countries on the 2020 Human Development Report. Haiti. <http://hdr.undp.org/sites/default/files/Country-Profiles/HTI.pdf>.

24 Joseph (2010).

25 Schacher (2014) Disaster-Risk Reduction through the Training of Masons and Public Information Campaigns: Experience of SDC's "Competence Centre for Reconstruction" in Haiti. In John F. Shroder, Max Wyss, Hazards and Disasters Series, Earthquake Hazard, Risk and Disasters <https://doi.org/10.1016/B978-0-12-394848-9.00003-1>.

26 Joseph (2010).

27 De Silva and Prustalis (2010). The Sahana Free and Open-Source Disaster Management System in Haiti. In: ICT for Disaster Risk Reduction. Chapter 2. Incheon City, Republic of Korea: United Nations APCICT-ESCAP.

28 Joseph (2010).

29 Schacher (2014).

To reduce vulnerability and increase the country's ability to anticipate, face and resist natural disasters and to recover from their impact, several gaps were covered by the following objectives in the PNGRD:

- Institutional actions needed to be enhanced in order to develop a long-term vision for DRR, in coordination with the Government, other national actors and international donors;
- A mechanism for valuing local participation and knowledge was required, on the basis of experience from the 2010 earthquake that indicated local networks of neighbours were crucial for rescue operations;
- A system for knowledge development and diffusion was needed to increase awareness and capacities to prevent and manage future disasters;

- A revised school curriculum was needed, in order to adapt knowledge production and learning to local needs in relation to natural disasters;
- Standards and protocols had to be developed regarding all phases of risk management and response to natural disasters, in order to facilitate action and monitoring and evaluation processes.<sup>30</sup>

The Directorate for Civil Protection (DPC) of the Ministry of the Interior and Territorial Communities (MICT) is primarily in charge of risk and disaster management in Haiti. In 2019, a law was in discussion to provide more capacity and autonomy to the DPC.<sup>31</sup> Following the adoption of the Disasters Risks Management (DRM) law in June 2020, DPC became the General Directorate for Civil Protection (GDPC) within MICT.<sup>32</sup> The law of 5 June 2020 formalized the PNGRD and designated DGPC as an autonomous body responsible for technical coordination, knowledge management, technical support and strengthening the capacity and mobilization of the SNGRD.<sup>33</sup>

<sup>30</sup> Joseph (2010).

<sup>31</sup> UNDRR, 2019, Haiti works together with the United Nations Office for Disaster Risk Reduction - Regional Office for the Americas and the Caribbean to strengthen its presence and commitments into Caribbean risk reduction initiatives, <https://www.eird.org/americas/news/haiti-works-together-with-the-united-nations-office-for-disaster-risk-reduction.html#Ys2aEHZByUkUn>.

<sup>32</sup> World Bank GFDRR, 2021, Building Physical, Fiscal and Inclusive Resilience in Haiti, <https://www.gfdrr.org/en/building-physical-fiscal-and-inclusive-resilience-haiti>.

<sup>33</sup> Republic of Haiti, Ministry of Planning and External Cooperation, 2021, Post-Disaster Needs Assessment in Haiti: Earthquake of 14 August 2021 in the Southern Peninsula; Executive Summary, see: [https://www.ilo.org/wcmsp5/groups/public/---ed\\_emp/documents/publication/wcms\\_831127.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_831127.pdf).



## 4. Description of the case

The main aspects of the Government's top-down approach as laid down in the PNGRD are described below. However, several initiatives have been implemented by non-State actors such as NGOs and international donors. Although a review of all initiatives goes beyond the scope of this case study, two examples of such bottom-up interventions are also discussed below.

### 4.1 Government-led initiatives under the PNGRD framework

**Creation of a network of local committees for disaster risk management:** Committees for disaster risk management have been established in every town to reduce dependence on centralized governance structures in Port-au-Prince. The network of committees created a training curriculum in disaster risk preparedness and response, conducted education and awareness-raising activities for the local population and

improved coordination. The network also helped to create an emergency plan that established a mechanism for organizing interventions in case of an event, including a coordination unit composed of at least three people, and guidelines for communication management in emergency settings.<sup>34</sup>

Implementation of platforms and mechanisms for institutional and intersectoral coordination, at both strategic and operational levels: Platforms such as the SNGRD, the International Cooperation Support Group, the NGO Forum, thematic committees on different aspects of DRR and the UNDP Civil Society Advisory Committee have helped to promote the development, systematization and standardization of practices and tools such as plans, protocols and procedures. Emergency operations centres (EOCs) established by DPC created a framework to provide coordination during emergency situations.<sup>35</sup> Under EOCs, local emergency response personnel are able to collect and analyse reported information, make decisions and manage the national response to natural disasters.<sup>36</sup> Various EOCs have been established in different locations over the years, and in 2021 a national EOC was established. EOCs publish regular reports.<sup>37</sup>

Figure 1. Communication during emergencies<sup>38</sup>



34 République d'Haïti (2019).

35 République d'Haïti (2019).

36 Reliefweb, 2012, Ground-breaking Ceremony for Disaster Response Facilities in Miragoane, <https://reliefweb.int/report/haiti/ground-breaking-ceremony-disaster-response-facilities-miragoane#:~:text=The%20Emergency%20Operations%20Center%20will,provide%20relief%20to%20affected%20populations>.

37 Reliefweb, 2021, Haiti Earthquake ETC Situation Report #2 Reporting period 20/08/2021 to 26/08/2021, <https://reliefweb.int/report/haiti/haiti-earthquake-etc-situation-report-2-reporting-period-20082021-26082021>.

38 World Bank, 2021, Strengthening Disaster Risk Management and Transport Infrastructure after a Disaster: The 2010 Haiti Post-Earthquake Experience, <https://www.worldbank.org/en/results/2021/10/12/strengthening-disaster-risk-management-and-transport-infrastructure-after-a-disaster-the-2010-haiti-post-earthquake-expe>.



Development of plans, protocols, procedures and other management tools: The PNGRD led to the development of:

- A disaster response plan (2001, updated in 2009);
- A manual for the organization and operation of the EOCs (2006, revised in 2017);
- A guide for the management of evacuation shelters (2013).

In addition, several action and contingency plans were developed and revised annually, including plans for hydrometeorological and seismic contingencies and procedures for meteorological monitoring developed by the Hydrometeorological Unit of Haiti.<sup>39</sup>

**Information management:** Improving information management was a priority in the PNGRD both during emergencies and in normal times. Haiti put in place mechanisms for collecting data on disaster risks, vulnerabilities and impacts, and for creating a national database.

The country also established information management cells and trained and hired personnel for handling and analysing the data collected in the field and in the EOCs.<sup>40</sup> DPC established a national early warning system (EWS) under the PNGRD and procedures for risk-mapping with support from international partners to implement effective EWS in many communities.<sup>41</sup>

**Training and communication activities:** The PNGRD led to the creation of new courses covering the fundamental principles in DRR, such as understanding the risks of preparedness for and potential responses to natural disasters. The courses included training and information-sharing (e.g. on alert systems, rapid assessment of damage and needs, management of evacuation shelters, management of EOCs and simulation exercises). There were also initiatives to increase awareness of issues relating to DRR within formal educational programmes, including at the university level, for instance through the creation of a postgraduate programme. Some of these initiatives were established in collaboration with foreign universities such as the University of Geneva and the University of Nice.<sup>42</sup>

39 République d'Haïti (2019).

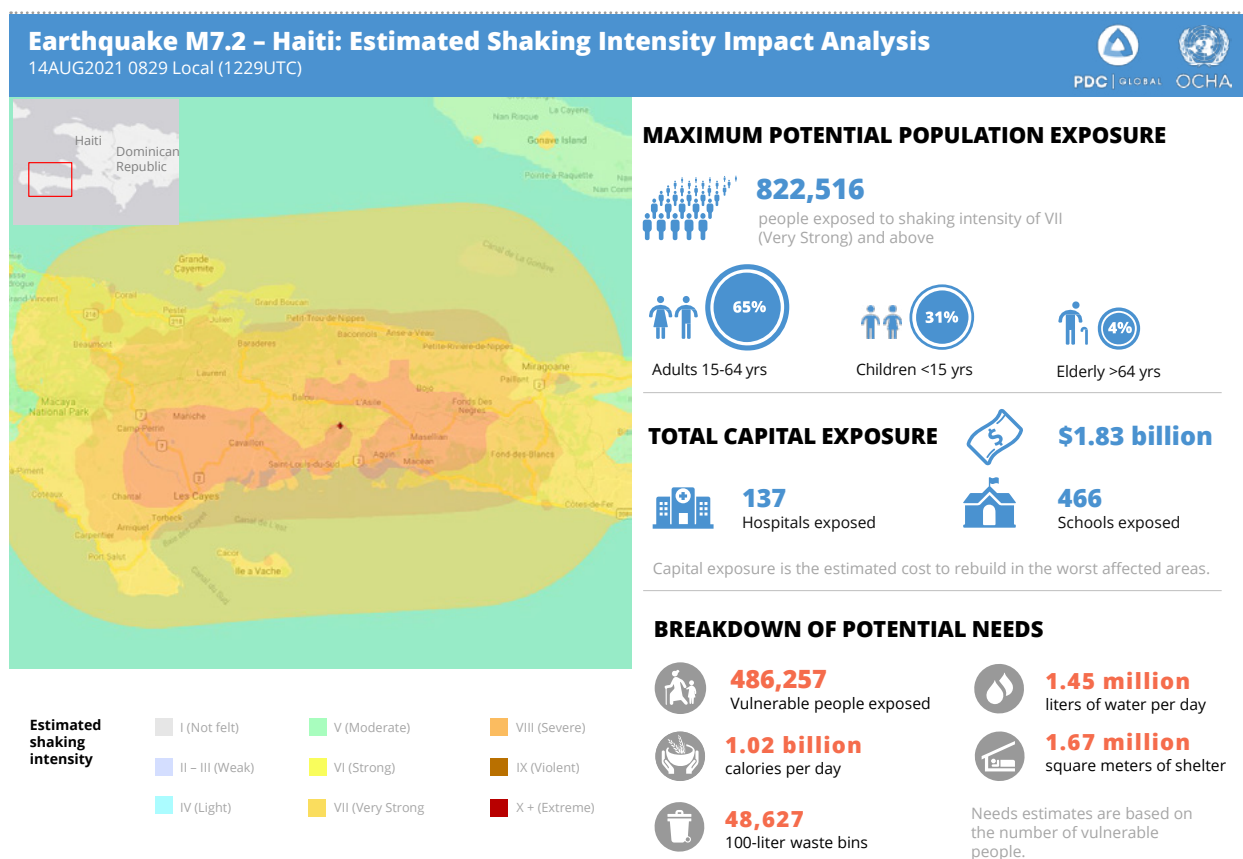
40 République d'Haïti (2019).

41 IFRC (2015).

42 République d'Haïti (2019).



Figure 2. Example of communication material on the impacts of earthquakes<sup>43</sup>



Moreover, the Thematic Committee for Education and Public Awareness (CTESP) provides coordination in and education about awareness-raising activities. CTESP brings together the main DRR stakeholders to support DPC, aiming to improve public knowledge of the main disaster risks and the best practices to implement throughout all phases of a disaster to reduce these risks. The aim of CTESP activities is to increase awareness of the possibility of, and the risks associated with, natural disasters, and to enable actors to act in the face of such events and to anticipate and recover from the impacts thereof. The targeted audience comprises individuals, families and local communities, including local leaders and the media. CTESP also validates, harmonizes and systematizes hundreds of audiovisual tools.<sup>44</sup>

Regarding communication activities, the Government carries out multiple efforts to inform the population, especially the most exposed and vulnerable groups, about DRR and disaster risk management and about how to reduce disaster risk and respond to a disaster as it happens.

These efforts include communication campaigns by local volunteers and DPC using newspapers, television, mobile communication tools and devices, and social media. These activities are carried out during emergencies and in normal times.<sup>45</sup>

**Integration of DRR into national and international cooperation planning:** DRR has been integrated into government planning as a cross-cutting issue associated with general environmental, poverty reduction and social development policies. Moreover, the Ministry for Planning and External Cooperation has carried out efforts to include DRR as a condition for all international cooperation programmes and projects, similar to the requirement to include environmental impact assessment studies.<sup>46</sup>

43 Reliefweb, 2021, Earthquake M7.2 – Haiti: Estimated Shaking Intensity Impact Analysis, see: <https://reliefweb.int/report/haiti/earthquake-m72-haiti-estimated-shaking-intensity-impact-analysis>.

44 République d’Haïti (2019).

45 République d’Haïti (2019).

46 République d’Haïti (2019).

**Establishment of public financial instruments:** The law of 16 September 1966 created a public fund for emergency situations by collecting 1% of salaries, initially from public sector employees but later also from private sector employees.<sup>47</sup> In addition, the Government established dedicated budget lines for emergency response and preparedness. Haiti has multiple risk-financing instruments in place, supported by the World Bank and partners such as the European Union, to benefit from funding innovations in disaster risk financing.

Haiti subscribes to the Caribbean Catastrophe Risk Insurance Facility (CCRIF), a regional insurance mechanism that makes insurance funds available quickly after a natural disaster.<sup>48</sup> CCRIF provided USD 7.7 billion to Haiti after the 2010 earthquake, accounting for around half of all funding the country received in the first 10 weeks after the event.<sup>49</sup> The restructure into CCRIF SPC reflected a shift in focus from a reactive post-disaster response to a more proactive approach focusing on prevention and preparedness.

Haiti is also a member of other mechanisms, such as the World Bank's Contingency Emergency Response Component, which allows funds to be reallocated from existing projects to address emergency response needs. The Bank is also working with the Government and other development partners on a comprehensive needs-based assessment and recovery plan that will be used to mobilize funding from the World Bank and its partners for resilient and inclusive recovery and reconstruction from natural disasters in Haiti.<sup>50</sup>

## 4.2 Civil society led initiatives after the 2010 earthquake

Following the 2010 earthquake NGOs, volunteers and international donors led some bottom-up initiatives to improve DRR in Haiti. Two relatively well-documented examples are given below.

**Knowledge of resilient reconstruction:** After the 2010 earthquake, the Swedish Agency for Development and Cooperation (SADC) carried out a project to rebuild a school and provide training for the local population at the periphery of the

earthquake-affected area. SADC focused on the rural areas of Haiti, where the involvement of structural engineers in construction projects is low, leading to buildings that are less resilient to natural disasters. The aim was to increase infrastructure resilience during the reconstruction phase and augment local capacities. SADC provided support in developing appropriate building techniques and improving awareness of earthquake- and hurricane-resistant building methods.<sup>51</sup>

**Sahana software for information management during emergency situations:** An important challenge during the response phase of emergency situations is data collection and management to help actors identify the scale of the disaster and coordinate action. Data collection and management can be especially difficult because infrastructure such as telecommunications and electricity is often damaged during a disaster, and remote areas can be difficult to reach. Additionally, available bandwidth is often limited and few devices can run applications. Human resources with little time available for learning might also be unfamiliar with software as an information management solution to better prepare for and respond to disasters. In addition, with representatives from several organizations and volunteers coming in to help, coordination is crucial to avoid duplication of effort and to ensure resources are allocated optimally. If the software used during disaster responses does not address these concerns, actors often go back to offline methods of data collection and management, undermining efforts to manage and share information during a response.<sup>52</sup>

The Sahana Free and Open-Source Disaster Management System was developed by volunteers in the information and communications technology (ICT) industry to help overcome challenges created by large-scale disasters. It was first deployed in Sri Lanka during the tsunami that occurred in the Indian Ocean in 2004, and has since been deployed in other countries in the aftermath of natural disasters. The system is designed to adapt to the constrained environment for ICT solutions during disaster response. For instance, it facilitates the interoperability with existing systems, is bandwidth-efficient, has a quickly accessible interface and can run on devices with low hardware specifications.<sup>53</sup>

47 It is as yet unclear whether this fund still exists.

48 CCRIF was established in 2007 as the first multi-country risk pool in the world, with technical support from Japan. In 2014, it was restructured into a segregated portfolio company, CCRIF SPC, and is capitalized by premiums paid by its member countries and funds from various donors, such as Canada, the European Union, Germany, Ireland, and Mexico, allowing it to sustainably provide disaster risk financing in the form of insurance to countries in Central America and the Caribbean.

49 République d'Haïti (2019).

50 World Bank, 2021, Haiti's Path to Building Financial Resilience Against Disasters, <https://blogs.worldbank.org/sustainablecities/haitis-path-building-financial-resilience-against-disasters>.

51 Schacher (2014).

52 De Silva and Prustalis (2010).

53 De Silva and Prustalis (2010).

Following the 2010 earthquake in Haiti, the Sahana Software Foundation and the Sahana community of volunteers responded with a considerable effort. They set up the Sahana Haiti 2010 Earthquake Disaster Response Portal, a live public website, to help fill gaps in information management during the relief operations. An ICT solution developed under Sahana, Sahana's Organization Registry (SOR), provided a searchable database that helped track organizations and offices working on the ground on disaster relief, their location, who they were helping and what assets and resources they had available. The SOR became the main repository for contact details during the first weeks of the response. Organizations could self-register by email or report to their office locations.<sup>54</sup> Crowdsourcing of volunteers played an important role in mobilizing human capital for data collection and management, especially since the government capacities were seriously hampered after the disaster. Volunteers were assigned to assist with data entry into the SOR and to merge information from multiple existing sources.<sup>55,56,57</sup>

The Sahana Software Foundation worked with the State Department of the United States of America and other actors on a project to process SMS text messages sent from Haitians with requests for assistance. Messages were processed and put into a structured data format providing the sender's name and location and the type of request (e.g. an immediate lifesaving request, a missing person report). The software was also able to gather information from Twitter about affected or missing persons, as well as population needs, using a hashtag system. Sahana centralized the information in a way that all actors could see all requests, as well as which requests had already been answered and by whom. The repository system was later adapted to synchronize with Haiti's hospital management system for requests for assistance, resources, staff and medical supplies. It also supported the World Food Programme by identifying needs and planning food distribution.<sup>58</sup>

**Figure 3. Recovery workers dig through debris after the earthquake of August 2021<sup>59</sup>**



54 De Silva and Prustalis (2010).

55 De Silva and Prustalis (2010).

56 Depelteau (2013). *L'usage et l'appropriation des communications mobiles textuelles par les acteurs de la réponse humanitaire du séisme du 12 janvier, 2010 en Haïti*. Montreal, Canada: Université du Québec.

57 Kankanamge et al (2019) Can volunteer crowdsourcing reduce disaster risk? A systematic review of the literature. *International Journal of Disaster Risk Reduction* 35 (2019) 101097. <https://doi.org/10.1016/j.ijdr.2019.101097>.

58 De Silva and Prustalis (2010).

59 World Bank, 2021, *Haiti's Path to Building Financial Resilience Against Disasters*, <https://blogs.worldbank.org/sustainablecities/haitis-path-building-financial-resilience-against-disasters>.

## 5. Assessment of the case functions

The following points discuss the vital systemic functions performed by the Haiti's Disaster Risk Reduction strategy, which have strengthened the Haitian innovation system's structural elements. For better reference, the table 2 describes

the systemic functions of systems of innovation.<sup>60</sup> The function F3, Market formation, is not a key function in the Haiti's Disaster Risk Reduction strategy, and consequently, is not included in this assessment.

**Table 2. Functions of systems of innovation<sup>a</sup>**

Number	Function	Description
F1	Knowledge development and diffusion	Expansion and intensification of the knowledge base of the innovation system, dissemination of knowledge among actors in the system, creation of new combinations of knowledge
F2	Entrepreneurial experimentation	Designing business models for emergent technologies and knowledge, practices of uncertainty reduction through experimentation with new technologies, applications and strategies
F3	Market formation	Creation of a space or an arena in which goods and services can be exchanged between suppliers and buyers. Includes processes related to definition of demand and choices, positioning (pricing, segmentation) of products, regulation of standards and the rules of exchange
F4	Influence on the direction of search	Processes that influence the direction of research of firms and other actors; that is, which technologies they explore, which problems or solutions they choose to invest in, where they channelize their resources from, etc.
F5	Resource mobilization	Processes by which the system acquires the resources required for innovation, which could be financial and human resources (workforce and capabilities), complementary assets such as infrastructure, etc.
F6	Legitimation	Mechanisms by which an emergent technology, its developers and the TIS in question attain regulative, normative and cognitive legitimacy as viewed by the stakeholders concerned
F7	Development of positive externalities	Creation of system-level utilities (or resources), such as pooled labour markets, complementary technologies and specialized suppliers, which are also available to system actors that did not contribute to building them up

<sup>a</sup> Adapted from Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. *Research policy*, 37(3), 407-429.

### Knowledge development and diffusion:

Several activities in Haiti have contributed to improvements in the development and diffusion of knowledge on DRR. Top-down activities include the national database established to provide data on disaster risks, vulnerabilities and impacts, the creation of information management cells, and personnel training on handling and analysing data under the PNGRD. Bottom-up activities include the response from the Sahana community through the establishment of the SOR, which provided a searchable database to help coordinate action in relief operations, with volunteers playing a crucial

role in collecting data and uploading data to the database.<sup>61,62,63</sup>

As a result of these efforts, Haiti has a publicly accessible national database<sup>64</sup> that provides geographic information system and cartographic data about risks and hazards of river and coastal floods, water scarcity, cyclones, earthquakes and landslides. Information from research institutes, the Government and development partners<sup>65</sup> has been used by a wide range of actors involved in risk and disaster management, urban planning, agriculture and food security, and environmental

60 TEC (2023).

61 Kankanamge et al (2019).

62 De Silva and Prustalis (2010).

63 Depelteau (2013).

64 <https://haitidata.org/>.

65 Green Climate Fund (2019).



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management.<sup>66</sup> However, integrating climate change related risks and including data on gender and socio-environmental vulnerabilities and capacities would help to better determine the resilience of different population groups.<sup>67</sup> In addition to making the database widely accessible, Haiti has also consolidated EWS for flooding and hurricanes.<sup>68</sup>

Knowledge diffusion has also been aided by educational and training activities under both PNGRDs. The establishment of new university courses has contributed to the integration of DRR into university curricula, and hence to an increase in the overall technical capacities of university graduates to cope with issues related to DRR.<sup>69</sup> The International Federation of Red Cross and Red Crescent Societies (IFRC) observed that some good practices in Haiti's educational policy, such as environmental education being a mandatory part of the curriculum, offer the opportunity to incorporate DRR into primary and secondary school activities.<sup>70</sup> However, the actual inclusion of DRR in the curriculum of primary and secondary schools can be improved, and NGOs have conducted bottom-up activities to increase awareness of DRR in schools. SADC has helped to share technical knowledge of building codes among the rural population in Haiti,

thereby increasing their capacity to build homes that are more resilient to natural disasters.<sup>71</sup>

IFRC considered the framework developed for knowledge development and diffusion in Haiti to be relatively effective, with MICT and DPC being able to coordinate a large number of actors at the national level.<sup>72</sup> CTESP has contributed to public awareness activities by targeting all types of audiences and using several communication channels, including DPC local structures and mass media.<sup>73</sup> Such communication activities have helped to overcome knowledge gaps among the population, for instance on how to proceed during a disaster or how to be better prepared. IFRC concluded that the network for sharing public awareness information has been generally effective, with a lot of DRR and DRR-related training taking place, led by DPC and other partners.<sup>74</sup>

The communication and training activities developed and actors involved have helped to strengthen knowledge development and diffusion in DRR and DRR-related issues in Haiti. In 2019, the Government stated that these measures led to significant progress in terms of coordination, public information and awareness, capacity-

66 <https://haitidata.org/>.

67 Green Climate Fund (2019).

68 IFRC (2015).

69 République d'Haïti (2019).

70 IFRC (2015).

71 Schacher (2014).

72 IFRC (2015).

73 République d'Haïti (2019).

74 IFRC (2015).

building for intervention, and the development and diffusion of methods and technologies for the prevention of, reduction of risks to and response to natural disasters.<sup>75</sup> The PNGRD and the SNGRD have strengthened the capacity of both national and decentralized institutions and civil society to address disaster risk management,<sup>76</sup> and have led to the development of a relatively effective structure at all levels of government that supports coordination across public stakeholders, international donors and the private sector.<sup>77</sup> In fact, IFRC highlighted that Haiti's preparations for the annual hurricane season are widely praised by those involved in the SNGRD.

**Entrepreneurial experimentation:** Sahana open-source software is a bottom-up entrepreneurial endeavour from the Sahana community and users such as volunteers and international donors. The experience with Sahana software then led to the creation of other databases.

**Influence on the direction of the search:** Coordination among different actors has helped to establish guidance and protocols on DRR and has influenced plans and protocols for DRR. For instance, the PNGRD 2019–2030, Haiti's most recent DRR policy plan, builds on efforts under the 2001 PNGRD, and sectoral laws now include DRR-related provisions. Both PNGRDs have helped to create norms regarding several aspects of DRR in Haiti, for instance on how to communicate about the risks of a disaster, how to react in the face of it and how to construct buildings. The coordination among actors was facilitated through the creation of networks that include actors at the local, subnational, national and international level, including national ministries and local communities, local leaders, donors and volunteers.

**Resource mobilization:** DRR and relief efforts in Haiti use support from multilateral and bilateral aid agencies, such as the World Food Programme, UNDP, the Green Climate Fund and SDAC.<sup>78,79,80,81</sup> The response to disasters in Haiti has also mobilized direct contributions from civil society, for instance via crowdsourcing,<sup>82</sup> the provision of open-source software such as Sahana<sup>83</sup> and support from NGOs.

However, Haiti remains chronically underfunded and is dependent on external funding, with more than 50% of the government budget coming from international aid,<sup>84</sup> which has impacted the effectiveness of the SNGRD. For example, DPC would not have been able to maintain its operations without international funding, notably from UNDP. Following the establishment of the National Bureau for Environmental Assessments in 2015, some private actors started carrying out environmental impact assessments, but private sector investments focused on climate change and DRR remained low in 2019.<sup>85</sup> Haiti receives support from the Green Climate Fund to avoid duplication of efforts and integrate climate change adaptation into development plans, including the PNGRD, and budgeting process. Establishing more independent and stable sources of finance remains a challenge that needs addressing in order to ensure the long-term effectiveness of Haiti's DRR system.

Haiti has made efforts, with international support, to move away from disaster response financing to more strategic – and proactive – disaster risk financing, including through its subscription to the CCRIF insurance pool. Disaster risk financing helps to increase the resilience of countries to natural disasters by establishing more predictable financial resources than international aid can provide. By planning ahead, national governments can invest in shock-responsive safety net mechanisms, registries of beneficiaries, aid logistics and pre-established national disaster funds, which all facilitate rapid assistance to at-risk populations in a reliable, predictable and efficient way. Haiti is developing, in partnership with the Caribbean Regional Resilience Building Facility, a comprehensive disaster risk financing strategy that will likely include coverage by CCRIF SPC, contingent credit lines, emergency funds and coordinated budget reallocations.<sup>86</sup>

**Legitimation:** The PNGRD led to the development of several protocols and procedures for DRR by taking actors and local capacities into account. A clear example of a good practice is the implementation of the National Building Code, which includes provisions for the design of structures against wind and seismic risks.<sup>87</sup> The building code has been praised for adapting technical language to make it more understandable for the general Haitian

75 République d'Haiti (2019).

76 Green Climate Fund (2019).

77 IFRC (2015).

78 Green Climate Fund (2019).

79 Schacher (2014).

80 De Silva and Prustalis (2010).

81 IFRC (2015).

82 Depelteau (2013).

83 De Silva and Prustalis (2010).

84 IFRC (2015).

85 Green Climate Fund (2019).

86 World Bank (2021).

87 IFRC (2015).

population. For example, the building code relies on the creative use of diagrams to increase the understanding and application of the code.

The PNGRD also led to the integration of DRR into strategic documents and national planning. Most of Haiti's sectoral laws contain DRR-relevant elements<sup>88</sup> in order to integrate concerns regarding climate change adaptation into the country's disaster management plan<sup>89</sup> and align the plan with overall development objectives.<sup>90</sup> Nevertheless, the effectiveness of implementation and enforcement of these laws fall short in many areas owing to funding and capacity constraints, especially at the local level.<sup>91</sup> The position of DPC under MICT can lead to a lack of legal certainty and undermine long-term planning. It is unclear whether the new disaster risk management law sufficiently addresses this issue.

**Development of positive externalities:** Haiti's HDI improved to 0.510 from 0.442 between 2000 and 2019, owing in part to improving education and health indicators, such as the mean years of schooling increasing from 3.8 years to 5.6 years and life expectancy at birth increasing from 57 to 64 years respectively. Advances induced through DRR may have had a positive impact on such indicators, but cannot yet be substantiated.

The DRR measures undertaken in Haiti since 2001 have strengthened the functions of its NIS. The measures have also increased actors' capacities, created and strengthened networks of actors, and established important institutions. These were significant steps to increasing Haiti's ability to anticipate, face and resist natural disasters and to recover from their impacts.

Nevertheless, challenges remain, especially concerning long-term planning, financial stability and effective implementation and enforcement, particularly of the PNGRD, owing to funding and capacity constraints, especially at the local government level. Following the development of international instruments such as the Sendai Framework and the Paris Agreement, a new PNGRD (2019–2030) was adopted in 2018. Impacts of this plan were not assessed in this study because it is so new. Nevertheless, it emphasizes the need for continuous monitoring and evaluation to take stock of progress, identify gaps and new developments, and readapt strategies, in order to ensure effective long-term risks management planning.

Table 3 presents the structure–function coupled analysis of Haiti's DRR activities.

88 IFRC (2015).

89 Green Climate Fund (2019).

90 République d'Haiti (2019).

91 IFRC (2015).





**Table 3. Structure–function coupled analysis of the Haiti’s DRR strategy<sup>a</sup>**

Function <sup>a</sup>	Structural element	Interventions in the Brazilian ethanol innovation system	
F1	Knowledge development and diffusion	Actors	<ul style="list-style-type: none"> <li>• Communication campaigns by local volunteers and DPC, using newspapers, television, mobile communication tools and devices, and social media</li> <li>• CTESP provides coordination in awareness-raising activities</li> <li>• Individuals, families and local communities, including local leaders and the media, were targeted in awareness-raising campaigns</li> <li>• Training for actors involved in data collection and management</li> <li>• Research institutes, the Government and development partners provide data and information to the national database established to provide data on disaster risks, vulnerabilities and impacts</li> </ul>
		Institutions <sup>c</sup>	<ul style="list-style-type: none"> <li>• New courses were established at the university level</li> <li>• Decentralization efforts through the empowerment of local committees and initiatives</li> <li>• Creation of sectoral committees for knowledge development and diffusion in certain areas</li> </ul>
		Interactions	<ul style="list-style-type: none"> <li>• Creation of a network of local committees for disaster risk management</li> <li>• Implementation of platforms and mechanisms for institutional and intersectoral coordination, at the strategic and operational level</li> </ul>
		Infrastructure	<ul style="list-style-type: none"> <li>• Training for building more resilient infrastructure</li> <li>• Creation of national databases</li> <li>• Establishment of EWS</li> </ul>
F2	Entrepreneurial experimentation	Actors	<ul style="list-style-type: none"> <li>• Government, local committees, volunteers and international donors</li> </ul>
		Institutions <sup>c</sup>	<ul style="list-style-type: none"> <li>• Sahana open-source software helped with the creation of additional databases that helped to consolidate data management for DRR</li> </ul>
		Interactions	<ul style="list-style-type: none"> <li>• Interactions between networks of the Sahana community, volunteers, donors and public organizations</li> </ul>
		Infrastructure	<ul style="list-style-type: none"> <li>• Use of Sahana open-source software</li> </ul>
F3	Market formation	Actors	NA
		Institutions <sup>c</sup>	NA
		Interactions	NA
		Infrastructure	NA
F4	Influence on direction of search	Actors	<ul style="list-style-type: none"> <li>• The Government established the SNGRD, a national system for disaster risk management coordination in Haiti</li> <li>• Multiple actors contributed to improving coordination under several thematic committees</li> </ul>
		Institutions <sup>b</sup>	<ul style="list-style-type: none"> <li>• Established guidance and protocols on DRR have influenced further plans, protocols and even sectoral laws, helping to integrate DRR into national planning</li> </ul>
		Interactions	<ul style="list-style-type: none"> <li>• Networks strengthened and interaction promoted between different actors (e.g. those implementing teaching, local and national governments and communities)</li> <li>• Networks became reference points for establishing guidance and protocols for DRR in Haiti</li> </ul>
		Infrastructure	<ul style="list-style-type: none"> <li>• Provision of plans, guidance, protocols and better information about geospatial data have helped to influence the building of new infrastructure in Haiti and to integrate more resilience techniques into building practices</li> </ul>

**Table 3. (continued) Structure–function coupled analysis of the Haiti’s DRR strategy<sup>a</sup>**

Function <sup>b</sup>	Structural element	Interventions in the Brazilian ethanol innovation system
F5 Resource mobilization	Actors	<ul style="list-style-type: none"> <li>• Government (i.e. through funding)</li> <li>• International and multilateral financial institutions</li> <li>• International donors (e.g. bilateral and multilateral aid agencies)</li> <li>• Volunteers and civil society (e.g. crowdfunding)</li> <li>• CCRIF</li> </ul>
	Institutions <sup>c</sup>	<ul style="list-style-type: none"> <li>• Public fund established by the law of 1966 for emergency situations</li> <li>• Dedicated budget lines for emergency response and preparedness</li> <li>• Participation in regional insurance mechanisms</li> <li>• Preparation of a disaster reduction financing strategy</li> </ul>
	Interactions	<ul style="list-style-type: none"> <li>• Coordination mechanisms through the Sahana database, for example on who is providing support, what the support is for and what the needs are</li> </ul>
	Infrastructure	<ul style="list-style-type: none"> <li>• Mobilization of financial resources and human resources (volunteers) for reconstruction after natural disasters</li> </ul>
F6 Legitimation	Actors	<ul style="list-style-type: none"> <li>• Sectoral committees help develop standards and protocols, such as the National Building Code</li> </ul>
	Institutions <sup>c</sup>	<ul style="list-style-type: none"> <li>• Development of plans, protocols and procedures</li> <li>• Integration of DRR into strategic documents</li> </ul>
	Interactions	<ul style="list-style-type: none"> <li>• Protocols provide guidelines for interaction, clear structure for communication, and so forth, for preparing for and in the face of natural disasters</li> </ul>
	Infrastructure	<ul style="list-style-type: none"> <li>• Establishment of codes and protocols to facilitate the development of infrastructure that is more resilient to natural disasters than existing infrastructure</li> </ul>
F7 Development of positive externalities	Actors	NA
	Institutions <sup>c</sup>	NA
	Interactions	NA
	Infrastructure	NA

<sup>a</sup> Grey cells indicate that not enough information was available to show that the initiatives have significantly contributed to these functions, but this does not mean that they did not contribute at all; see, for example, the discussion on potential contribution to the improvement of Haiti’s HDI in the function 7: development of positive externalities. NA = not applicable.

<sup>b</sup> See the table 2 for the description of functions.

<sup>c</sup> References to institutions as a structural element in this table are to systems of formal and informal rules.

## 6. Role of the initiatives in Haiti's nationally determined contribution

Haiti's nationally determined contribution (NDC)<sup>92</sup> did not initially mention the PNGRD as an overarching institutional framework to reach climate change goals, but the updated NDC does mention the need for capacity-building and technology transfer for Haiti's contribution to climate change mitigation and adaptation, highlighting the importance of this process being appropriately tailored to national context and needs.<sup>93</sup>

The updated NDC indicates that, in line with its National Policy for the Fighting Against Climate Change, Haiti should focus on:

- Building the capacity of actors such as public servants, the private sector and civil society to address climate change;
- Involving universities in training and research programmes on climate change related issues, and further updating the NDC;

- Increasing government capacity through reforming legal and institutional frameworks and strengthening inter-institutional cooperation;
- Creating an education, communication and awareness plan for the general public;
- Including climate change and sustainable development in school curriculums, starting in primary school.

The PNGRD 2019–2030 does not make a direct link to Haiti's NDC, but it was developed in line with Haiti's Strategic Development Plan and sectoral policies and plans. Leveraging the experience, networks and capacity built for DRR, on the basis of the contribution of past DRR initiatives to strengthening Haiti's NIS functions, is expected to support the adaptation goals set out in the NDC.

92 République d'Haïti (2022). Contribution Déterminée au niveau National de la République d'Haïti. <https://unfccc.int/sites/default/files/NDC/2022-06/CDN%20Reviser%20Haïti%202022.pdf>.

93 République d'Haïti (2022).

## 7. Key success factors and lessons learned

**Taking a systemic approach is important:** DRR requires a systemic approach because multiple factors affect Haiti's vulnerability to natural disasters. In order to have more resilient infrastructure, techniques for building more resilient buildings had to be developed, for example by establishing new protocols for harmonizing construction practices throughout the country and revisiting university curriculum. Furthermore, for new protocols and techniques to become widely adopted across Haiti, the new regulation and codes had to be shared with a range of actors and therefore networks had to be strengthened. While introducing new technological hardware can support DRR efforts, for instance by providing construction materials that are more resilient to natural disasters, the impact will be limited if knowledge – software – and institutions are not also developed to support their uptake.

**Local needs and knowledge should be taken on board:** In the aftermath of a disaster, local communities are crucial in providing support, as communication and transportation networks are often down. Building the capacity of local communities to prevent and react in the face of disasters is therefore crucial. Haiti has undertaken significant efforts to decentralize the administration and empower local communities to engage in DRR. Training and information activities are more effective when conducted in collaboration with local partners, which helps to ensure they are better suited to local needs and knowledge, and that they reach the target audience.

**Strong networks are crucial in coordination:** Strong networks are crucial to providing coordination and ensuring effective disaster risk management and DRR. They help in the sharing and management of information about vulnerabilities of local populations while building capacity of local actors by facilitating access to knowledge. They also support the coordination of actions and the identification of needs, as well as the establishment of codes of conduct and best practices. Weak networks can significantly undermine a country's ability to anticipate, face and resist natural disasters and to recover from their impacts.

**Combined top-down and bottom-up efforts can create synergies:** Using the efforts and infrastructure of bottom-up initiatives such as the Sahana community using Sahana open-source software to create the SOR increased the scope and effectiveness of Haiti's data management and sharing activities. This bottom-up activity contributed to other databases being created and increased the amount of data available for inclusion in those databases.

**Multi-stakeholder partnerships, including international collaboration, are important:** The Haiti case showed the importance of collaborating with a variety of actors, from local to national, including volunteers and international development partners.

**Systemic change requires time:** Systemic change entails changes not only in technologies, educational programmes and regulatory frameworks, but also in behaviour. New collaborations need to be formed, knowledge needs to be put into practice and new routines need to be established. Actors need to collaborate with stakeholders they are not used to collaborating with. New practices under building codes need to be implemented in construction projects. People need to learn new skills and integrate them into practice. New data collection and reporting practices need to be incorporated into the routine of organizations. Experts conducting training need time to identify local population needs and to incorporate feedback into future activities.

**Long-term planning and review are important:** The case of Haiti highlights a need for continuous monitoring and evaluation to take stock of progress, identify gaps and new developments, and readapt strategies, in order to ensure effective long-term planning.

## 8. Good practices for potential replication

The above lessons learned led to identifying the following good practices in the Haiti DRR case that might be replicable in other countries:

- ***Focus beyond hardware innovation:*** Technological hardware such as satellites can have an important contribution to DRR by helping with EWS. However, building the capacity of local actors, creating the right communication channels for sharing knowledge and information, and establishing the right regulatory framework are crucial aspects of a DRR strategy.
- ***Strengthen local capacities while ensuring coordination across different actors and levels:*** Strengthening the capacity of local communities is crucial for effective DRR action. However, there is also a need for harmonizing curricula, protocols and information management mechanisms. Finding the right balance between bottom-up and top-down processes can be challenging, but can contribute to more effective strategies. Furthermore, forming partnerships across a variety of actors can help build capacity and strengthen coordination across levels.
- ***Plan according to longer time frames while allowing monitoring, evaluation and review:*** Since systemic change takes time, planning with time frames that are too short will only be effective to a limited degree in achieving objectives. It is therefore important to plan according to longer time frames while continuously taking account of progress and reviewing plans where necessary.



## About the Technology Executive Committee

The Technology Executive Committee is the policy component of the Technology Mechanism, which was established by the Conference of the Parties in 2010 to facilitate the implementation of enhanced action on climate technology development and transfer. The Paris Agreement established a technology framework to provide overarching guidance to the Technology Mechanism and mandated the TEC and CTCN to serve the Paris Agreement. The TEC analyses climate technology issues and develops policies that can accelerate the development and transfer of low-emission and climate resilient technologies.

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