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From Disaster to Development: Finance provides a platform to empower technology for resilience to climate change

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Abstract

The Sendai Framework for Disaster Risk Reduction emphasizes four principles: understanding risk; strengthening governance; investing in resilience; and building back better. Parametric insurance, offered to nations, provides a financial platform to pool and transfer risk from the regional to the global marketplace. The Caribbean Ocean Assets Sustainability faciliTy (COAST) expands upon the prior success of parametric insurance by providing a new platform to more fully link policy and technology with the aim of increasing disaster resilience. COAST focuses upon the nexus among food and nutrition security, the health of the ocean, and the occurrence of severe weather in the Caribbean Sea. The benefits of COAST - linking the technologies highlighted in the Climate-Smart Agriculture Sourcebook and the goals of the Caribbean Community Common Fisheries Policy - are examined using ghost fishing and spiny lobster as an example. This study points to the potential of using finance to provide a platform to empower technology to increase resilience in the face of a changing climate.

Keywords: disaster risk management; climate change; food security; climate smart agriculture; Caribbean; ocean; fish; COAST; sustainability

1. Introduction

During 2015, four major international agreements provided an important path forward towards global development by 2030. The United Nations [UN] Sustainable Development Goals [1], the Sendai Framework for Disaster Risk Reduction [2], the Addis Ababa Action Agenda on Financing for Development [3] and the 21st Conference of Parties (COP21) to the UN Framework on Climate Change (UNFCCC) offered to the world an opportunity to link the policies and technologies of 'first world problems' and 'third world problems' under a common agenda in recognition of the increasing interconnectedness of the global community. In particular, climate change offered a common threat and a fresh opportunity to engage in policy, finance, and technology solutions that can be scaled among the needs and actions of those living on less than $1.25 per day and the 'global one percent'.

With the continued growth in the global population, migration of the human population towards the coasts, and increasing concentration of people in urban environments, the risks are increasing to the infrastructure upon which humanity depends [4, 5]. While the total number of deaths from natural catastrophes has decreased over the past century, much of this gain is related to the control of epidemics and flooding; whereas deaths due to earthquakes and storms have remained relatively consistent, and the periodic deaths due to droughts (and related reduction in food security) still occur but with moderately lower impacts [6]. In contrast, the absolute number of disasters reported, the number of people reported as affected, and the monetary damage associated with disasters have risen dramatically [6]. In addition, disasters have a disproportionate impact on the poor as they often lack the technology, financial resources, and institutions to rapidly recover from a set back. Furthermore, few countries have the technical knowledge or financial resources to systematically identify risk, to develop and execute plans for risk reduction, and to coordinate agencies for proper preparations ahead of a disaster.

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In recognition of these conditions, the Global Facility for Disaster Reduction and Recovery (GFDRR) was created in 2006 with the goal of 'mainstreaming' disaster and climate risk management into the financial policies and strategies of developing countries [7]. GFDRR provides grants, technical assistance, training, and knowledge sharing with the support of 34 donor countries and 9 international organizations through a partnership hosted by the World Bank and deploying a resource pool of more than $500 million in cumulative pledges and contributions. As noted in the 2015 Guide to Developing Disaster Recovery Frameworks [8], "Enabling communities to recover from disasters requires both good preparedness before the disaster and ensuring that recovery measures are aligned with ongoing development following the disaster."

In parallel to the work of GFDRR, additional development efforts have explored regional financial solutions to address the challenges presented by disaster recovery. For example, in 2007 the insurance company, Caribbean Catastrophe Risk Insurance Facility (CCRIF), was formed as the first-ever multi-national risk pool [9, 10]. Backed with financial contributions of approximately $60 million, CCRIF has served as a global model of a successful company using parametric insurance as a means of providing financial liquidity to Caribbean nations after a devastating tropical cyclone (aka, hurricane), an earthquake, or excess rainfall. The policies offered by companies such as CCRIF offer an opportunity to link technology innovation and good governance through actuarial science to monetize risk as well as to monetize the use of technology and the use of good governance to reduce and manage risk (i.e., an example for individuals is the Snapshot device from Progressive Insurance [11]).

2. The Example of Insurance

Insurance provides a means of hedging against a future, uncertain financial loss through a transaction in which the policyholder pays a premium and the insurance carrier promises to indemnify the potential loss. The process of indemnification requires the insurance carrier to know the value of the asset, to estimate the likelihood of potential loss, and to verify the value of the claim. This process of indemnification is data and labor intensive, and therefore the associated overhead costs can represent a substantial portion of the premium.

One approach to reduce these costs is through the use of a deductible where future losses below a predetermined threshold are not submitted as a claim. By negotiating the value of the deductible, the costs of the premium may be adjusted [12]. A second approach to reduce these costs is through collecting additional information about the likelihood of potential loss [11]. For example, the Snapshot device offered by Progressive Insurance collects information on the driving patterns of an individual and allows the insurer to calculate the premium based upon the driving profile of an individual rather than upon an aggregate profile of other drivers sharing similar traits (i.e., just because a 16 year old male is driving a red sports car, does not necessarily mean that he has a 'lead foot' and 'drives fast and breaks hard') [13]. A third approach to reduce the costs of the data and labor necessary for indemnification is to use parametric insurance [14]. The payout for a parametric insurance plan is not directly related to the specific value of the asset, but rather an ex ante payout is issued upon the occurrence of a triggering event. Often, the triggering event is selected based upon a high probability of damage occurring to the asset, and therefore parametric insurance provides an alternative means of hedging.

The difference between indemnity insurance and parametric insurance can be clarified with an example. An indemnity type collision insurance policy for an automobile would provide a payout in the event of ramming an automobile into a utility pole. Before issuing a policy, the insurer would determine the value of the automobile, and the insurer would determine information about the driver such as age, gender, and prior driving record. Actuarial science would be used to relate the cost of the policy to the value of the automobile, and the cost of the premium would be calculated using the information collected about the driver (i.e., younger, male, and past driving infractions resulting in a higher premium). After the policyholder rammed into the utility pole and submitted a claim, the insurer would determine the amount of damage to the automobile and might investigate the primary and contributing causes to the accident ultimately resulting in an adjustment (i.e., settlement and payment). Depending upon the value of the automobile and the details of the driver, the costs associated with the process of indemnification might represent a substantial portion of the premium.

A parametric insurance policy for the same automobile and the same driver could be structured differently. For example, while many drivers would likely avoid ramming into a utility pole in good weather, the probability of ramming into a utility pole increases when the roadway is covered in snow and ice during congested traffic of the regular workweek rush hour. Therefore, a parametric insurance policy might be designed to offer a payout to the policyholder when more than one inch of snow accumulated over a period of one hour at a nearby regional weather station between the hours of 7am and 7pm on Monday through Friday. The cost of the premium and the value of the payment would be determined using information about the predominant weather patterns in the region, the typical rates of automobile accidents, and the typical values of automobiles. While the parametric policy is intended to have a relationship to the asset and the loss, there is no explicit link for the parametric policy as can be found for the indemnity policy. The parametric policy can be constructed without the overhead costs associated with necessary data and labor-intensive activities required for the indemnity policy.

A hybrid approach may combine all three methods – higher deductible, improved data on the likelihood of loss, and a parametric product—to reduce the cost for insurance coverage.

3. The Caribbean Ocean Assets Sustainability faciliTy (COAST)

In 2004, Hurricane Ivan devastated the small island nation of Grenada inflicting damage of more than $900 million (i.e., equal to nearly 200% of the national Gross Domestic Product (GDP)). In comparison, in 2005 Hurricane Katrina devastated New Orleans and the surrounding areas inflicting damage of more than $150 billion (i.e., equal to approximately 1% of the United States GDP). Both storms, Ivan and Katrina, inflicted tremendous damage in terms of lives lost, homes destroyed, and businesses interrupted. And while the absolute value of financial loss associated with Katrina was substantially higher, the relative impact of the damage as compared to the national GDP was much more severe for the small island nation of Grenada.

The countries of the Caribbean Sea are highly susceptible to extreme weather; 10 of the worlds 50 most disaster prone nations are found in the Caribbean where major hurricanes strike on average every 2.5 years. To address the challenge presented by these storms, Caribbean leaders and development professionals worked together to establish CCRIF as a company in 2007. Originally, CCRIF offered countries the opportunity to purchase parametric insurance products to protect against losses from hurricanes and earthquakes. Recently, CCRIF added an excess rainfall product to its portfolio. The first pay out from CCRIF occurred in 2008 when Hurricane Ike struck the Turks and Caicos Islands. While damages included loss of life, homes, businesses, and infrastructure, one of the major immediate needs during disaster recovery was a lack of adequate food stores. To address the complexities of loss, including protecting food security and nutrition, the World Bank is partnering with the United States of America (USA) Department of State (DoS), the UN Food and Agriculture Organization (FAO), the Nature Conservancy, and others to develop a new insurance product, the Caribbean Ocean Assets Sustainability faciliTy (COAST), that will leverage the ongoing success of similar parametric insurance products offered by CCRIF [15, 16].

The objectives of COAST include: a) creating a new insurance product at an affordable premium; b) informing planning efforts on food security and disaster risk management; and c) promoting technical assistance for climate resilience among participating Caribbean countries. As a new product to be sold by CCRIF, COAST offers an opportunity for countries to buy insurance to help protect their fisheries sector, and hence their food security, from severe weather. The concept has been endorsed by two organs of the Caribbean Community and Common Market (CARICOM): Ministers of Agriculture endorsed COAST at the 9th Caribbean Regional Fisheries Mechanism (CRFM) Ministerial Council in the summer of 2015; and Ministers of Finance and Planning endorsed COAST at the 6th Caribbean Disaster Emergency Management Agency Ministerial (CDEMA) Council in the summer of 2015. In addition, COAST has received an endorsement from the Caribbean Network of Fisherfolk Organizations (CNFO).

As described by the USA DoS, COAST was designed with the following tenants [16]:

1) donor funds are being housed at PROFISH, the World Bank's multidonor trust fund with a mission to promote and facilitate sustainable economic growth and better nutrition through fisheries and aquaculture;
2) a parametric insurance product is being designed using a modification of the existing CCRIF tropical cyclone hazard model by adjusting the trigger for the surge, wind, and/or excess rainfall peril related to a three-to-five year storm event and adjusting the exposure model to focus on coastal infrastructure;
3) to incentivize risk reduction, premiums would be co-financed for countries that develop a country-led, climate-smart food security strategy in the fisheries sector and implement verified climate-smart food security best practices in the fisheries sector utilizing the Caribbean Community Common Fisheries Policy;
4) to incentivize coordinated disaster management, pay-outs would be supplemented for countries that commit to implement country-led plans to ensure that national asset, small and medium enterprises, and smallholder fisherfolk are all provided for after a trigger event;
5) donor funds would be used to financially support technical assistance for countries to develop food security and disaster management plans in the fisheries sector, to co-finance premiums and supplement payouts, and to capitalize the new product at CCRIF; and
6) participation in the insurance will be open to all CCRIF member countries.

The USA DoS has contributed five million dollars to support COAST, and The Nature Conservancy has publically announced a contribution of two million dollars of aligned funding [17].

4. The Need for Technology to Manage Caribbean Fisheries in a Changing Climate

The threat of climate change is well recognized [18], and international organizations such as the FAO have developed policy and technical information to assist regions, nations, and subnational actors (including individuals) to achieve the three pillars of climate smart agriculture, namely: 1) achieve sustainable increases in the productivity of food systems; 2) adapt livelihoods of food producers to the effects of a changing climate; and 3) mitigate greenhouse gases from food production, where possible. The Climate Smart Agriculture Sourcebook, published by the FAO in 2013, is one such resource [19]. Module 10 of the Sourcebook specifically details the policies and technologies available to address climate change for fisheries and aquaculture. For example, Table 10.1 "Overview of practical options for reducing vulnerability in fisheries and aquaculture," identifies "weather warning systems; improved vessel stability/safety/communication" as one of the potential responses to the increased dangers of fishing in the capture fisheries food production area. Similarly, "improve farm siting and design; individual/cluster insurance; use indigenous or non-reproducing stocks to minimize biodiversity impacts," are offered as potential responses to extreme weather events for aquaculture. These examples of climate-smart food security best practices rely upon the innovative use of technology to improve food production.

The need to cooperate and collaborate, "in the conservation, management and sustainable utilization of the fisheries resources and related ecosystems in the Caribbean region in order to secure the maximum benefits from these resources for the Caribbean peoples and for the Caribbean region as a whole," is also well recognized by international organizations including CARICOM [20]. The Caribbean Community Common Fisheries Policy (CCCFP) specifically provides the vision, goals, and objectives as well as outlines approaches to be used to ensure sustainable food production from Caribbean fisheries. Article 11 of the CCCFP states that parties (i.e., countries) are required to, "collect and compile fisheries catch and fishing effort, registration and licensing data as well as biological, ecological, economic, social, aquaculture and any other relevant data – and – develop and maintain national and regional databases and develop and adopt appropriate standards for data and information sharing…" Furthermore, Article 12 states that, "Participating Parties shall formulate, adopt, implement and revise conservation and management measures and, where appropriate, fisheries management and development plans on the basis of the best available information…" These examples from an international, binding treaty rely upon the innovative use of technology to improve effective ecosystem management to enhance food production.

One specific example of the importance of linking the development and implementation of innovative technology with improvements in food security and ecosystem management for fisheries can be identified in the area of 'ghost fishing' and the loss of fishing gear during a storm [21]. As described by the USA National Oceanic and Atmospheric Administration (NOAA), "Derelict fishing gear, sometimes referred to as 'ghost gear', is any discarded, lost, or abandoned fishing gear in the marine environment. This gear continues to fish and trap animals, entangle and potentially kill marine life, smother habitat, and act as a hazard to navigation. Derelict fishing gear, such as nets or traps and pots, is one of the main types of debris impacting the marine environment." [22]. Scientific studies have evaluated the effects of ghost fishing lobster traps in the Caribbean Sea [23]. Of note, the location of traps (bay, inshore, and offshore) and the type of traps (wire, wire-wood hybrid, and wooden) showed statistically significant correlations to the effects of ghost fishing with inshore, wire traps capturing both a greater number of fish as well as a greater number of spiny lobster (aka, Panulirus argus) [23]. The FAO reported in 2007 that the weight of spiny lobsters captured in The Bahamas was nearly 7,000 tonnes with an export value of more than $70 million making export of spiny lobster tails one of the most lucrative export fishing industries throughout the Caribbean Sea [24]. The design and placement of traps depends upon technology. The loss of traps during a storm depends upon technology. Thus, preventing the loss of traps before a storm and replacing lost traps after a storm with more sustainable alternatives represent two examples where technology can be used to improve food security, livelihood of fisherfolk, and the management of the marine ecosystem.

As described by the Caribbean Council for Science and Technology, promoting the adoption of new technologies for sustainable development can be a challenge [25]. For example, "… agencies and/or government ministries responsible for fishing activities in the region, especially in countries of the Organization of Eastern Caribbean States (OECS), have been urging fishermen to invest in bigger boats and gear, and to develop the type of fishing that is more suited to temperate waters with large fish stocks. This approach to fishing has been taken, because the majority of technical assistance programmes comes from the Japanese, who fish in that particular way… On the other hand, the local artisanal fishermen in the OECS, have over the years, developed an approach to fishing that is sustainable. They have generally divided the year into two seasons – line fishing from November to June; and trap fishing from July to October. Coincidentally, part of the later period corresponds with the hurricane season in the region when the fishermen are concerned about their well being" [25]. This example highlights the value of employing country-led strategies for climate-smart food security that are based upon the realities of the local fishery, as well as the importance of using coordinated disaster management ensuring that assets at all scales – including national, small and medium enterprises, plus smallholder fisherfolk – are carefully considered in any country-led plan.

5. Linking Insurance and Technology

The climate is changing, and development professionals have an opportunity to use these changes to increase the uptake of more sustainable technology. On one hand, the typical deterministic approach to development argues that incremental improvements over time – such as increasing investments in official development assistance – is one solution to deal with the challenge of climate change. Yet, these deterministic solutions often suffer from an inability to handle "black swan events" where the conditions fall outside of the norm or expected. For example, predictions of future humanitarian aid are predicated upon predictable patterns of past disasters. Climate change may impact the extent of weather and associated phenomena as well as the variability of changes in conditions (i.e. not only velocity but also acceleration) [18]. Thus, while a traditional approach to a deterministic design for development assumes for planning purpose that once every century an event such as the 100-year flood with associated infrastructure damage will occur, in a world with a changed climate one may observe extreme catastrophic events such as a 100-year flood occurring twice in only a decade [26]. To address these rare events, development professionals need to develop alternative, stochastic approaches to development. Unfortunately, as the degrees of freedom in the design space are increased to account for increased variability in weather, there is a lack of incentives to pay for such open-ended design approaches in the field of development. Thus, to effectively design new technologies to meet the challenges of the variability of a changing climate, new policies are needed that will empower appropriate design (i.e., the type and placement of lobster traps in the Caribbean Sea).

The product, COAST, is an example of the implementation of such a policy. COAST will provide a financial incentive – in the form of a premium reduction – for a country that "… implement(s) verified climate-smart food security best practices (i.e. Climate Smart Agriculture Sourcebook) in the fisheries sector utilizing the Caribbean Community Common Fisheries Policy (CCCFP)." By using aid financing to incentive the adoption of country-led climate-smart technology, the financial model for COAST is similar in structure and purpose to the financial model for a "good driver discount" used to adjust the premium for an indemnity type collision insurance policy for an automobile. Good drivers have fewer accidents. Good drivers pay less for insurance. Good drivers have a financial incentive to use technology properly to reduce the occurrence of an automobile accident. Similarly, countries that employ country-led, climate-smart food security best practices will pay lower premiums for COAST; and these same countries will also have higher financial rewards from well-managed fisheries that are less susceptible to a changing climate because of the proper use of technology.

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