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ENVIRONMENTAL VULNERABILITY AND ECONOMIC RESILIENCE BUILDING: THE CASE OF THE REPUBLIC OF THE MARSHALL ISLANDS

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Abstract. This chapter deals with the interconnection between environmental vulnerability and economic resilience. It is well known that the economies of many SIDS rely heavily on the environment, and therefore the mismanagement of environmental resources often has major economic repercussions. The chapter discusses the vulnerabilities which are mostly associated with water, energy sources, waste generation and fisheries. These vulnerabilities can to an extent be managed so as to reap economic benefits, thereby strengthening the economic resilience of SIDS. The chapter also suggests some potential solutions, mostly based on innovative approaches, chosen as examples as to how interlinkages can be maximised, which, apart from promoting an efficient use of environmental resources, also generate positive spillover effects on the economy. Most of the discussion will relate to the situation in the Marshall Islands.

1. Introduction

While all developing countries face challenges, in addition to those general problems of development, small island developing states (SIDS) experience specific problems arising from the interplay of such factors as their smallness, remoteness, geographical dispersion, vulnerability to natural disasters, ecosystem fragility, transport constraints, a highly limited internal market, lack of natural resources and high dependence on international trade. As a result of these characteristics, SIDS tend to be exposed to exogenous shocks. This is what essentially constitutes the economic, environmental and social

[1] The views expressed in this chapter are the personal views of the author and represent no commitment on the part of the Republic of the Marshall Islands or of the United Nations.

vulnerabilities of SIDS. These three dimensions of vulnerability are interconnected. While it is possible to analyse different aspects of vulnerability in isolation, it is very clear that there are interlinkages and feedbacks that create a very complex picture for analysis.

An obvious interconnection is that between environmental vulnerability and economic resilience. It is well known that the economies of many SIDS rely heavily on the environment, and the mismanagement of environmental resources often has major economic repercussions, notably those on the balance of payments and on government finance.

This chapter discusses the vulnerabilities associated with water, energy, wastes and fisheries, which mostly emanate from environmental factors, but which have major economic impacts. The chapter also suggests some potential solutions, mostly based on seeking innovative approaches for generating positive interlinkages and making efficient use of resources. Most of the discussion will be with respect to the situation in the Marshall Islands.

The rest of the chapter is organised as follows. Section 2 briefly outlines the geography and the economy of the Marshall Islands. Section 3 discusses some features of environmental vulnerability of the Marshall Islands which have major economic impacts, and proposes a number of win-win solutions. Section 4 concludes the chapter.

2. The Marshall Islands: Geography and Economy

The Republic of the Marshall Islands consist of 29 coral atolls and five islands with two vast parallel chains. They are scattered over two million square kilometres of the Central Pacific Ocean, covering 181 square kilometres of land, located between 4° and 19° North latitude and 160° and 175° East longitude.

The environmental vulnerabilities discussed in this chapter relate mainly to physical and geological factors, and the geographic location of the Marshall Islands. The atolls range in height above sea level from one to three metres on average and six metres at the highest. They range in size and length, with Kwajalein being the largest atoll in the world.

There are over 1,225 islands and 870 reef systems in the Marshall Islands with over 800 species of fish and 160 species of coral. It is a fairly typical atoll country, and shares many characteristics with

other coral atoll SIDS. The population of the Marshall Islands was about 57,000 in 2003.

The economy of the Marshall Islands depends heavily on assistance from the US, which accounted for about a half of government revenue in 2003. The modern sector of the economy consists mostly of services, including distributive trades, restaurants and banking and insurance. Construction and copra processing are also modernising.

Agricultural production is primarily subsistence and small scale. The tourist industry is relatively small but is an important source of foreign exchange.

The most important exports of the Marshall Islands are copra cake and oil and tuna. Currently distant water fishing nations pay some $50 million in licensing fees to the Government. However, this amount of income pales into insignificance when compared to the huge potential for further development of the fisheries trade and other ocean resources through the sustainable exploitation of the Marshall Islands' vast exclusive economic zone (EEZ) of almost a million square miles.

The GDP per capita in the Marshall Islands was about US$2,000 in 2003. However, internal differences in income distribution are quite significant, ranging from under $87 in one remote atoll (Lib Island) to $2,426 for groups of persons receiving nuclear testing compensation (see Hart, 2004).

3. The Vulnerabilities of the Marshall Islands

This section focuses on what we consider to be the major source of environmentally-based vulnerabilities, namely water, energy, waste and fisheries. As we shall show, these have important economic repercussions, and the management of these resources can help the Marshall Islands to build its economic resilience.

Water

The availability of freshwater is a real development problem and a key source of vulnerability. Many SIDS have limited freshwater supplies yet lack the financial and technical resources to implement seawater desalination for all of their population. Non-potable water uses for brackish and gray wastewater have been sought to moderate the demand for potable water. Unfortunately, the political and economic reality in many SIDS has not been able to support a holistic

approach to water-supply development and management based on appropriate water-quality requisites for the various water-use sectors to accommodate both potable and non-potable water supplies.

Each island and coastal area is distinct in its hydrologic/geologic setting, topographic and topologic features, rainfall and runoff characteristics, as well as population and its distribution. Water use differs from island to island, as does the economic well-being of the population and fiscal integrity of individual island-state governments. Accordingly, there can be no single strategy for all SIDS with regard to water-quality and water production.

Low-lying, small islands and atolls generally receive limited rainfall and have high evapotranspiration rates. They typically exhibit carbonate or coralline geology, with highly permeable soils, local drainage, and no true rivers. Most drainage is subterranean, with rainfall infiltrating the porous soil and limestone. Lenses of fresh groundwater accumulate from rainfall percolating through the soil zone, and reside in fragile hydrodynamic equilibrium with the underlying saltwater, separated by slight differences in density. The freshwater lenses represent the only naturally occurring freshwater resources in many low-lying, carbonate islands and atolls.

Useful innovations with regard to water. Many innovative strategies have been considered for the sustainable development of fresh groundwater and surface-water supplies for small, arid, oceanic islands. Recent innovations and evolving technologies reveal that a sustainable water supply use can be achieved in many island environments without implementing large-scale desalination. One such innovation relates to scavenger-well couples (see Zach and Lara, 2003). In the case of freshwater lenses, saltwater intrusion toward pumping wells is a vertical phenomenon, referred to as upward coning. Pumping wells can induce a vertical flow component from the underlying saltwater regions, causing the saltwater to migrate upwards and become intercepted by the pumping well. In addition, saltwater coning during groundwater pumping agitates the interface, further widening the zone of diffusion and dispersion, and ultimately reducing the freshwater lens thickness. The development of fresh groundwater supplies under these circumstances has been problematic to island water authorities.

Scavenger-well couples represent an inexpensive, practical solution for the long-term development of fresh groundwater by controlling the upward advance of saltwater, markedly improving and sustaining freshwater recovery. By abstracting water from above and below the

interface simultaneously, scavenger wells provide the only known hydraulic formula for stabilising the interface. By setting specific pumping rates above and below the interface, hydraulic gradients develop within both freshwater and saltwater regions of the aquifer, promoting horizontal flow lines to well screens and maintaining interface equilibrium by slight differences in water density.

But the choice of scavenger wells alone will not be sufficient to ensure long term water sustainability. Climate change will likely alter weather patterns, and will increase the saline intrusion already witnessed. In such scenarios, the only solution will have to be an increasing reliance on desalination.

Energy

For the Marshall Islands, like most SIDS, the nexus between energy services and economic development is complicated by four factors, namely (a) heavy dependence on imported petroleum for commercial energy needs; (b) ongoing loss in preferential access to OECD markets; (c) vulnerability to natural disasters and the adverse impacts of climate change; and (d) limited integration of the energy sector with the other sectors so as to maximise synergy and the efficient use of financial resources.

For the Marshall Islands, imported petroleum (mainly end-use products) is the chief source of primary commercial energy and is used largely for transportation and electricity generation. The cost of petroleum products in the Marshall Islands is among the highest in the world. The cost of electricity generation using petroleum products is therefore also high, given the added costs of fuel distribution for small-scale generation systems. This is exacerbated by the geographic dispersion of SIDS and the distance from suppliers.

The ratio of petroleum imports to total merchandise exports in most of SIDS tends to be comparatively higher than in other developing countries. The almost total dependence of SIDS, with the notable exception of a few countries, on imported petroleum and the relatively low level of conversion efficiency for their commercial and domestic energy needs, is a major source of their imbalances in trade.

The potential savings that would accrue from a reduction in SIDS' dependence on imported petroleum, arising from increased use of energy efficiency and conservation measures and utilisation of renewable energy technologies (RETs), could contribute significantly to improving the economic, social and environmental well-being of SIDS.

For SIDS, the linkages between patterns of energy consumption and production and the effects of global climate change pose particularly serious future challenges to improving the quality of life for the population of SIDS. Although SIDS are among those that contribute the least to the problem of global climate change because of low per capita and aggregate greenhouse gas emissions, the latest report from the IPCC states that these states would suffer most from the adverse effects of global climate change (such as sea-level rise, coastal zone inundation, and escalations in the frequency and intensity of hurricanes and typhoons) which threaten their very existence (IPCC, 2001: chapter 17). The sustainable development of energy resources in SIDS is therefore an urgent priority.

Most SIDS have significant renewable energy resources that could be developed to reduce dependence on imports, thereby strengthening their economic and environmental resilience. Relative to other countries, SIDS have a high and relatively constant supply of solar energy. In a number of SIDS, the use of small scale solar photo-voltaic (PV) power to provide electricity in rural areas and remote islands with isolated pockets of low load densities have been implemented on a pilot scale, but more work on financing and institutional arrangements needs to be done to realise their full potential.

Wind and biomass resources vary significantly with location, both within and between countries; however, technological advancement in recent years makes wind power a cheaper option for commercial energy services in many SIDS. Biomass from agriculture, either as by-products in agro-industry (bagasse from the processing of sugarcane, or waste from livestock production or fish processing) represents not only a potential substitute for fossil fuel, but an opportunity to improve local agricultural productivity and economic profitability, directly contributing to quality of life improvements and reducing vulnerability. In some SIDS, the combination of energy from the agricultural sector combined with wind and hydro sources represent opportunities for base load and peak electricity production.

Also untapped is the vast energy resource of the tropical oceans in which many SIDS are located. This resource has the potential not only to provide substitutes for fossil fuel but also to provide commercial energy at a cost that will create opportunities for the development of energy-intensive industries in SIDS. There is therefore a need for a greater degree of understanding of how best to encourage technology transfer and the national/regional

adaptation of Renewable Energy Technologies (RETs) and energy efficiency, and how this could reduce the need for government to provide subsidies. The Marshall Islands are now taking an active interest in regional mechanisms to improve information dissemination about energy efficiency and renewable energy.

Innovative approaches with regard to energy. There are opportunities for overcoming the multiple challenges associated with energy. One proposed solution for SIDS would be to pursue Ocean Thermal Energy Conversion systems (OTEC). The system produces electricity, potable water and clean saltwater for high-end aquaculture (see Binger, 2004).

Wastes

The management of urban organic wastes (sewage, household garbage, and paper from offices) is a growing concern for SIDS. The small land area limits the availability of waste disposal sites and the relatively high population densities contribute to the waste problem. The "out of sight out of mind" solution is of course not an option for most SIDS.

The Barbados Programme of Action for the sustainable development of SIDS (BPoA) identifies the following as major problems in waste management in SIDS: (a) pollution of groundwater, surface and marine pollution from land-based sources such as domestic sewage, industrial effluents and agricultural runoff—they carry risks for human health, and can degrade habitats such as coral reefs, and tourist attractions such as beaches; (b) the management of toxic substances such as pesticides, waste oil, heavy metals—most SIDS do not have the systems or physical capacity to isolate and dispose of such substances; (c) sewage treatment facilities—in many SIDS such facilities are inadequate either because they are overloaded or because of a shortage of trained manpower—as a result, poorly-treated effluent is often discharged into the environment; (d) ineffective regulations— some SIDS have spent a considerable amount of time and financial resources on developing regulations, however, regulations have not been very effective in many cases because of inadequate institutional and human resource capacities to enforce them; (e) lack of waste disposal sites, and; (f) lack of facilities for storage and disposal of hazardous wastes (see United Nations, 1994).

Innovative waste management. Apart from the well-known reduce, reuse and recycle options, the problem of waste in SIDS can also be

addressed in a cost effective manner through the use of waste-to-energy systems or biogas systems which would not only contribute to increased energy independence but help to address pollution and public health concerns, as well as providing a source of organic fertilizer.

Fisheries

The Pacific island countries have one of the most vibrant and vital fishing regions in the world. The tuna fisheries is the largest in the world. The catch has been increasing in recent years, but studies suggest that it is still within the sustainable ranges (Government of the Marshall Islands, 2004).[2] It is of course important that over-exploitation does not occur in the Pacific island countries (PICs) as has been happening in many other regions.

Most commercial exploitation of the tuna fisheries of the Marshall Islands is carried out by foreign fishing fleets. While the treaties which the PICs have been able to negotiate with these partners have been an important source of income, it is no doubt a concern that these countries today only receive a small proportion of the true value of this fishing industry. Figures of around $1.7 to $2 billion are cited as the real value, while license fees collected are often less than a small percentage of that value. The average yearly catch of one million tons should ideally net a better profit for the PICs. In addition while it is clear that these foreign fishing fleets have beneficial financial impacts on the ports in which they refuel and re-supply, there have also been reports of pollution and dumping from these fleets.

The Marshall Islands and other ocean SIDS face challenges with regard to the exploitation of the EEZ. These are by no means easy to contend with. However, it is impressive to see how well the region has been able to work together so far in drafting a regional agreement on Highly Migratory Fish Stocks. In articulating their well founded priorities to those distant water fishing nations, Pacific SIDS are clearly establishing precedence for regional cooperation on fisheries for the other regions.

Another challenge faced by the Marshall Islands with regard to fisheries is to maintain growth in the industry and create inter-industry connections with the other sectors of the economy. This calls

[2] For further information on the fisheries industry in the Pacific region, see Forum Fisheries Agency – http://www.ffa.int .

for an integrated approach in the industry's development to promote economic linkages and thereby increase the value-added arising from fisheries.

Integrated approaches and policy coordination. Most of the solutions proposed above require an integrated approach to overcome vulnerability and step up economic resilience. In turn, this calls for policy coordination. National sustainable development strategies are possibly the best means of achieving this. The recognition of this requirement is in itself a major step, and government of SIDS, including the Marshall Islands, will be better served through an integration process.

The Republic of the Marshall Islands has taken steps through its National Economic and Social Summit (NESS) process. The NESS has helped in the identification of what is required for sustainable development in the country, and has set the stage for improving intra-governmental cooperation and stakeholder involvement. But it has yet to lead to a formal national sustainable development strategy. Like many SIDS, the Marshall Islands is finding this ultimate step to be fairly difficult. It raises an important question, echoed by many SIDS, as to how to practically implement such a strategy, since this will require substantial financial and human resources.

4. Conclusion

This chapter has argued that environmental vulnerability has important economic repercussions. We have focused on a few areas of vulnerability, namely water, energy, waste and fisheries. There are of course other sources of environmental vulnerability of SIDS (see SOPAC, 2002) including exposure to natural hazards. In this chapter we have dealt with those that can be managed so as to reap economic benefits, thereby strengthening the economic resilience of the islands.

Moreover we have been very selective in the solutions proposed. Needless to say there are many innovative approaches that are being developed to manage environmental resources, with the aim of using them more efficiently and at the same time minimising environmental damage. The solutions proposed in this chapter were chosen as examples as to how certain approaches can maximise interlinkages, that apart from promoting efficient use of environmental resources, also generate positive spillover effects on the economy.

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