



Unlocking the full potential of the blue economy:
Are African Small Island Developing States ready to
embrace the opportunities?



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This paper also builds on the assessment missions undertaken by a team of the African Climate Policy Center (ACPC) in all African SIDS to support the climate change adaptation efforts underway and to address the adverse effects of climate change in key economic sectors such as tourism and fisheries as well as unlocking the potential of renewable energy sources in African SIDS.

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DISCLAIMER

While every effort has been made to ensure the veracity of this research and we remain hopeful that it will be used to stimulate discussion in the public domain and inform decision-making in building African SIDS potential towards blue economy, the ECA, as an initiator of the project and any of its sponsors, disclaim all liability for any loss, damage or expense arising from the use of this information.

ACRONYMS AND ABBREVIATIONS

AIMS	Atlantic, Indian, Mediterranean and South China Sea
BPoA	Barbados Programme of Action
CDM	clean development mechanism
EEZ	exclusive economic zone
FDI	foreign direct investment
GDP	gross domestic product
LSCI	Liner Shipping Connectivity Index
NAMAs	nationally appropriate mitigation actions
REDD+	reducing emissions from deforestation and forest degradation from developing countries
SIDS	small island developing States

SUMMARY

Ocean and coastal zones are of great importance to small island developing states (SIDS). In recent years there has been increasing focus on the emerging concept of the “blue economy”, based on the original development within the United Nations of the concept of the “green economy”. SIDS regard the blue economy as an approach to sustainable development that is better suited to their particular circumstances, constraints and challenges. It advocates the same desired outcome as the green economy, which is, “improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities” (UNEP, 2012).

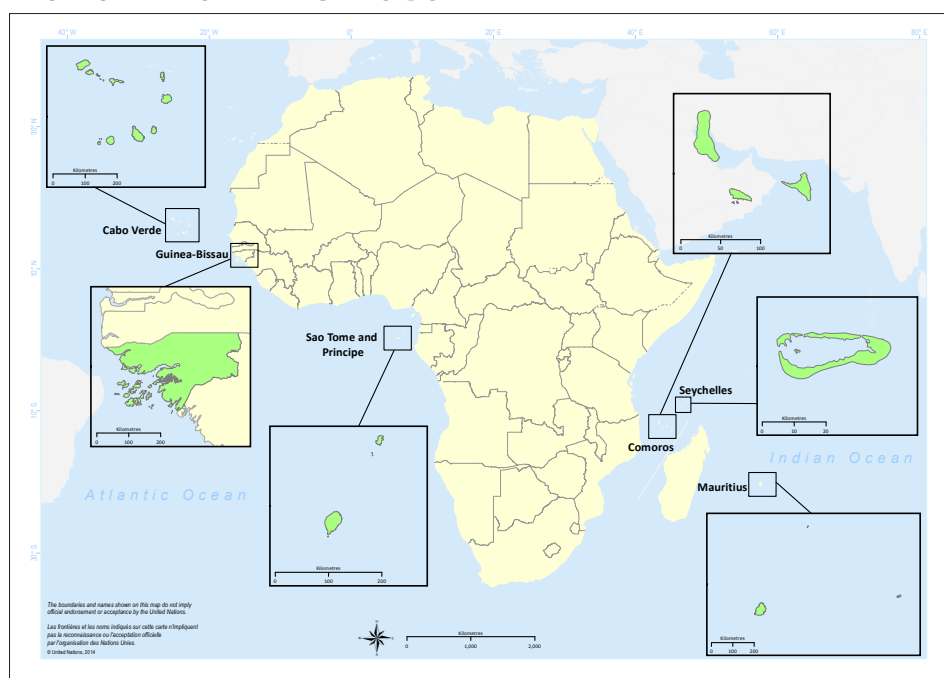
The blue economy focuses on areas such as fishing, shipping and maritime transport, coastal tourism, marine energy (fossil and renewable, such as wind energy, tidal energy, and energy derived from marine microbial fuel cells); pharmaceutical and cosmetic industries, genetic resources, general sea-based products and blue carbon trading opportunities. This

approach, based on SIDS’ strengths in coastal and marine sectors, offers SIDS the prospect of sustainable and environmentally sound and moreover socially inclusive economic growth.

The six African SIDS (Cabo Verde, the Comoros, Guinea-Bissau, Mauritius, Sao Tome and Principe, and Seychelles) – are all highly dependent on coastal and marine sectors. The blue economy sectors in these six countries are in various phases of development, facing both challenges and great potential.

The potential for development for each sector differs for each African SIDS due to specific ecological, geographical, political circumstances, and technological and human expertise. It also poses challenges mostly in the form of environmental externalities and socioeconomic consequences, for local populations. Development of the different sectors should take the conflicting interest of other

FIGURE 1: LOCATION OF THE SIX AFRICAN SIDS



sectors into consideration, and the environmental and socioeconomic consequences.

The objective of the present report is to examine the importance of the blue economy for African SIDS and

the future challenges and opportunities this sector presents. As there is no global blue economy strategy at present, this report also adds to the global blue economy strategy for SIDS in general.

I. INTRODUCTION

Small island developing states (SIDS) are small islands or low-lying coastal countries located in the tropical and subtropical regions (partly) surrounded by oceans (Boto and Biasca, 2012). Though there is no commonly accepted definition of what constitutes as SIDS (Boto and Biasca, 2012; Polido, João, and Ramos, 2014), they are still considered to be a separate group by the United Nations (see figure 1) as they share similar sustainability challenges related to their specific characteristics such as small size; isolation; susceptibility to natural disasters; vulnerability to external shocks and excessive dependence on international trade (Guillotreau, Campling, and Robinson, 2012; Mimura et al., 2007; Nurse et al., 2014).¹ The present report will focus on the 52 SIDS that are officially recognized by the United Nations.² Of the 52 UN recognized SIDS, 23 are located in the Caribbean, 20 in the Pacific and 9 in the Atlantic, Indian, Mediterranean and South China Sea (AIMS) of which 6 are located in Africa (see figure 2 and table 1).³

SIDS were first formally recognized as a distinct group by the United Nations in 1992 at the Conference on Environment and Development held in Rio de Janeiro, Brazil (Boto and Biasca, 2012). In 1994 the first United Nations Global Conference on the Sustainable Development of Small Island Developing States was held in Bridgetown, Barbados). The Conference adopted the Barbados Programme of Action for the Sustainable Development of Small Island Developing States (BPoA) which identified 14 priority areas and the necessary actions to be taken at the national, regional and international level.⁴ In 2005 the Mauritius

Strategy for Further Implementation of the Programme of Action for Sustainable Development of Small Island Developing States (MSI) was adopted, which identified further critical areas in the BPoA and new emerging issues (Boto and Biasca, 2012). MSI further strengthened the social and economic dimensions for the BPoA by placing more emphasis on matters such as health, culture, knowledge management, education for sustainable development, consumption and production. It also emphasized the importance of trade and trade liberalization for SIDS, and it gave a focus on the graduation from least developed country status (United Nations, 2005). MSI was followed by the MSI +5 Review in September 2010, which consisted of several regional meetings and two interregional meetings. The last meeting adopted a political declaration that elaborates new and renewed commitments to implement BPoA and MSI.

Despite the common characteristics of SIDS, they are by no means homogenous, varying by geographic, physical, climatic, social, political, cultural, and ethnic characteristics as well as their differing levels of economic development (Nurse and others 2001). African SIDS (Cabo Verde, the Comoros, Guinea-Bissau, Mauritius, Sao Tome and Principe, and Seychelles) represent 6 of the 9 SIDS under the header African, Indian, Mediterranean and South China Sea (AIMS) (see table 1), the other three are scattered across other oceans. As the AIMS group (9 SIDS) is much smaller than the Caribbean (23 SIDS) and Pacific (20 SIDS) group and is less homogenous because these countries are not located in the same geographical region, there has been less attention for AIMS SIDS or the subgroup of African SIDS within AIMS.

A. BLUE ECONOMY

At the United Nations Conference on Sustainable Development (Rio+20) in 2012, the concept of the “green economy”, first launched in 1989, was further

1 See also www.sids.org

2 See also <http://unohrrls.org/about-sids/>.

3 See also www.sids.org.

4 Priority areas are: climate change and sea-level rise; natural and environmental disasters; management of wastes; coastal and marine resources; freshwater resources; land resources; energy resources; tourism resources; biodiversity resources; national institutions and administrative capacity; regional institutions and technical cooperation; transport and communication; science and technology; human resource development

TABLE 1: LIST OF SIDS CATEGORY OF SIDS

Caribbean Sea (23): Anguilla, Antigua and Barbados, Aruba, Bahamas, Barbados, Belize, British Virgin Islands, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti,* Jamaica, Montserrat, Netherlands Antilles, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, United States Virgin Islands.
The Pacific Ocean (20): American Samoa, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati,* Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea, Samoa, Solomon Islands,* Timor-Leste,* Tonga, Tuvalu*, Vanuatu.*
Africa, Indian Ocean, Mediterranean and South China Sea (AIMS) (9): Bahrein, Cabo Verde, the Comoros,* Guinea-Bissau, Maldives, Mauritius, Sao Tome and Principe,* Seychelles, Singapore.

Source: www.sids.org

developed. The green economy is based in the context of sustainable development and contributes to eradicating poverty, sustaining economic growth, enhancing social inclusion, improving human welfare, and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the Earth's ecosystems. However, throughout the preparatory process for Rio+20 many coastal nations questioned whether the focus on the green economy was applicable to them and stressed a focus on blue economy. As a result, institutional efforts were made to expand the *Blue* aspect of the Green economy as embodied in the "Green Economy in a Blue World" report (UNEP, 2012). Coastal and island developing countries have remained at the forefront of this blue economy advocacy, recognizing that the blue economy offers an approach that this kind of sustainable development approach is better suited for their particular circumstances, constraints and challenges. The Blue Economy advocates the same desired outcome as the Green economy namely: "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP, 2012). At the core of the blue economy is the de-coupling of socioeconomic development from environmental degradation. To achieve this, the blue economy approach is founded upon the assessment and incorporation of the real value of the natural (blue) capital into all aspects

of economic activity. Efficiency and optimisation of resource use are paramount whilst respecting environmental and ecological parameters. The blue economy approach recognizes the role played in each economy and the potential to develop this sector further in the future.

The blue economy focuses on areas such as: fishing; shipping and maritime transport; coastal tourism; marine energy (fossil and renewable); pharmaceutical and cosmetic industries, genetic resources and general sea-based products; and blue carbon trading opportunities. The blue economy approach thus offers the prospect of sustained environmentally sound but also socially inclusive economic growth based on SIDS strengths in coastal and marine sectors.

In recent years there has been increased attention in SIDS for the special set of opportunities 'blue economy' can offer. The importance of marine and coastal resources to SIDS is evident, and has been elaborated in numerous international forums. The blue economy offers the potential for SIDS to alleviate one of their defining obstacles to sustainable development; a narrow terrestrial resource base. As SIDS are island or insular territories they are (partly) surrounded by oceans. SIDS are blessed with vast ocean territories, large intricate coastlines and commonly have large Exclusive Economic Zones (EEZs) in comparison to their

land area. Accordingly, the ocean and coastal areas and all their ecosystem functions are thus of crucial importance for SIDS. The majority of the population and infrastructure are located in coastal zones. Maritime transport, international trade in fisheries, food security for coastal communities, and coastal tourism are highly important in SIDS since they all depend on the sea. Ocean and coastal areas present excellent opportunities for development which can yield significant economic and social benefits for coastal populations while protecting environmental integrity. Marine and coastal biodiversity provide many valuable services and products to people, including climate regulation, cancer-curing medicines, genetic resources, carbon storage, cultural value, and sustainable livelihoods among others. The oceans and coasts, however, also face considerable challenges such as increasing degradation, depletion of oceans, pollution, population rise and climate changes. SIDS are prone to climate change effects such as sea-level rise, increased intensity and frequency of events (such as El Niño Southern Oscillation [ENSO]), sea surface temperature

rise and ocean acidification (Nurse and others 2014; Boto and Biasca, 2012). These challenges compromise the ability of the ocean to continue providing essential resources and critically important services. These drivers exacerbate many of the existing challenges to sustainable oceans management and endanger the welfare of coastal nations and particularly that of SIDS. The blue economy concept is emerging also partly to reverse this current trend of continuous degradation of marine ecosystem and its functionalities.

The objective of the present report is to examine the importance of the blue economy and the future challenges and opportunities this sector entails for African SIDS. As there is currently no global blue economy strategy, the report also adds to the global blue economy strategy for SIDS in general. It will present: (1) the vulnerability of African SIDS; (2) a description and the potential of each blue economy sector; (3) the challenges that different sectors face; and (4) conclusions and recommendations.

FIGURE 2: MAP OF SMALL ISLAND DEVELOPING STATES RECOGNIZED BY UN



Source: http://en.wikipedia.org/wiki/Small_Island_Developing_States

II. VULNERABILITY OF AFRICAN SMALL ISLAND DEVELOPING STATES

SIDS are considered vulnerable because of their population and size; insularity and remoteness, economic vulnerability due to heavy reliance on a limited number of natural resources, high import dependency and dependency on global markets; and geopolitical weakness (Boto and Biasca, 2012; Easter, 1999; Nurse and others, 2014; Monnereau and others 2015). SIDS are not homogenous however and one can expect regional differences between the SIDS from Caribbean, Pacific and African SIDS and all other coastal nations (excl. Least Developed Countries (LDCs).

Table 3 explores some of the main differences in vulnerability discussed above between the different SIDS group and other coastal nations. The table shows that the population of African SIDS is the second smallest of all groups. Only the Pacific SIDS have a smaller average population. Caribbean SIDS have a substantially higher number with other coastal nations having a much larger population. African SIDS are significantly smaller than all other country groups in terms of land size in km², with the average land area per country only 25 per cent of the second smallest group, Caribbean SIDS. The EEZ of African SIDS is large with an average of 639,638 km² per country, while Pacific SIDS have a larger EEZ. However, when their

EEZs are divided by land area, only Pacific SIDS have a higher EEZ per land area ratio. The percentage of the population living within 10 km from the coastline shows that Pacific SIDS have the highest percentage with 89 per cent, closely followed by African SIDS with 84 per cent and Caribbean SIDS with 79 per cent. Other coastal nations show significantly lower levels of population living in the coastal zone. Gross domestic product per capita on average for African SIDS is low. It is the second lowest of all groups with only Pacific SIDS having a lower GDP per capita. GDP per capita in African SIDS is approximately half that of Caribbean GDP per capita and only 40 per cent of the average GDP per capita of other coastal nations. Table 2 shows that African SIDS are indeed very small in land area and population while they have a very low GDP per capita. Their EEZ in general is vast in comparison to other groups and particularly so when their EEZ is compared to land area. This implies potential as well as challenges for the development of the blue economy also because a very large percentage of the population (84 per cent) lives within 10 km from the coastline (SEDAC 2010).

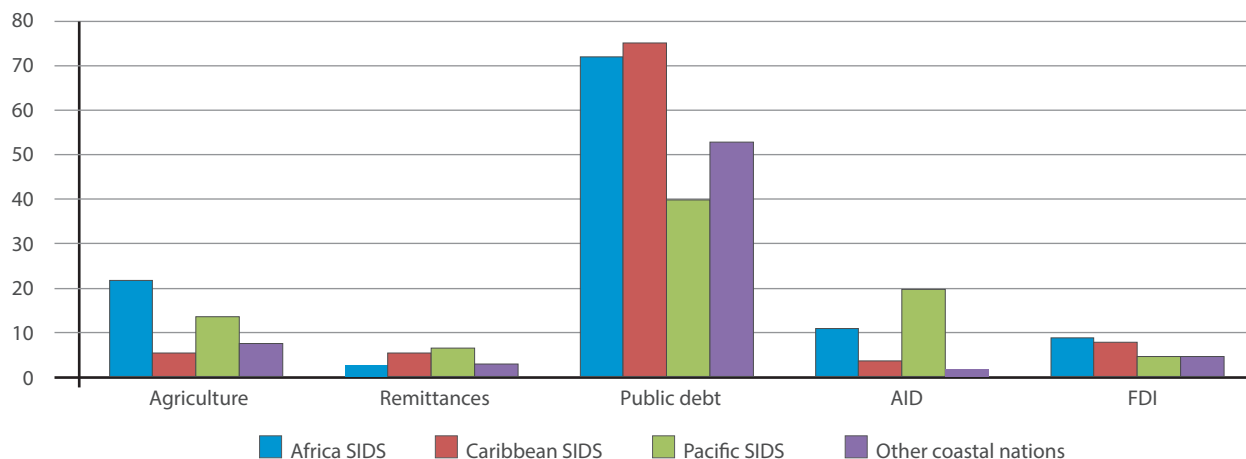
African SIDS have the highest percentage of agricultural contribution to GDP (see figure 3). Their public debt (as a percentage of GDP) is extremely

TABLE 2: GENERAL CHARACTERISTICS OF THE THREE SIDS GROUPS AND OTHER COASTAL NATIONS

	African SIDS	Caribbean SIDS	Pacific SIDS	Other coastal nations
Population (average per group) ¹	757,351	1,839,885	594,189	55,525,137
Land area km ² ⁽²⁾	6,244	25,988	30,966	959,720
GDP per capita ³	8,433	15,370	7,024	21,108
EEZ ⁴	639,638	127,420	1,430,636	878,629

Source: 1 World Factbook (Central Intelligence Agency, 2012). Available from <https://www.cia.gov/library/publications/download/download-2012/index.html>; 2 WorldBank 2011; 3 Ibid; 4 For more information on exclusive economic zones see www.seaaroundus.org

FIGURE 3: COMPARISON OF ECONOMIC CHARACTERISTICS BETWEEN THREE SMALL ISLAND DEVELOPING STATES GROUPS AND OTHER COASTAL NATIONS

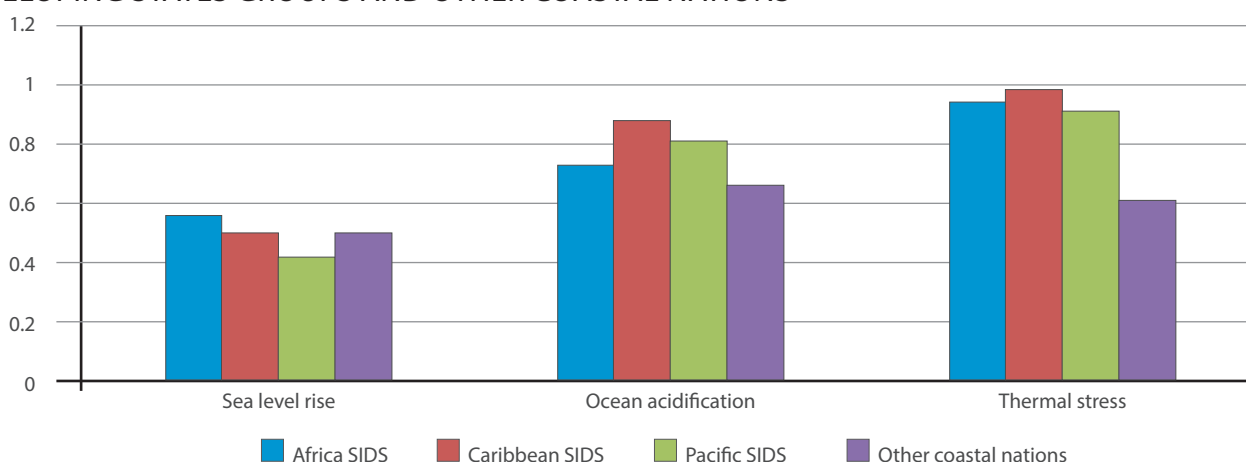


high in comparison to Pacific SIDS and other coastal nations, while their remittances as a percentage of GDP is very low. Official aid as percentage of GDP is much lower than Pacific SIDS yet much higher than Caribbean SIDS. Foreign direct investment (FDI) is relatively high in terms of percentage of GDP. Considering the GDP per capita is low as well as the magnitude of the African SIDS economies, the absolute FDI for African SIDS is low.

A. CLIMATE CHANGE VULNERABILITY OF AFRICAN SMALL ISLAND DEVELOPING STATES

African SIDS are responsible for only 0.02 per cent of green house gas emissions⁵ but are expected to be disproportionately affected by the threats of climate change (UNFCCC, 2007), due to their social, economic and geographical characteristics (Guillotreau and others, 2012). Figure 4 shows various aspects of vulnerability of the African SIDS in the face of climate

FIGURE 4: CLIMATE CHANGE VULNERABILITY CHARACTERISTICS OF THREE SMALL ISLAND DEVELOPING STATES GROUPS AND OTHER COASTAL NATIONS



⁵ Based on annual emissions in 2009 <http://cdiac.ornl.gov/trends/emis/top2009.tot>

change: sea level rise (SLR), ocean acidification, and thermal stress. What about one of the major factors that affects the SIDS: the increase of the number and intensity of storms and climate events?

Figure 4 shows that African SIDS are particularly vulnerable to sea-level rise (SLR) in comparison to other country groups. Only coastal least developed countries (also mostly located in Africa) show a similar amount of sea level rise. A rise in sea-level results in coastal inundation and habitat loss; and storm surges, and coastal flooding can lead to death, injury, ill-health or disrupted livelihoods in low-lying coastal zones. Increased storm frequency and intensity may also imply that more days at sea are lost due to bad weather, an increased risk of accidents, and a decrease of safety at sea for fishermen (Daw, Adger, and Brown, 2009; Mahon, 2002). High flood risks affect the coastal infrastructure in these areas such as e.g. harbours and ports, fishing landing sites, boats, and fisheries processing plants.

Over the next decade and beyond, cool-and-warm water coral communities will be at an increasing risk of being negatively affected by ocean acidification, especially because the ocean acidification will be combined with rising temperature extremes (Pörtner and Karl, 2014). Ocean acidification results in reduced growth and survival of commercially valuable shellfish and other calcifiers such as reef-building corals and calcareous red algae (Burkett and Suarez, 2014). Changes in ocean acidification show that African SIDS have experienced the least level of ocean acidification of the three SIDS groups and least developed countries. However, they still experience higher levels of ocean acidification than other coastal nations.

Coral reefs are extremely important for biodiversity, providing a home to over 25 per cent of all marine life. They are also vital for various ecosystem services. They provide nurseries for many species of commercially important fish, protection of coastal areas from storm

waves, and are a significant attraction for the tourism industry. Increasing greenhouse gas emissions cause ocean temperatures to rise, which can induce coral bleaching, one of the most visually dramatic impacts of climate change on corals. When the ocean warms, the oxygen content reduces, and corals become 'bleached' as a result of damages to the algae that live symbiotically with corals. Thermal stress for example, abnormally high ocean temperatures can also cause corals to bleach. This threat has added to the local pressure on many reefs over the past 10 years (Burke and others 2011) and the rapid increase of greenhouse gases in the atmosphere present a growing threat to coral reefs in the future. Thermal stress in African SIDS (as figure 4 shows above) is high and only slightly lower than that of the Caribbean SIDS. Coral reefs in African SIDS can thus be expected to suffer from coral bleaching in the future.

B. AFRICAN SIDS

The six African SIDS range in size from the smallest land surface: Seychelles with 460 km² to the largest African SIDS Guinea-Bissau - a coastal country of 28, 120 km² with an estimated 80 islands located in its coastal waters.

Table 3 shows that Guinea-Bissau also has the largest population with over 1.6 million inhabitants while Seychelles only has approximately 5.5 per cent of that population with 90,849 inhabitants. Despite the fact Guinea-Bissau has the largest land area and largest population, the EEZ of Guinea-Bissau is the smallest of all six African SIDS. Seychelles is composed of 115 small islands which represent the largest number among African SIDS and as a result it has a significant extended EEZ of 1.3 million km². Seychelles and Mauritius have a very small land area; of the 173 coastal nations in the world they only come in at the 154th and 137th place in land area. However, their EEZ is very high as they list number 26th and 28th in absolute EEZ size globally. Together Seychelles and Mauritius have one of the world's biggest continental shelves, an

TABLE 3: GENERAL CHARACTERISTICS OF THE SIX AFRICAN SIDS

	Land km ²	Population (*1000)	EEZ (*1000)
Cabo Verde	4030	531.046	796.84
Comoros	1861	752.288	164.691
Guinea-Bissau	28,120	1,660.87	106.117
Mauritius	2030	1,322.238	1,272.787
Sao Tome and Principe	960	186.817	165.364
Seychelles	460	90.846	1,332.031

indication of the large potential of the blue economy. Nevertheless, African SIDS show a significant EEZ in comparison to land area which provides great potential of the blue economy.

Table 4 shows that GDP per capita is highest in Seychelles with an average GDP per capita of 26,200 USD in comparison to the lowest GDP per capita in Guinea-Bissau of 1100 USD. This shows the large differences between the two different groups within the African SIDS; Mauritius and Seychelles on one side and Cabo Verde, the Comoros, Guinea-Bissau, and Sao Tome and Principe on the other. There are large differences in GDP per capita, with Seychelles and Mauritius having high levels, while Cabo Verde, Guinea-Bissau, the Comoros and Sao Tome and Principe have very low GDP per capita. The latter three are also considered Least Developed Countries. Guinea-Bissau and the Comoros are clearly the most dependent on agricultural production with

approximately half of their GDP stemming from agriculture. Foreign direct investment (FDI) is highest in Sao Tome and Principe, followed by Seychelles and Cabo Verde. Official aid is also highest in Sao Tome and Principe as it makes up nearly one third of the total GDP. Cabo Verde and Guinea-Bissau also have large shares of official aid (14 per cent and 12 per cent respectively), followed by 9 per cent in the Comoros. Mauritius and Seychelles receive a very small percentage of official aid (2 per cent for both). Remittances in Cabo Verde are highest with 9 per cent, followed by Guinea-Bissau with 6 per cent. Public debt is highest in Cabo Verde, followed by Sao Tome and Principe, Seychelles and Mauritius. Of all six countries Sao Tome and Principe and Cabo Verde are thus most dependent on FDI, official aid and remittances for their economy while they face the highest public debt ratio. Development of the blue economy is thus for these countries perhaps even more important than for the other four.

TABLE 4: ECONOMIC CHARACTERISTICS OF THE SIX AFRICAN SIDS

	GDP per capita	Agriculture (%GDP)	Foreign Direct Investment	Official Aid (% GDP)	Remittances (% GDP)	Public bet (% GDP)
Cabo Verde	4100	8	10	14	9	86
Comoros	1300	46	1	9	Na	na
Guinea-Bissau	1100	56	1	12	6	na
Mauritius	15,600	4	4	2	0	58
Sao Tome and Principe	2300	14	23	30	2	76
Seychelles	26,200	2	13	2	0	68

III. BLUE ECONOMY SECTORS IN AFRICAN SMALL ISLAND DEVELOPING STATES

This chapter investigates African SIDS and key blue economy sectors: 1) extent of involvement; 2) development opportunities; and 3) challenges for further development.

A. FISHERIES

The fisheries sector is of great importance to African SIDS for livelihood and employment, food security and foreign exchange earner. The importance of these different aspects of the fisheries sector, however, differs per country. For Sao Tome and Principe, Seychelles and Mauritius the fisheries sector is important for livelihood and employment as 8 percent, 6 percent and 5 per cent respectively of their economic active population are employed directly in the fisheries sector (see table 5). A multitude of people are dependent on the fisheries sector in all six countries as a result of indirect employment (boat builders, traders, processors etc.) and household dependents. For food security fish is also mostly consumed in Sao Tome and Principe (see figure 5), Seychelles and Mauritius. The Comoros is least

dependent on fish for animal protein with only 0.8 of their daily animal protein consumption stemming from fish. All countries have a large small-scale fisheries sector which often involves handline fishing, hooks and sometimes seines. The fish is often processed in a limited fashion onshore. However in some cases, such as in Cabo Verde, small-scale fishers catch of tuna and mackerel is processed and exported in cans.

Fish export is most important in Seychelles, Cabo Verde and Mauritius (52 percent, 43 per cent and 15 per cent respectively of total exports). These countries are most dependent on fish exports (mainly tuna) as a source of revenue. Fish imports in the six countries is close to nothing with only the Comoros spending 1.5 per cent of total merchandise imports on fish, and Sao Tome and Principe spending 0.1 per cent. African and Indian Ocean waters are host to a number of important fish species that are caught by EU vessels. The EU has bilateral fisheries agreements with non-EU countries. The countries are paid a fee per

TABLE 5: FISHERIES SECTOR CHARACTERISTICS

	Fisherfolk ¹	Fisherfolk %Eco- nomic Active Population ²	Fish nutrition (% of daily animal protein) ³	Fish exports (*1000) USD ⁴	Fish exports % of total exports ⁵
Cabo Verde	4817	2	11	14931	43
Comoros	10385	3	56	0	0
Guinea-Bissau	9800	2	4.1	3070	3
Mauritius	27469	5	17	284534	15
Sao Tome and Principe	4520	8	46	9	0
Seychelles	2302	6	47	210200	52

Source: 1. Monnereau, and others, *Vulnerability of the fisheries sector to climate change impacts in small island developing States and the wider Caribbean : early findings* (p. 45), (2013); 2. Ibid.; 3. Food and Agriculture Organization of the United Nations, *Food balance sheets and fish contribution to protein supply in 2009* (Rome, FAO, 2009); 4. Food and Agriculture Organization of the United Nations, *The relative importance of trade in fishery products in 2009* (Rome, FAO, 2009); 5. Ibid

FIGURE 5: PRAO CANOE WITH SAIL IN SAO TOME AND PRINCIPE



boat annually as well as a fee per metric ton of tuna caught. They are intended to allow EU vessels to fish for surplus stocks in that country's exclusive economic zone (EEZ), in a legally regulated environment. These agreements have been made with five African SIDS, notably: Cabo Verde, the Comoros, Mauritius, Sao Tome and Principe and Seychelles. All these agreements are tuna agreements which allow EU vessels to pursue migrating tuna stocks as they move along the shores of Africa and through the Indian Ocean as well as the Atlantic one. Approximately half of the revenues made per country are earmarked for fisheries policy development. The sectoral support aims to promote sustainable fisheries development in the partner countries, by strengthening their administrative and scientific capacity through a focus on sustainable fisheries management, monitoring, control and surveillance.⁶ The fee per ton of tuna caught paid by ship owners differs per country. In Sao Tome and Principe ship-owners pay the highest price (between 55-70€ per mt), followed by the Comoros (55€), Mauritius (35€), and Cabo Verde with 25-35€ per mt.⁷ Negotiations thus result in different outcome for

the different countries and can make a large difference in export revenues. Although the countries make revenues as a result of the bilateral agreements with EU and other countries, the SIDS countries do not have their own industrial fleet (even if for example when they fly the flag of Seychelles they are foreign owned). The lack of a commercial fleet in the six countries has decreased their ability to fully reap the benefits of the tuna stocks. There are some challenges that face these types of fisheries. The rewards gained by the Government do not necessarily flow back to the coastal communities which consequently catch less fish because of the foreign industrial fishing. Mauritius deliberately made the choice of making Port-Louis a hub for tuna processing, competing with Seychelles but they also developed high value product processing using for the latest technology (minus 60°C sashimi quality tuna processing) while Seychelles is still doing canning.

For the tuna fishery that is processed in the country a global value chain analysis of the tuna fishery needs to be made to ensure proper benefit sharing between the SIDS and foreign license owner. Part of a 'blue economy' fishery sector is one equitably distributes the benefits to both small-scale fishers, industrial

6 http://ec.europa.eu/fisheries/cfp/international/agreements/index_en.htm

7 Fee for Seychelles was not listed

FIGURE 6: TUNA FISHING VESSEL IN MAURITIUS



Source: <http://business.mega.mu/2012/07/30/tuna-sapmer-invest-around-rs-8-10-iillion-mauritius-eez/>

fishers, market parties, Governments as well as those living in coastal communities.

The EEZ of the countries is very extensive, their own commercial fishing fleet limited to small-scale boats while little finances are available for patrolling and surveillance large-scale Illegal, Unreported and Unregulated (IUU) fishing takes place. Western Indian Ocean offshore pelagic fisheries represent some highly valuable tuna stocks and an abundance and diversity of other species that live in these waters such as demersal snappers, crustaceans and molluscs. Seychelles and Mauritius are actively engaged in management and research of their pelagic offshore fisheries. However, this is hampered by Illegal, Unreported and Unregulated (IUU), and the bulk of this is occurring in mainland East African countries' EEZ waters, which has significant implications because most of the pelagic species are highly migratory or straddling stocks. Due to the overfishing of coastal stocks, many countries, especially those with large EEZs, plan to expand their semi-industrial and industrial national fleets to new fishing grounds in their EEZs. In addition, since part of the agreements implies that countries are paid per ton of tuna caught,

the countries lose out on a lot of income as part of the tuna catch is not reported.

The long-term sustainability of fisheries in these SIDS has been threatened by IUU fishing, overexploitation of living marine resources, land-based pollution, destructive harvesting methods, overexploitation, invasive alien species, oceanic acidification, natural disasters and climate change are some of the natural and anthropogenic factors threatening fisheries in these SIDS. Amid those challenges, the fisheries sector is expected to meet the demands of a growing population and increasing requirements for fish protein. There are often inadequate fisheries monitoring control and surveillance systems at both the national and regional levels. The effects of climate change are also anticipated to indirectly affect fisheries, as changing water temperature negatively impacts coral reefs and mangroves that function as nurseries, habitats and foraging grounds for fish. Also associated with changing weather patterns, are shifts in migratory patterns of fish species, affecting their availability during different periods of the year. These climate change impacts on fisheries potential yield are diverse throughout the oceans and no

precise projections can yet be made. The impacts will most likely differ for demersal, crustacean or pelagic fisheries whereby pelagic fisheries are considered to be least potentially affected.

B. AQUACULTURE

Fish farming is increasing and will continue to increase and expand in the maritime environment as the demand for food fish increases. Approximately 16.6 million people worldwide are employed in fish farming, mostly concentrated in Asia. It is the fastest growing food-production sector, and future development prospects appear promising (UNEP, 2012). African aquaculture production is almost exclusively of finfish, primarily tilapias (Boto, Phillips, and D'Andrea, 2013). Word needs to be given here on the growth of fish farming in Africa (Nigeria moved from 25 000 tons in the early 2000 to more than 250 000 tons in 2011). In the African SIDS, aquaculture has not been widely developed. Aquaculture can help lessen fish imports and increase employment as well as help food security. Sustainable coastal aquaculture can reduce pressure on aquatic resources including the depletion of wild fish stocks, destruction of fish habitats and declining biodiversity.

In Cabo Verde the entire yearly consumption of at least 60 tons of shrimp is imported. With a growing tourism sector and a worldwide trend to fulfil protein demand increasingly with seafood, a good market opportunity has arisen. A Brazilian company has joined hands with those in Cabo Verde and in 2009 a joint venture to implement a shrimp farm of open ponds on Sao Vicente was developed and is expected to replace shrimp import in the short term and surplus production. A similar project for a tilapia fish farm is also under way involving the same Cabo Verdean and Brazilian business owners (ASemana, 2009). The idea is to raise the fish to serve as bait for tuna fishermen. China has also shown interest in developing a shrimp farm in Cabo Verde. However, the

information available on the success of these projects is unavailable.

In the Comoros, Sao Tome and Principe, and Guinea-Bissau there is no literature on fish farming available. With this knowledge, this report takes the view that at present, no fish farming is being undertaken in these three countries. In Guinea-Bissau, during a 2011 workshop on aquaculture potential, fishers had shown a large interest in developing aquaculture. However, it was observed that ocean mariculture practice were fraught with difficulties such as: securing fish cages amidst high ocean swells, strong and high waves and strong seasonal currents. Sustainable shellfish aquaculture in Guinea-Bissau could provide great potential. It would provide food security with a high-quality, high-value product for exports and for local consumption. From a habitat perspective, shellfish would provide valuable benefits to the Gulf of Guinea marine environment.

In Mauritius aquaculture is currently booming thanks to the change of the coastal legislation in aquaculture practices in Mauritius that dated back to the French colonization period. Fingerlings of multiple species of marine fishes were collected from the lagoon and stocked in 'barachois' for fattening to be used as live prey on fishing around fish aggregating devices. This type of farming is still practiced. With the support of the Food and Agriculture Organization of the United Nations, financed by the European Union, two aquaculture projects have been implemented in Mauritius in 2014. In one of the projects fish breeding cages (see figure 7) were built and installed at sea (within the lagoon) and have already been stocked with fingerlings of the Rabbit fish (*siganus sutor*). The culture of the freshwater prawn has been undertaken by a number of small and medium scale farmers in fresh water, with seeds provided by the Mauritian Government hatchery. Another project being considered by the Ministry of Fisheries is seaweed farming as many Asian consumers consume

FIGURE 7: AQUACULTURE CAGE IN MAURITIUS



this product. Experimental culture trials of two sea cucumber species were undertaken and crab farming and oyster farming (also carried out in Seychelles). These have not yet been considered commercially viable yet it shows the wide range of interest in aquaculture in Mauritius.

In Seychelles the aquaculture sector is fairly recent and is quite small in terms of importance compared to the fisheries sector. The development of the aquaculture sector started in 1989 with the construction of a pilot projects to grow black tiger shrimps (*penaeus monodon*), which later expanded into a full-fledged commercial integrated project following several development phases. There are a total of 200 grown-out ponds supplied by two hatcheries and the production is processed directly in a processing factory. The shrimp feed is produced at the Animal Feed factory located on Mahé. On a different scale, giant clam (*tridacna maxima*) and pearl oyster (*pinctada margaritifera*) farming started in 1993 and 1995 respectively. The quality of pearls produced from the black-lipped pearl oyster more than matches the quality of those obtained from the Pacific islands which are the main production centres for that type of pearls. To date, Seychelles is the only country in the western Indian Ocean region that has a

commercial pearl farm and a giant clam farm. Overall the aquaculture sector employs around 400 people, mostly by the shrimp farm and its ancillary services

This paragraph has shown aquaculture is still underdeveloped in African SIDS and provides great potential to those that have no aquaculture as well as for those countries who already engage in aquaculture. These SIDS offer a local market and/or tourists sector to consume the aquaculture products; processing facilities often already available as well as local (fish) feed in Seychelles, Mauritius and Cabo Verde. Development potential for aquaculture development in African SIDS can be found in: shrimp farming; fish farming in cages in bays; mud crab culture or ranching (mangrove areas); culture of marine aquarium fish; coral farming and pearl cultivation. The potential to develop the aquaculture industry and substantially increase fish production and promote export and economic growth exists and it is believed that the technology undertaken for the various types of aquaculture need to be adapted to suit local conditions.

RECOMMENDATIONS

For aquaculture to be feasible in these countries: small-scale pilot projects for technology transfer and evaluation need to be carried out. In addition, economic feasibility studies and marketing analyses for aquaculture proposals need to be carried out.

Development of the aquaculture sector also demands a role of the private sector to invest in development of sustainable fish markets; for national institutions to develop an appropriate aquaculture policy and legal framework for aquaculture development; a need to build capacity and train fish farmers. This is necessary as the vital contributions from aquaculture to food security and economic growth is constrained by a variety of problems. Poor governance, conflicts over the use of natural resources such as land, persistent use of poor aquaculture practices, poor infrastructure,

costs of transport, pollution and other environmental impacts as well as climate change impacts all affect the potential of aquaculture in the African SIDS.

C. SHIPPING AND TRANSPORT

Ports are critical infrastructure assets that serve as catalysts of economic growth and development. In addition to playing a key role in international trade, they create jobs, generate wealth and value, contribute to national GDP and promote the expansion of related and near-by industries and cities. Maritime transport handles over 80 per cent of the volume of global trade and accounts for over 70 per cent of its value. The expansion of maritime trade over the past decade is accompanied by opportunities for some countries and a constraint for others. The technological developments required for the efficient management of port services and infrastructures have also encouraged the construction of increasingly larger ships. Larger ships also require larger handling ports. However, in the African SIDS the development and use of these larger ships have not always coincided with development of bigger ports and harbours. As developing countries strive for improved infrastructure capacity, they will be confronted with increasing concentration of shipping services. Recently, the United Nations Conference

on Trade and Development (UNCTAD) found that 35 coastal countries were served by only three or fewer liner companies in 2011. The consolidation of services that was provided by the container shipping industry to achieve improved operational efficiency may have also resulted in the reduced negotiating powers for some players. The Liner Shipping Connectivity Index (LSCI) of the African SIDS is relatively low. The LSCI captures how well countries are connected to global shipping networks. It is computed by the United Nations Conference on Trade and Development based on five components of the maritime transport sector: number of ships, their container-carrying capacity; maximum vessels size, number of companies, number of services, and number of companies that deploy container ships in a country's port.

LSCI numbers for African SIDS are listed below. They are on the low side as lowest is Cayman islands with 1 and highest is China with 158. Mauritius is the only country with the highest LSCI of the six countries (see table 6). Table 6 further shows⁸ that none of the six SIDS have a port that can be categorized as medium or large on a global scale. They only have small to very small ports. Only one port can handle ships up to 1000 meters (Guinea-Bissau) whereby the port is located in the river rather than on the coast. The remaining

TABLE 6: PORT CHARACTERISTICS AND LINE SHIPPING CONNECTIVITY

	LSCI	Number ports	Size port Small	Size port Very small	Port for medium ships up to 500' (M) or large ships 1000'(L)	Coastal natural	Coastal breakwater or other
Cabo Verde	4	2	1	1	1 M	1	1
Comoros	5	4		4	4 M		
Guinea-Bissau	4	2		2	1 L		1 River natural
Mauritius	25	1	1		1 M		1
Sao Tome and Principe	7	2		2		1	1 Open roadstead
Seychelles	8	1		1		1	

⁸ Based on World Port Index 2014

ports are nearly all located on the coast and either natural coastal ports (a coastal harbour sheltered from the wind and sea by virtue of its location within a natural coastal indentation or in the protective lee of an island, cape, reef or other natural barrier) or coastal harbour (a coastal harbour lying behind a man-made breakwater constructed to provide shelter). These ports can thus be vulnerable to climate change impacts such as increased frequency and intensity of storms and sea-level rise.

In order to increase economic activities the current maritime services need to be improved. The Comoros, Mauritius and Seychelles have all committed themselves to a Regional Monitoring Committee (RMC) to set up a new Regional Maritime Service (RMS). This will contribute to the connectivity of regional markets, facilitating trade, the movement of people, and the promotion of inclusive and equitable growth. Cabo Verde has two ports according to the world ports index (Mindelo and Praia). The infrastructures of Mindelo and Praia have the characteristics of deep-water ports and have processing facilities and storage container traffic. These facilities help ensure not only the integration of the Archipelago into the world but also serve towards the distribution of goods to other islands. The country's geographical location at the crossroads of international shipping lines, is favourable to the development of a hub function, more at a regional level than international level. The development of deep-sea port in Mindelo will further increase economic interactions of islands among themselves and between them and the mainland. Investment in sea ports construction and rehabilitation, will contribute to consolidating territorial integration and facilitating movement of goods and people.

The Comoros has four ports which are all classified as very small by the world port index. Nevertheless, they all can handle medium size vessels. Moroni (Grande Comores) port handles an estimated 80 per cent of the

country's business volumes. Larger vessels need to anchor out of the port and transfer the load to barges that are towed to the port as the draft is limited. Only vessels provided with their own crane can download containers onto the barge in Moroni port. There is also limited handling equipment, which does not allow a high rate of loading and offloading vessels. Recent investments in Moroni port are improving the cargo handling capacity (Boloré's investment, see the 2011 ten years agreement) and further development in the quay are expected. The deeper draft of the second port Musamudu (Anjouan Island) enables this port to recently act as a redistribution centre for other ports such as Moroni, Mozambique, Mayotte, Mauritius, Réunion, and Seychelles.

The two ports of Guinea-Bissau are both located on the river. The Port of Bissau plays a crucial role in the Guinea-Bissau economy as it carries 80 per cent of the country's international trade transactions. However, the port has performed very poorly and faces steep competition from other ports in neighbouring countries such as Guinea and Senegal. Poor performance of the port represents one of the biggest constraints, along with energy deficiencies, for the improvement of the country's competitiveness on the international arena. A lack of adequate port facilities has hindered the efforts of Guinea-Bissau to improve the competitiveness of its cashew crops, the main export product of the country, even though their cashews are considered among the best in the world. Options for building a second port in the country or to use ports in neighbouring countries have been considered in the past, but until now, the Port of Bissau continues to be the main existing port in the country. In 2010 the Government of Guinea-Bissau requested a study to be undertaken to examine the cost of improving the port. The report states that four phases of port development are necessary. The first phase of the project that came out of this study has been carried out while for the second phase the

Government is in negotiation with the West African Bank for Development.

Mauritius has one port but is still very well connected to the LSCI. Port Louis harbour is strategically located between Africa, Europe and Asia. It handles 99 per cent of the Mauritian external trade and acts as an engine for growth in the process. Over the past two decades the port has seen many investments in modern infrastructure and container facilities, supporting seafood exports, Freeport services, logistics, trans-shipments, and cruise-ship tourism. The Mauritius Port's Authority has launched a two phase port infrastructure development program which is to be completed in 2016. It includes a quay extension, container terminal extension and a deeper draft. The quay extension and dredging to accommodate vessels with drafts up to 18 m Port Louis will be able to receive larger petroleum, vessels, as well as larger cruise-ships.

Sao Tome and Principe has two very small ports. A French large container cargo company signed an agreement in 2009 with the Sao Tome and Principe Government to build a deepwater port in the Fernão Dias area. The work, estimated at US\$500 million, should have begun in 2009 but has been continually postponed due to the inability of the French company to obtain sufficient funding. As a result the country has for several years for several years, been seeking outside assistance for such construction during which time there has been abortive negotiations with other countries, including Russia. China now intends to build a massive deep-water port in Sao Tome and Principe, which will make exporting oil easier and generally facilitate sea-borne commerce. The main port currently has a shallow draft and as a result can only accommodate small vessels. Large ships have to anchor over a mile offshore where cargo is unloaded onto small vessels. The new port will be able to handle containers and is being built at Fernao Dias, 10 km north of Sao Tome city.

Port Victoria is a modern deep water port in Seychelles, which has been specifically planned for mechanized handling of cargo. Today's Port Victoria has berthing facilities for all major vessel types including cargo and container ships, tankers, naval vessels, large fishing ships (for example tuna purse seiners) and smaller local fishing vessels, recreational yachts and launches, and inter-island ferries (Anon, 2006). The longest wharf in the country (New Port Wharf) is 370 m long and can service ships up to 210 m in length. Port Victoria has a range of large storage sheds for cargo, an industrial dock yard and slipway and a tuna processing plant adjacent to the main tuna vessel wharf that services purse seine vessels of up to 160 m in length (Anon, 2006). Port Victoria is a busy international shipping port and the major hub for the Western Indian Ocean tuna fishery. In 2003, Port Victoria handled 88 per cent of the 450 000 tons of tuna caught by purse seiners in the Western Indian Ocean (SFA, 2003).

So, except for the Seychelles port, all ports in the African SIDS either require better infrastructure or are already currently under port improvement projects. The sector is considered essential and better and improved ports are thus crucial to sustain each country's economy. These types of projects are, however, very costly and thus require international funding for the countries involved. Climate change is expected to impact the shipping sector and adaptation needs to be considered when building new, or improving old ports. Adaptation in transport involves enhancing the resilience of infrastructure and operations through, amongst others, changes in operations, management practices, planning activities and design specifications and standards. Climate change thus needs to be integrated into considerations of investment and planning decisions for ports as well as broader transport design and development plans. In addition, ports can carry an environmental burden such as air and water pollution, dredging, loss of wildlife habitat, aquatic nuisance

species, restraining public access to coastal resources, and land conflict use issues.

D. TOURISM

SIDS are often endowed with a pristine environment, unique ecosystems and cultural features that naturally differentiate them from other tourism destinations.

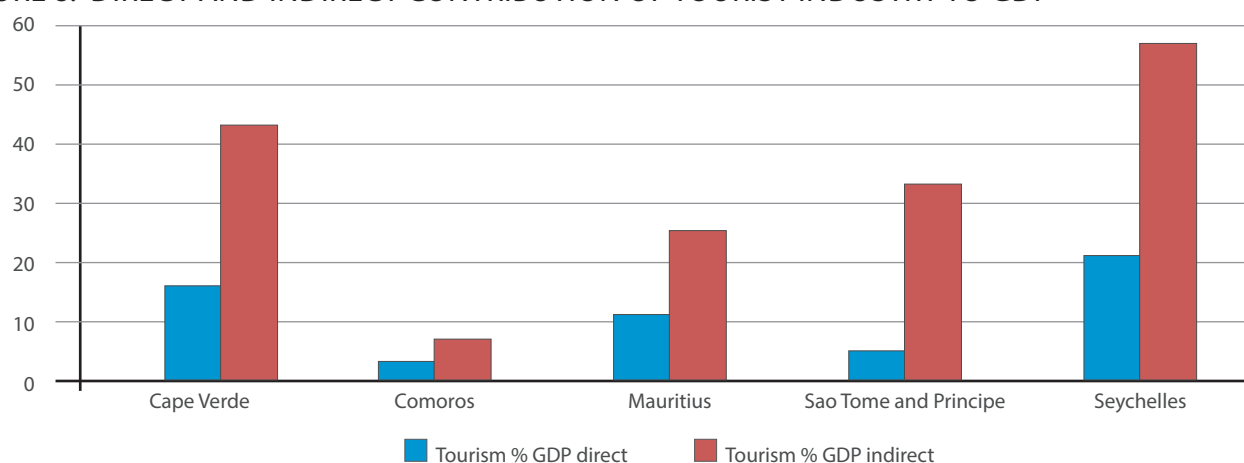
Tourism is an important sector for the African SIDS except perhaps for the Comoros and Guinea-Bissau where the tourist sector is much less developed. In both countries it was developed but collapsed (in Comoros after the series of coups and the islamization of the country and in Guinea-Bissau after the civil war in the late 1990s.). Tourism has contributed much to the development of the four SIDS and, as one of only a few development strategies currently being employed, will continue to be very important for their future growth. It could also stimulate the development of other sectors. Figure 8 shows the direct and indirect contribution of the tourist sector to five African SIDS. The figure shows that particularly Cabo Verde and Seychelles are very dependent on the tourist industry with indirect contribution as high as 43 per cent in Cabo Verde and 57 per cent in Seychelles.

In Cabo Verde the tourism industry is a very important economic sector. With 10 islands strategically positioned between South America, West Africa and Europe, it offers a diverse array of distinct landscapes, nature, and beaches. The tourism industry has become an important engine of growth in the Cabo Verdean economy after 2005 and the economic downturn in 2008 which slowed the economic growth in the tourism sector. However, tourism neither significantly contributed to job creation nor substantially supported the expansion of others sectors, except construction (12 per cent of GDP) as most of their all-inclusive resorts and real estate are foreign-owned.

RECOMMENDATIONS

Structural reforms are needed to have the local get a better share of the benefits of the tourist industry and more general sharing of the benefits. This could be through the organization of local production of goods and services, the creation of a quality certification system for local products, and improvements in the inter-islands transportation systems and more substantially the ownership of tourism infrastructures that currently belong to foreigners (Italian and Portuguese mainly). Although one primary goal of the Cabo Verdean Government is to ensure that tourism keeps within the margins of its fragile ecosystems and

FIGURE 8: DIRECT AND INDIRECT CONTRIBUTION OF TOURIST INDUSTRY TO GDP*



Source: <http://www.wttc.org/research/economic-impact-research/country-reports/>

that economic growth spreads to the poorest sectors of the population this also proves to be a challenge in reality. Cabo Verde is also looking into cruise tourism to diversify its tourism industry. In 2011 the first cruise operators came to the island for inspection. that are complemented with its rich culture, history, music and warmth of the people. The islands are all different and can thus offer something different to the cruising industry. From 2012 the number of cruise ships stopping in Cabo Verde has increased. In general the number of calls in 2011/12 has been increasing and for 2013/14 it is expected an increase of 50 per cent in Praia and 25 per cent in Mindelo.

The Comoros does not have as strong a tourist industry as other small islands in the vicinity such as Mauritius, Réunion, and Seychelles. The country's weak tourism industry is mainly because of its insecure political climate, with many political upheavals over the past three decades. There have been initiatives by both the public and private sectors in the tourism industry, but to date, a lack of commitment from both sectors and external circumstances have prevented further growth of the tourist sector. As the sector is undeveloped this also provides a great opportunity for sustainable development of the tourist sector from the onset of the development of the sector. The Comoros needs a tourism development plan that ensures ecological sustainability as well as social equity. The country needs a tourism development plan with benchmark that would provide a strong framework for all tourism stakeholders for the next phase of development. This would need to begin with an analysis of the tourism sector's potential and possibilities.

The tourism industry in Guinea-Bissau is currently very limited. Persistent political instability of the last decade has had a negative effect. Frequent coups, a civil war and general unrest over the past decades have prevented any substantial investments in the sector – a quasi-permanent state of insecurity and

the absence of economic and legal framework to help boost the private sector. The Government's stated policy is for an orderly development and expansion of the sector to include cultural and eco-tourism in order to maximize the benefits from tourism. Off Guinea-Bissau's coast lie the magnificent Bijagós Islands, an archipelago of about 20 tropical islands. Although there are some facilities on the islands catering for tourists, their potential for eco-tourism remains largely untapped. On the island of Orango it is possible to see hippopotamus, while other islands are nesting grounds for sea turtle. The country thus holds great potential for the tourist sector but it still requires substantial investments by public and private sector.

Tourism contributes significantly to the economic growth of Mauritius and has been a key factor in its overall economic development. Mauritius is predominantly a holiday destination for high-end beach-resort tourists. The National Tourism Policy emphasizes low impact, high spending tourism. Selective, up-market, quality tourism is favoured, and although such tourism is not the only type, it constitutes the major segment of tourists who stay in high class hotels. It is to be noted that as tourism infrastructure is mostly located in all-inclusive resorts, much of the accruing benefits do not trickle down to ordinary Mauritians. Nevertheless, it does provide foreign exchange and local employment. Having tourists reside in particular spots also places less burden on the fragile environment. One new development for Mauritius could be the development of maritime archaeology. Many tourists enjoy the ocean and although there are shipwrecks that have potential for sustainable tourism and resources in SIDS, they have not been researched or protected for tourism development.

Sao Tome and Principe does not have a full-fledged tourism sector, although some 33 per cent of its GDP is indirectly generated from tourism. The gradual development of the sector began in the 1990s and

was initially led by private investors. Starting in early 2011, the Sao Tome and Principe Government worked with the World Bank Group to abolish a colonial licensing system hindered private enterprises in the sector. This change facilitated the implantation of the industry on the island, where small-scale and medium sized businesses were began to enter the sector. In 2011, the number of business registrations more than quadrupled to 241. In 2012, this number increased by another 61 per cent to 88 percent. The environmental impacts of tourism on the islands can be severe. The reform is part of a medium-term tourism development strategy to build capacity within the tourism administration. As reforms continue, the country is expected to attract more entrepreneurs and tourists. Now it will be much better positioned to respond to growing demand and interest. Sao Tome's delicate and small number of ecosystems should be a serious consideration in development planning to bring tourists to the country. Currently, the minimal importance that culture places on the environment, coupled with the lack of institutional capacity to address environmental issues ranks them last on the country's priority list.

Seychelles has a very large tourism industry and 57 per cent of GDP is directly and indirectly generated from the sector. Most tourism is high-end tourism with a special emphasis on luxury sun vacations. Although there is increasing interest in ecotourism and other forms of tourism, the focus, even in marketing, is still on beach tourism. There is an important yachting activity, with the yachting and cruising sector employing some 100 people. Other related revenues are from; fuel, food, landing and docking fees, maintenance and repair services, harbour fees etc. Piracy is a major issue affecting the yachting sector in Seychelles.

For all African SIDS there is still new potential in tourism. Besides promoting regular dive tourism, maritime archaeology is a niche that could be

developed in several SIDS. Due to its location Mauritius for example has a rich maritime history but deep waters are all around the island. Extensive search with latest equipment using divers, robots, and underwater instruments may be made. It can boost education and diving tourism. Cabo Verde also has over a 100 shipwrecks that were found and shipwrecks were also found in Seychelles. In this regards, heritage tourism is also an area to be developed. Fishing tourism can also be a new route of interest for those islands that have a lot of larger pelagics, although this is only a niche market

E. MARINE (BLUE) ENERGY (FOSSIL AND RENEWABLE)

SIDS are highly dependent on fossil fuels, and the majority of them spend over 30 per cent of their annual foreign exchange earnings on this. Ironically, the vast renewable energy resources of SIDS remain undeveloped. Islands around the world are working on renewable energy and energy efficiency projects to increase self-sufficiency in the energy sector. In order to convert renewable energy resources into economic benefits, SIDS face a number of hurdles including limited availability of financial resources, institutional barriers and human capacity, and access to technology. The development of a sustainable energy sector in SIDS will, in addition to improving energy security and promoting economic growth, bring about reductions in greenhouse gas emissions. Non-renewable resource extraction can also provide a potential pathway to decrease dependency on imported fossil fuels. Imports of fossil fuels often take up a very large portion of foreign exchange.

1. NON-RENEWABLE OIL AND GAS RESOURCES

As terrestrial, near-shore, and shallow water reserves are generally plateauing and declining, offshore hydrocarbon development in deeper waters, further offshore and in more hostile environments, has become more significant. This trend is underpinned and reinforced by escalating demands and

consequently elevated oil prices. According to the United States Energy Information Administration, the six African SIDS currently do not produce any natural gas or oil and therefore depend fully on exports for these products. As oil has been found in the EEZ of neighbouring states of some of the countries, over the past decade oil and gas exploration has gained interest in the six countries. However, in none of the six African SIDS has exploration been successful to the extent that oil can be commercially extracted. In the three African SIDS on the west coast of Africa, exploration has shown mixed results.

Cabo Verde has been discussing oil exploration with the Brazilian oil company Petrobras, a world leader in deep and ultra-deep oil exploration and production. Petroleo Brasileiro S.A. (Petrobrás) of Brazil and the Government have signed an exploration accord for the exploration of petroleum offshore Cabo Verde. The accord was part of a package of measures that included an interdisciplinary study for research of the country's marine resources. The Government stated that the accord would help the country develop its resources, including natural gas and petroleum (Energia.gr, 2010). The exploration has not yet shown results however.

In Guinea-Bissau there have been irregular initiatives to explore offshore oil reserves and a number of international companies have been involved in offshore exploration during the last 40 years. Among them were Esso, Elf, Pecten, Lasmco, Sipetrol of Chile, West Oil, Sterling Energy, Benton Oil and Gas and Petrobank Energy and Resources. Offshore exploration was hindered by a boundary dispute with Senegal, which was not resolved until 1993. Under an agreement signed in 1995, the area of the border dispute with Senegal, now jointly managed by both Senegal and Guinea-Bissau. Under the terms of the agreement, the proceeds from activity in the joint exploration area were divided between Senegal and Guinea-Bissau in a ratio of 85 to 15. A study of the oil

reserves of Guinea Bissau by an independent oil and gas explorer revealed that the geotechnical studies showed significant hydrocarbon resource potential. With the permits being located in benign shallow waters, the costs of exploration and development are commercially attractive. The chance of exploration success in the first well in the permits, planned for late 2014, is thus considered to be high.

Oil and gas have been found elsewhere in and around the Gulf of Guinea, especially in Equatorial Guinea and Nigeria. There is every geological reason to assume that the territorial waters of both Sao Tome and Principe also hold exploitable reserves of oil and gas. Despite a dispute between Nigeria and Sao Tome and Principe which halted exploration, the state signed the first oil exploration agreement with a foreign company in 1997. The dispute over whether all of the relevant waters were Nigerian or belonged to Sao Tome and Principe was settled by sharing whatever was discovered along with several concerns. In 2005 the blocks exploration permits were awarded and exploration began. The results however were not successful and therefore in 2012 several companies abandoned three blocks and in 2013 the French oil company Total abandoned Block 1 in the Sao Tome and Principe –Nigeria Joint Development Zone (JDZ). The reason behind abandoning the blocks were the same for all the other companies: the disappointing results for exploration as a result of limited hydrocarbon reserves do not justify further investment.

Africa's east coast has become a region of high interest in the hunt for hydrocarbons following massive gas finds in Mozambique and Tanzania and substantial oil discoveries in Uganda and neighboring Kenya. Promising prospects of abundant mineral resources in the western Indian Ocean is a magnet to several Asian economies. The challenge currently facing the region is harnessing the exploitation of the hydrocarbon find into a blessing and avoiding the environmental and

social challenges that countries can face in Africa as a result of oil finds.

The Comoros granted its first license for exploration and production of oil in 2012 to a Kenya-based exploration company, Bahari Resources Ltd. Hopes are high as the area to be explored is an area adjacent to a number of offshore areas of Mozambique where two oil and gas companies have made new hydrocarbon discoveries. In 2014, the Comoros awarded oil and gas exploration licenses to two companies to search for petroleum in an additional number of offshore blocks which are adjacent to the highly prospective offshore Mozambique hydrocarbon areas.

The oil potential of Seychelles continues to be promoted. Exploration had already begun in 1969. Despite active exploration through 1995 no commercial petroleum resources had been discovered. In late 2008, Avana Petroleum Ltd. of Madagascar and East Africa Exploration Ltd. of the United Arab Emirates signed a production agreement with the Government to explore for petroleum offshore Seychelles in 2009 (Newman 2011). The companies selected 15,000 square kilometres in three trenches that they believed included a series of high-potential drilling targets. In June 2013 oil and gas exploration companies were invited to bid for exploration oil blocks after its two year moratorium lapsed. This exploration freeze gave Seychelles time to review its energy sector's legislation and consult with the industry.

Aware of the quest that has swept across the Western Indian Ocean region in the last five years, Seychelles decided to start with the policy framework before allowing prospective oil companies access to oil and gas blocks. Seychelles signed the Extractive Industries Transparency Initiative (EITI) because it considered it was better that oil companies know what they will be required to do upfront. The country has set about preparing a strong legal

framework and meeting top international standards with transparency as a key issue. The EITI requires oil companies to declare how much tax they pay and that the Government in turn also has to declare how much tax it receives. The country also wishes to protect its environment during oil exploration and production. With tourism making up a vital component of the economy, the country is putting strong protection measures in place, from regulating drilling to how operations are conducted, including compulsory environmental impact assessments before drilling. However these regulations can also give Seychelles a disadvantage as some companies can turn to other places where rules are less stringent.

In the EEZ of Mauritius some oil drilling has taken place however no commercial viable oil resources have yet been found. The Oil and Natural Gas Corporation of India has shown the most interest in oil and gas exploration in Mauritius. Seychelles and Mauritius plan to jointly explore for petroleum in an area in the Indian Ocean that they own in common. The two island nations received permission in 2012 from the United Nations for an extended continental shelf of their respective coast. The granting of the joint exploration rights was meant to forestall any future maritime territorial disputes.

Also Mauritius is trying to adopt a cautious approach. Its aim is also to find a fine balance between exploration, exploitation of petroleum products and sustainability of the industry and environment. Environmental protection therefore is also of great importance to Mauritius as the island also greatly depends on the tourist industry. Offshore drilling operations have various environmental impacts on marine and other wildlife. These include drilling muds (dumping of drilling fluid, metals [including toxic metals] into the ocean), brine wastes, deck runoff water and flowline and pipeline leaks but also more catastrophic spills and blowouts are also a threat from offshore drilling operations. These operations

also pose a threat to human health, especially to oil platform workers themselves. Whenever oil is recovered from the ocean floor, other chemicals and toxic substances come up too things like mercury, lead and arsenic that are often released back into the ocean. In addition, seismic waves used to locate oil can harm sea mammals and disorient whales. Studies (Business Mega 2013) have been undertaken for the 'mapping' of the seabed, an exercise which will identify the most at-risk areas need more attention. Mauritius and Seychelles have also established an Environmental Code of Practice. Both countries thus show a great awareness of the pitfalls other countries have endured after oil was discovered and indicates the countries do not wish to put the exploitation of the hydrocarbon into a 'resource curse'. The 'resource curse' refers to the paradox that countries and regions that are abundant in natural resources, most notably non-renewable resources such as minerals and fuels, tend to have less economic growth and worse development outcomes than countries with fewer natural resources.

Technological revolutions in vessel-and offshore-infrastructure design are providing solutions such as floating liquid natural gas (FLNG) unit that can produce and liquefy millions of tons per year of once-stranded natural gas supplies in the Indian Ocean. However, the Prelude (Shell biggest ship) is currently not expected to start producing until 2017. It will start operating in the waters to the west of Australia. Shell is planning to build more FLNG barges that could be of potential interest to those countries with gas fields in the Indian Ocean and East Africa. However, the time for actual operation of these new vessels which still have to be built remains unclear and depend on the success of the Prelude and its consecutive boats.

2. OTHER NON-RENEWABLE RESOURCES

Oil and gas reserves do not constitute the only minerals that can be extracted from the seabed. The sea floor has long been the source of valuable

resources such as diamonds and both precious and base metals (such as gold and tin) from placer deposits in marine sediments and materials such as aggregates for building construction and land reclamation that's should be in the introduction. These developments have taken place mostly in the near shore areas. However, oceans are considered as a 'warehouse' for minerals, which are associated with different topographic features, ranging from the placer minerals and sand along the coasts, phosphorites on the shelf, cobalt-rich crusts on the seamounts, seafloor massive sulphide (SMS) deposits on the mid-oceanic ridges, and polymetallic nodules (ferromanganese nodules) on the deep abyssal seafloor. These Such deposits also have the potential to contain rare earth elements, something that is likely to enhance their attractiveness as targets for seabed resource development. Seabed minerals are thus being looked upon as the alternative source for metals in the future, especially in view of the depleting land resources and increasing industrial demands (Sharma, 2010). The six African SIDS might thus potentially have different minerals across the different ocean habitats in their EEZ.

The existence of deep seabed polymetallic nodules, containing strategic metals such as cobalt, nickel, platinum and molybdenum has been known for many years. Further offshore deep sea minerals such as polymetallic nodules have been under consideration since at least the 1960s. Recent advances in exploration and extraction technologies have revived hopes of the commercially viable recovery of a range of resources from the seabed. Developments in both technology and legislation, the latter spearheaded by the International Seabed Authority (ISA), have led to greatly enhanced interest in these strategic resources.

As the six African SIDS need to enhance their energy production and depend less on fossil fuel imports other non-renewable minerals are seen as a potential new pathway for economic development. The

exploration of seabed mineral availability has only seriously taken place in Mauritius and Seychelles which has not resulted in commercially viable production. In the Indian Ocean Polymetallic nodules and polymetallic massive sulphides are the two mineral resources of primary interest to developers in the Indian Ocean.

The minerals for which economic assessments have been carried out in Mauritius and Seychelles are the coastal placer minerals that lie within the EEZ of different countries, and the polymetallic nodules that generally occur in the 'area' outside EEZ of any country and are regulated under the UN Law of the Sea. In 1987 there was a large-scale survey around Seychelles, and in Mauritius. Polymetallic nodules were known to occur on the ocean bottom near the Amirantes Islands. Limited sampling was done in the mid-1980's, but funds for further planned work were not available. In Mauritius potentially important are the polymetallic nodules that occur on the ocean floor at about 4,000 m depth around Mauritius. They contain more than 15 per cent of both iron and manganese and more than 0.35 per cent cobalt. However, in Mauritius the contents of manganese nodules do not warrant extensive mining since they are not perceived to be commercially viable. According to Africa minerals book 2010 (Yager and others 2012) there was no manganese production in Mauritius and in Seychelles they were not even included in the book. There are indications there is extensive granite below Mauritius that may contain hydrocarbon. However, this is located very deep and investigating and extracting will thus be very expensive. As terrestrial minerals become depleted and prices rise, the search for new sources of supply is turning to the sea floor there are also international concerns regarding the environmental impacts of seabed mining. Seabed mining may, for example, have detrimental effects on fish resources vital to coastal communities. The waste released may contain sediment and heavy metals. Whales and other marine life might be

affected by the noise. Large robots will cut and collect material removing part of the ocean habitat. There are nevertheless different types of deep sea mineral deposits, each with different biological environments, and the extraction techniques and as a result their environmental consequences will vary between types. It is therefore difficult to predict impacts without knowing the specific details of a specific site or method of extraction.

3. RENEWABLE BLUE ENERGY

SIDS are highly dependent on imported oil and other fossil fuels for transport and electricity generation, which makes this a major source of economic vulnerability for SIDS as it leaves them highly exposed to oil-price volatility. It is extremely important therefore that SIDS engage further in renewable energy development. There are many commercially feasible options in many small island states for providing energy such as wind, solar, geothermal, and oceans energy. Some African SIDS have shown their commitment to increasing the share of renewable energy at the recent 2012 conference in Barbados on "Achieving Sustainable Energy for All in Small Island Developing States". At this conference Mauritius committed to increasing the share of renewable energy – including solar power, wind energy, hydroelectric power, and biogas to 35 per cent or more by 2025; and Seychelles committed to produce 15 per cent of energy supply from renewable energy by 2030. The Government of Cabo Verde established a target goal in 2008 of achieving 50 per cent of its electricity from renewable sources by the year 2020.

Blue energy can come from a number of sources including wind, solar and ocean energy. Blue energy can increase the reliability of electricity production in SIDS while reducing the overall cost to the consumer. From a macro-economic perspective generating energy from renewable energy saves SIDS from all too-rapid use of their foreign exchange resources

to pay for energy imports, which in view of the rise in energy prices on world markets constitutes a considerable additional burden on their economies. At the same time, diversifying national energy sources usually enhances the security of supply. In the long term, reducing energy generation from fossil sources will make a positive contribution to climate protection and improve local air quality. The local market will also gain new impetus for growth, and many new jobs in the fields of maintenance, repair and controlling.

4. WIND ENERGY

The wind energy potential in many of the African SIDS is substantial. In comparison to fossil-fuelled power stations wind energy can now be cost-effective in many places. Cabo Verde is one of the 15 countries with the best wind resource in Africa. Cabo Verde is the site of Africa's largest wind power project, which started up in autumn 2011. The island has no offshore wind farms, they are located on land. The islands of Cabo Verde lie across the trade winds belt, as a result the archipelago has consistent wind speeds of up to 10m/s creating one of the best locations in the world for power generation. Generating equipment on four of the islands will produce a greater proportion of electricity from wind than anywhere else in the world. The aim is for the wind farm to provide 25 per cent of the islands' energy. The construction of the Cabeolica wind farm means that Cabo Verde will benefit from the Clean Development Mechanism (CDM). CDM is a provision of the Kyoto Protocol that governs project-level carbon credit transactions between developed and developing countries and could lead to further Certified Emission Reduction (CER) projects in the country. There is also an interest in small scale wind projects for small electrical grids in remote locations.

RECOMMENDATIONS

The development of wind energy could be hampered because of restrictions on investment, and the need for further capacity building. Wind was also very popular in the past for water pumping purposes. The

project has been so successful the country aims to have 100 per cent of its electricity use by 2020 come from wind turbines.

In the Comoros, offshore wind energy has been less successful as a result of low wind potential. In 1985, two wind turbines were installed on land to drive groundwater pumps. However, neither has provided the amounts of water initially estimated. A wind generator requires average annual wind speeds of at least 3 m/s, and data has shown that the island winds do not always reach this speed. It is believed the Comoros would benefit more from solar energy, geothermal energy and hydropower installations.

In Guinea-Bissau only a small proportion of the population has access to public electricity, primarily in the capital Bissau and often only part of the time with still no public electricity. The country's entire public power system is operating on a generation capacity of 25 per cent of what it had been before the 1998-99 internal conflict and equivalent to the capacity needed to supply less than 2000 people in the US.

The country is completely dependent on petroleum products, despite its own high energy potential, especially in terms of hydroelectric power. The average wind speed is estimated at 2.5 to 7 m/s along the coast and on some of the islands and is thus very promising potential. In 2012 China donated 150 million USD to develop wind farms in Guinea-Bissau.

Mauritius's aim is to source 35 per cent of its electricity from renewables by 2025, with wind supplying 8 per cent of total generation. The Government is drafting a renewable energy plan to indicate how it intends to meet that target. Several wind farm projects are under way at the moment and some farms are close to being finished. Part of the financing of the wind farms comes from the sale of carbon credits generated from the wind farm project. The wind farms started building in May 2014.

Sao Tome and Principe has low wind farm energy potential as the wind measurements in the country indicate that wind power development has relatively low potential. Topographical conditions mean the potential for the technology cannot be ruled out, however. A 2 MW demonstration project was launched in 2007 in the district of Caue, 90 kilometres from Sao Tome city, with technical support from German firms.

In Seychelles the potential for electricity generation from wind energy is present, with some sites having been identified as having average wind speeds of 6.9-7.5 m/s at 80 m. Recently 8 wind turbines were constructed on two different islands and connected via 3 kilometres of subsea cables. The turbines used are designed to work effectively in low-to-medium wind speeds, and are built so as to be resistant to corrosion from the salt and humidity of the location. Part of the wind turbines are located on the uninhabited islands of Ile du Port and Ile Romainville.

None of the six African SIDS have offshore wind turbines. All wind turbines have been built on land, often (outer) islands. This indicates that there is no scarcity of land to install wind turbines and there have been no space limitations for terrestrial wind farms. Installation of wind turbines offshore is much more costly and while wind turbines still can be built on land this will be more cost effective. Nevertheless, once space becomes more limited as a country wants to reap more energy from wind energy offshore wind farms can provide a solution. In addition, for some SIDS such as the Comoros and Sao Tome and Principe which suffer from low wind speeds and thus low wind farm potential perhaps offshore wind energy might provide potential as offshore wind can be stronger and thus more beneficial. Yes but do they have adequate condition for that? It is also easier to install larger turbines offshore in comparison to on land. Nevertheless, technical challenges are large and offshore turbines are approximately 50 per cent more expensive to install. In addition, one needs shallow

coastal waters as offshore turbines currently have a limited 20 m water depth

5. TIDAL ENERGY

Tidal energy is the energy obtained from changing sea levels. Electricity generation is achieved by capturing the energy contained in moving water mass due to tides. This kind of energy requires huge investment but can be beneficial for some SIDS in the long run. The key benefit of tidal energy is that it does not generate unsafe greenhouse gases and is totally predictable, as tidal currents result from perfectly known astronomical phenomena. However, tidal energy faces several challenges. In order to generate electricity from tide change one needs large current velocities which are relatively rare. As slower tidal currents are not suitable for energy extraction, this can therefore only be used successfully in a few places round the world, where a large bay or estuary is so shaped that a huge amount of water rushes through a narrow opening when tides rise and fall. You need a 7 meter tide difference for tidal energy projects to be feasible so it depends on the island whether this tide difference is reached. Of the six African SIDS only Guinea-Bissau would be a potential site for a tidal energy project which experiences a high value of tidal range on its coast, the highest along the West African coast. The presence of tidal estuaries further enhances the tidal range: its maximum recorded value is 6.80 m in Porto Gole, on the banks of Rio Geba.

Beside the fact that there are only very few sites globally suitable for tidal barrages it also has other shortcomings. It only provides power for around 10 hours each day, when the tide is actually moving in or out. Another difficulty is the extremely harsh nature of the operating environment. Corrosion, bio fouling, lack of easy access to the turbines, and the expense of undersea cabling all pose large engineering challenges for the African SIDS which are low in technical and financial capacity. In addition, the lack of knowledge on the effects of tidal energy

extraction are still largely unknown projects. Areas of high quality tidal resource are often sensitive marine environments. Tidal energy projects thus pose the same threats as large dams, altering the flow of saltwater in and out of estuaries, which changes the hydrology and salinity and possibly negatively affects the marine mammals that use the estuaries as their habitat.

6. MICROBIAL FUEL CELLS

Some alternatives to agriculturally grown biofuels are microalgal biofuels and marine microbial fuel cells. Culturing microalgae for biofuel production has several advantages in comparison to monocultures: 1) they grow at fast rates and can be harvested at short intervals; 2) culturing microalgae does not require arable land and thus does not interfere with food security; 3) the consumption of algal biofuels produces fewer emissions than fossil fuels (Mutanda and others 2011).

Microbial fuel cells are devices that can use bacterial metabolism to produce an electrical current from a wide range of organic substrates. Due to the promise of sustainable energy production from organic wastes, research has intensified in this field in the last few years. While it holds great promise only a few marine sediment MFCs have been used practically, providing current for low power devices. The discovery that bacteria can be used to produce electricity from waste and renewable biomass has gained much attention. To further improve MFC technology an understanding of the limitations and microbiology of these systems is required. Some researchers are uncovering that the greatest value of MFC technology may not be the production of electricity but the ability of electrode associated microbes to degrade wastes and toxic chemicals.

F. PHARMACEUTICAL AND COSMETIC INDUSTRIES, GENETIC RESOURCES AND GENERAL SEA-BASED PRODUCTS

These sedentary living resources of the outer continental shelf, including marine genetic resources, may also prove to have considerable value. Given their extent, the ocean offers great potential in terms of marine living resources including marine-derived genetic resources. The oceans are a rich source of biological molecules which could be used for research and development (Bollman and others. 2010). This is a result of the high species richness and the multitude of ecological influences on marine organisms. The oceans are estimated to account for 95 per cent of the Earth's biosphere but it has also been suggested that they remain 95 per cent unexplored. This helps to explain why around 1,000 new marine natural products are reported annually. This is especially relevant to deep water areas, as illustrated by the fact that of over 30,000 marine natural products reported since the 1960s, less than 2 per cent derive from the deep sea organisms. Marine biota (plants and animals) therefore represent a relatively untapped resource offering developmental potential for a range of valuable applications. There is a clear trend in bioprospecting activities suggesting a move away from terrestrial ecosystems towards marine and freshwater ecosystems. Marine biodiversity, which so far has only been vaguely explored, is believed to contain a high diversity of secondary metabolites synthesized by the marine microfauna and microflora, and therefore is increasingly the focus of scientific research. Marine natural products seem to have a promising future in drug discovery, and the potential of marine genetic resources is high (Leary, and others, 2009). The potential of marine genetic resources is high (Leary and others. 2009). It is difficult to gauge the full market potential of marine genetic resources as there is a paucity of published commercial data, largely because much of this information is commercially sensitive. In 2002 global sales of marine biotechnology products, including anti-

cancer compounds, antibiotics and antivirals, were estimated at about \$2.4 billion. Most products have been developed from shallow-water marine sources (sponges, cone snails, tunicates, other invertebrates and algae) and only a few products from deep sea origins have made it to the market at this stage. Of the six African SIDS only Mauritius and Seychelles appear to have engaged in marine genetic resource collection and/or research.

The Mauritius Oceanographical Institute (MOI) initiated a project to valorise the pharmaceutical potentials of marine resources found in the Exclusive Economic Zone (EEZ) of Mauritius. The MOI focuses on the anti-cancer properties of the substances found in Mauritian marine sponges. The potential of sponges from Mauritian waters to fight cancer is that they are one of the simplest forms of animals. They are found in shallow to deep waters and are normally attached to a surface. Owing to their immobility, sponges produce chemical compounds as a defence against predators. These compounds possess anti-viral, anti-tumour, anti-microbial and anti-cancer properties. MOI has a repository of different types of human cancer cells, which are used for testing purposes. The collection includes cancer cells from eight different organs from the human body and thus allows MOI to study several deadly cancers. Sponge extracts are tested on cancer cells to investigate their medicinal properties. So far, the study has revealed interesting anti-cancer properties of some sponge extracts obtained from Mauritian waters. Extracts from marine sponges and other organisms will be tested on other human cancer cells and extracts with potential activity will be fractionated with the aim of isolating pure compounds. In Mauritius seaweed biomass research continued in 2009. The thrust would be the production of bio-fertilizer from the sap of seaweed and the generation of electricity from the combustion of the remaining biomass. In Seychelles up to 2000 marine collection analyses has been carried out (such as the case of sponges). There is no evidence for

marine-derived genetic resource research in the other four African SIDS.

Despite the large potential of marine-derived genetic resources there are also significant challenges and limitations. Securing an adequate supply of marine natural products is a major obstacle and the high costs of research are some of the problems. Commercialization of marine biotechnology products are still few and far between although a few examples do exist which also poses a challenge for African SIDS to fully reap the benefits of this potential. The United Nations Convention on the Law of the Sea is the key international instrument regulating all activities. The current system stipulates bilateral exchange, under which a user of marine genetic resources, often a foreign owned company, returns a share of the benefits of utilization to the provider state where the user accessed the resource, in this case an African SIDS. However, problems exist with this system as it fails to include other source states sharing the same marine genetic resource when demanding benefit sharing. It is ineffective because provider States, the African SIDS, cannot control the whole value chain of a particular marine genetic resource after exportation. States can thus not always benefit from the research carried out in its EEZ.

G. BLUE CARBON MARKET OPPORTUNITIES TO DEVELOPMENT OF AFRICAN SMALL ISLAND DEVELOPING STATES

The United Nations Framework Convention on Climate Change has developed strategies and mechanisms to enhance terrestrial “green carbon” sinks. In recent years, there has been increasing attention for marine and coastal ecosystems. The world’s oceans and coastal vegetation binds carbon in living organisms. Mangroves, seagrasses and marshes capture and store most of the carbon buried in marine sediment. These ecosystems have the equal capacity to sequester carbon both in their tree biomass as well and in the

deep mud that accumulates around the roots. The abundance of mangrove forests, seagrasses and tidal marsh ecosystems in Africa, and particularly in African SIDS, makes “Blue Carbon” important for many of the six countries climate change strategies.

Conserving and restoring terrestrial forests have for some time been recognised as important components of the international climate change mitigation debate through their ability to act as carbon sinks. The UNFCCC have developed different mechanisms such as Reducing Emissions from Deforestation and Forest Degradation (REDD+), nationally appropriate mitigation actions (NAMAs), and the clean development mechanism (CDM). These types of projects provide opportunities and incentives for financial support to enhance conservation, restoration and sustainable use of natural systems such as forests. These types of programmes have led to the economic quantification, purchase and trade of carbon ‘credits’. Usually this has occurred within international and national REDD+ programs whereby developing countries are compensated for maintaining carbon sequestration functions of their forests. The rapid growth of such markets offers potentials for small, equitable and self-sustaining conservation programmes in developing countries. It is increasingly being recognized that coastal ecosystems can offer equally rich carbon reservoirs and can offer potential mitigation benefits and provide similar types of projects. Yet they have been largely excluded in the global climate discussions within these mechanisms.

RECOMMENDATIONS

African SIDS negotiators need to understand potential of the carbon benefits of “Blue Carbon” and use this as opportunities to attract financing for the conservation and restoration of vital marine and coastal ecosystems. “Blue Carbon” credit trade can thus potentially provide large-scale economic benefits for African SIDS as they are endowed with large mangroves, marshes and seagrasses. Conservation and restoration of

these mangroves, seagrasses and marshes can thus potentially provide much more economic gains in the long term ranging from the community to the national level than the short term gains that are made from destruction of these habitats. Blue Carbon should therefore be more fully integrated into international policy discussions on climate change mitigation by African SIDS negotiators, as well as within regional and national policy discussions on marine and coastal management frameworks.

It is unlikely Blue Carbon will become a new and separate issue on the climate change agenda of the UNFCCC. The best opportunities to influence policy lie in the further development and expansion of IPCC guidelines (e.g. to include seagrasses or mangroves) and integration Blue Carbon into existing NAMA and REDD+ agendas. Other potential lies in the definition of activities qualifying for NAMAs, which countries are able to tailor to their specific needs and mitigation potential. SIDS, which do not represent typical REDD+ countries, can use NAMAs to explore opportunities to access climate change mitigation finance for coastal management activities. In addition they can be used to promote capacity building and awareness programs around ecosystem services and carbon sequestration. Several countries, such as Sierra Leone, Eritrea and Ghana have submitted coastal wetland related NAMAs, African SIDS should follow suit. It is important to improve the ability of African SIDS to pursue carbon financing, via the UNFCCC or through voluntary carbon markets, as primary vehicles for supporting national and project-level Blue Carbon activities.

Countries with abundant coastal vegetation (e.g. mangroves) can also seek financing from the UNFCCC’s Adaptation Fund. Other funding options exist in areas such as biodiversity offsetting conservation funding from ecotourism, private sector finance to meet corporate social and environmental responsibility targets, or via bilateral

and multilateral agencies. Several challenges still exist however in Blue Carbon trading. Although scientific evidence exists to support the carbon sequestration benefits of coastal ecosystems, there is currently no international regulatory framework or convention to

protect the value of coastal and marine ecosystems for sequestration carbon and mitigating climate change. Blue Carbon benefits have not yet been fully integrated into policy discussions within the financial mechanisms for climate mitigation.

IV. CHALLENGES AND OPPORTUNITIES IN THE BLUE ECONOMY SECTORS

As discussed in the previous chapter, opportunities do exist for the African SIDS across the different blue economy sectors, as do the challenges of implementing them. Fisheries are the most important renewable resource that African SIDS have for food security, employment and foreign exchange. A 'blue economy' fishery sector is one that is ecologically sustainable, provides a higher level of economic goods and services at lower environmental costs and equitably distributes those benefits. Fisheries are bound to be affected by climate change. Changes in sea surface temperature, salinity, ocean acidification and thermal stress will affect fisheries distribution, migration and production. Climate change thus will provide a significant challenge on top of other challenges the fisheries are already facing: overexploitation; pollution; and IUU fishing. Aquaculture development holds great potential as it is still very limited in the six countries. Aquaculture could help African SIDS lessen fish imports and increase employment as well as help food security. Sustainable coastal aquaculture can reduce pressure on aquatic resources including the depletion of wild fish stocks, destruction of fish habitats and declining biodiversity. However, a proper legal framework for aquaculture development will need to be put in place, while conflicts over the use of natural resources such as land, use of poor aquaculture practices, poor infrastructure, costs of transport, pollution as a result of aquaculture and other environmental impacts as well as climate change impacts can all affect the potential of aquaculture in the African SIDS.

Ports are critical infrastructure assets that serve as catalysts of economic growth and development in African SIDS. As trade to African SIDS nearly exclusively takes place via maritime transport, improving ports is crucial to stimulate economic growth. Port development projects are however

very costly while all six countries require extensive infrastructure improvement as services of the ports are unable to facilitate economic growth under current conditions. In some African SIDS this development is already taking place while others are still seeking international assistance for funding of projects for port development. Climate change impacts such as increased frequency and intensity of storms could impact ports and needs to be incorporated in future projects.

The tourism sector is of great importance to African SIDS except for two countries. Pristine environments, unique cultures, beautiful beaches, extensive coral reefs and a tropical climate all support large-scale tourism in SIDS. The tourism sector is thus responsible for a large part of the GDP in four out of six African SIDS. Tourism should be further enhanced by attracting cruiseship tourism, developing maritime archaeological tourism and creating a value chain whereby benefits are more equally shared. Tourism development plans however need to take careful considerations of increased pollution, energy use and coastal pressure.

Expansion of renewable energy infrastructure would help African SIDS reduce its dependence on imported fuel. Offshore oil and gas exploration offers great potential in some of the African SIDS and exploration is currently being carried out. In other African SIDS no oil resources have been found that are commercially viable and exploration companies have retreated. Offshore oil and mineral exploration must be undertaken within guidelines that ensures environmental sustainability and that the local coastal communities and SIDS economies do not lose out.

Renewable energy offers great potential for African SIDS. Sustainable development should be built

on a sustainable energy foundation. Countries are mostly engaged in wind farms placed on land and could be further developed. Tidal energy is only of potential interest in one African SIDS while microbial fuels development is still in the development phase. While recognizing the great potential for small island developing states to make use of local renewable energy resources, improved access to technology, financial resources and local expertise are vital as well as the need to learn from other (African) SIDS.

In African SIDS the ocean offers great potential in terms of marine living resources including marine-derived genetic resources. Only in Seychelles and Mauritius however has research currently been carried out and no commercial production is in place in either of the two. Research in marine-derived genetic resources should be carried out in the other four African SIDS to examine their potential. Hurdles to development include insecure supply of marine products, capital intensive technology and difficulties with benefit sharing between producer countries and users.

The abundance of mangrove forests, seagrasses and tidal marsh ecosystems in Africa, and particularly in African SIDS, makes “Blue Carbon” important for many of the six countries climate change strategies. African SIDS negotiators need to understand the potential of the carbon benefits of “Blue Carbon” and use this as opportunities to attract financing for the conservation and restoration of vital marine and coastal ecosystems. “Blue Carbon” credit trade can thus potentially provide large-scale economic benefits for African SIDS as they are endowed with large mangroves, marshes and seagrasses. However, despite scientific evidence there is still a lack of institutional support to protect the value of coastal and marine ecosystems for sequestration carbon and mitigating climate change and Blue Carbon benefits have not yet been fully

integrated into policy discussions within the financial mechanisms for climate mitigation.

A. CONFLICTS BETWEEN DIFFERENT BLUE ECONOMY SECTORS IN THE AFRICAN SMALL ISLAND DEVELOPING STATES

- Ports can carry environmental impacts such as air and water pollution, dredging, loss of wildlife habitat, aquatic nuisance species, restraining public access to coastal resources, and land conflict use issues. This could therefore impact biodiversity and as a result impact the fisheries and tourism sector.
- Tourism sector development will lead to a higher demand on energy which is already consuming a lot of foreign exchange earned by SIDS. Tourism development should therefore go hand in hand with renewable energy development.
- Aquaculture can create conflicts over competing land use in coastal areas in SIDS. In SIDS there is already significant amount of coastal pressure and for some aquaculture development projects placement in land, if possible, it could therefore be a preferred option.
- Oil drilling can have far reaching environmental consequences and thus potentially impact fisheries. Oil and gas exploration and production should therefore carefully take environmental concerns into consideration.
- Tidal energy production has many environmental impacts of which the consequences for biodiversity and marine life are still unknown. Until scientific evidence exists developing other renewable energy options is therefore perhaps more sustainable.
- Aquaculture can interfere with Blue Carbon conservation projects as aquaculture can create environmental impacts in mangrove areas where Blue Carbon projects can be expected to occur.

V. CONCLUSIONS AND RECOMMENDATIONS

The sea and the coasts are drivers of the economy in the African SIDS and offer a lot of developmental potential. The concept of the blue economy is still under development. In practice, however, this report shows that the sectors that are part of the blue economy are in many cases already well developed in many African SIDS. This report has shown the pathways for development of the different blue economy sectors in African SIDS: fisheries, aquaculture, shipping and maritime transport, tourism and non-renewable and renewable energy, marine genetic resources as well as blue carbon trading. The different sectors are of great importance to the African SIDS yet all provide different stages of development for the six countries. This also provides opportunities for cross country information and technology exchange. The potential for development per sector, nevertheless, also differs per African SIDS due to specific ecological, geographical, political circumstances as well as technological and human expertise. Institutional arrangements should be made to facilitate the sharing of experiences, the pursuit of mutual goals and the sharing resources across the six African SIDS on the different blue economy sectors as well as between African and other SIDS (e.g. Caribbean and Pacific SIDS). Technologies must be made accessible, affordable and adaptable to the needs and particular circumstances of African SIDS by the international community, including mainland Africa.

RECOMMENDATIONS

- Environmental impact assessment should be carried out prior to design and implementation of new blue economy development projects. Blue economy implementation should follow steps clearly identify by SIDS themselves (see Seychelle current initiative).
- Institutional arrangements exist in various individual Blue economy sectors but no mechanism is in place to facilitate the sharing of experiences, pursuing of mutual goals and sharing of resources across the six African SIDS in the sector of the blue economy as a whole.
- The six African SIDS should develop a forum and organize meetings to learn and share experiences and support each other in blue economy development. The dissemination and transfer of new technologies and expertise can assist the countries in developing the different sectors as some are more advanced in some sectors while others are more advanced in other sectors. As a result the position of African SIDS within the global SIDS group will be strengthened. In addition, it will provide a better position to interact with mainland Africa.
- National, regional and international policy, regulatory and economic instruments can be used to promote blue economy pathways.
- African SIDS also need to learn from blue economy development in SIDS in other regions such as the Caribbean and the Pacific. SIDS DOCK is such a type of initiative whereby Caribbean, Pacific and African SIDS are all part of this initiative to develop renewable energy in these regions. This collective institutional mechanism will assist them in transforming their national energy sectors into a catalyst for sustainable economic development and help generate financial resources to address climate change challenges.
- It is crucial to build human capital in the countries involved by means of training and education on new developments in the different blue economy sectors.
- Technologies must be made accessible, affordable and adaptable to the needs and particular circumstances of African SIDS. The international community, particularly developed countries as well as some mainland African countries and organizations, should provide financial resources, technology transfer and capacity building to SIDS.

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About ClimDev-Africa

The ClimDev-Africa Programme is an initiative of the African Union Commission (AUC), the United Nations Economic Commission for Africa (ECA) and the African Development Bank (AfDB). It is mandated at the highest level by African leaders (AU Summit of Heads of State and Government). The Programme was established to create a solid foundation for Africa's response to climate change and works closely with other African and non-African institutions and partners specialised in climate and development.

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