Research Article

Towards a Circular Blue Economy in the Global South: Potentials and Challenges in Kiribati

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Abstract

Countries with large ocean areas tend to rely on aquaculture products to drive their economy, such as Kiribati which relies heavily on the fisheries sector because its ocean area is significantly larger than its land area. To claim that the sea is Kiribati's only hope for its economy is not an exaggeration given how much aquaculture products contribute to its national income. Unfortunately, Kiribati's heavy reliance on the fisheries sector is not balanced with an adequate management framework and this condition is increasingly exacerbated by climate change and over-exploitation of marine resources, which are posing serious threats to Kiribati's economy. Using descriptive qualitative methods, this research aims to identify sectors with potential as new economic sources and challenges for the development of a blue circular economy in Kiribati. The findings of this research reveal that Kiribati has several sectors that can be utilized in the implementation of a circular blue economy: coastal tourism, hydrogen-based energy production, and waste management system. However, numerous challenges prevent these sectors from reaching their full potential, including the availability and feasibility of infrastructure, logistical hurdles due to its remote and isolated location, and public access to information. Furthermore, this research suggests several policy recommendations, focusing on strengthening existing institutions, giving more attention to previously neglected aspects of the KSTDPF (such as the Kaoki Maange System), and establishing a comprehensive policy framework for green energy.

Keywords: Kiribati; Global South; Economic Development; Circular Economy; Blue Economy

Introduction

Based on their level of development, countries in the world are classified into developed countries, developing countries, and least developed countries (LDCs). This categorization is determined by evaluating three key criteria: (1) Gross national income (GNI) per capita, which reflects the level of income and available resources; (2) Human Assets Index (HAI), which measures the quality of human resources; and (3) Economic and Environmental Vulnerability Index (EVI), which gauges structural vulnerability to economic and environmental shocks. Of the three categories, LDCs are quite prominent so they are easy to identify. For the 2024 review, a

country will be classified as LDC if they have (a) average GNI per capita under $1,088; (b) HAI[1] equal to or below 60.0; and (c) EVI[2] equal to or above 36.0 (UN DESA, 2023).

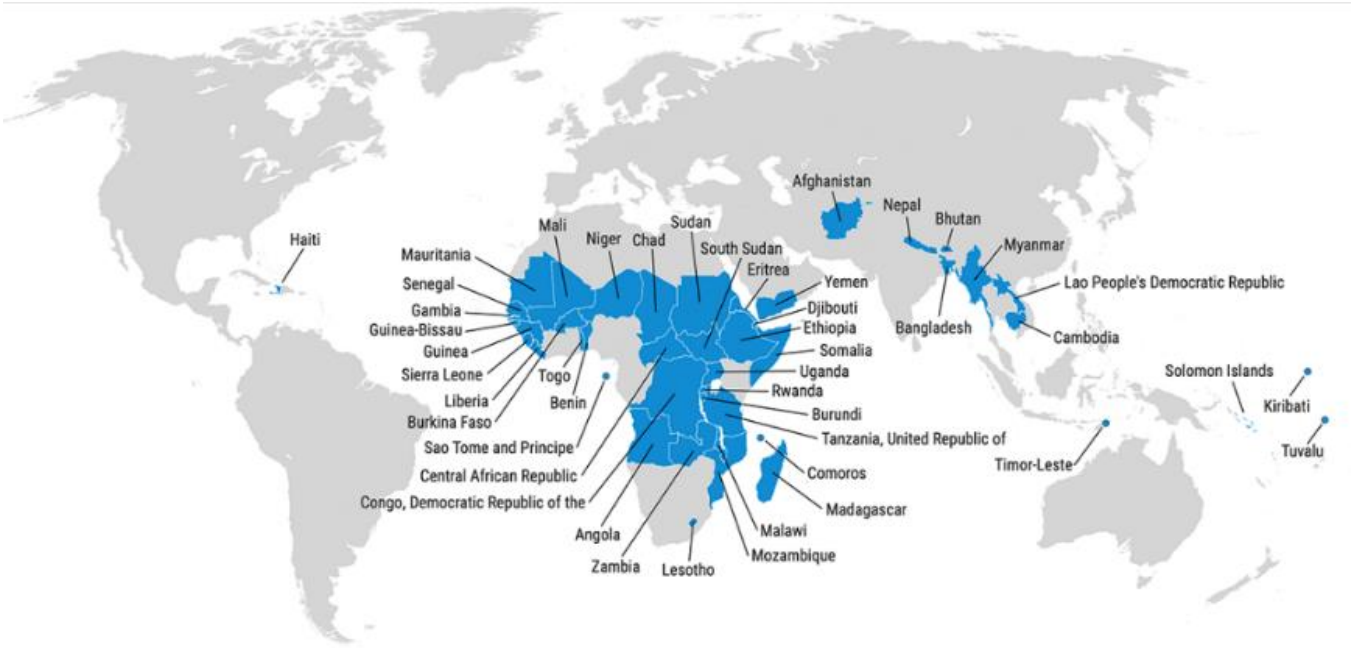

Figure 1. LDCs in the World (2021 Review)
Source: United Nations Conference on Trade and Development (2023)

According to the 2021 review, 46 countries in the world are classified as LDCs, with 33 of them located in Africa, nine in Asia, three in the Pacific, and one in the Caribbean (UN DESA & Committee for Development Policy, 2021). Combined, these 46 LDCs are home to 1.1 billion individuals (representing approximately 14% of the global population). Despite this large population, these countries contribute a mere 1.3% to the world's GDP (UNCTAD, 2023).

Several obstacles pose significant challenges to the progress of LDCs towards national development. Firstly, the increasing foreign debt burdens, which are projected to reach $43 billion in 2022, create difficulty for local governments to allocate funds for domestic infrastructure development. Secondly, the marginalization of exports due to narrow market targets and a lack of diversity in commodities. Thirdly, around 570 million people, most of whom live in rural areas, suffer from energy poverty and have no access to electricity. Lastly, despite the minimal contribution of LDC residents to carbon emissions, they are extremely vulnerable to the consequences of the climate crisis (UNCTAD, 2022).

In the economic sector, agricultural products and natural resource extraction (including mining, forestry, and fishing—are primary sources of income for many LDCs. While these commodities are (and will always be) essential for human survival, the real problem lies in the lack of diversification. LDCs usually rely on very limited commodities for export and fiscal revenue, which leaves them vulnerable to terms-of-trade shocks—changes in the ratio of export and import prices, both temporary and permanent.

[1] The HAI is comprised of two sub-indices: (1) Health, i.e., under-five mortality rate, maternal mortality ratio, and number of stunting cases; and (2) Education, i.e., lower secondary school graduation rate, literacy rate, and gender equality in education level.
[2] The EVI is comprised of two sub-indices: (1) Economic vulnerability, i.e., contribution of the agricultural, forestry, and fisheries sectors to the Gross Domestic Product (GDP), remoteness and landlockedness, export concentration, and instability of exports of goods and services; and (2) Environmental vulnerability, i.e., population distribution in coastal areas and drylands, agricultural production instability, and disaster victims.

In another scenario, LDCs may possess valuable assets that could be used to diversify their economies. For instance, African countries have abundant reserves of oil, natural gas, and coal. However, these assets often will (have to) remain untouched, either because (a) LDCs do not possess the capacity to extract, process, and distribute them; (b) Developed countries have already carried out environmentally disruptive infrastructure megaprojects that contribute to environmental degradation so that latecomers are being discouraged from engaging in similar activities due to 'environmental considerations'; or (c) The market for such resources has shrink as people are starting to switch to green energy. These represent huge potential losses, severely limiting the space for the growth and development of LDCs (Akiwumi, 2021).

LDCs like Kiribati have successfully diversified their economies by exploring alternative sectors like manufacturing, but these efforts are often limited to labor-intensive industries. Kiribati, a small nation with 33 islands, has been recommended for graduation from LDC status since 2018 and 2021. However, due to its high EVI score and the socio-economic impacts of the COVID-19 pandemic, it will remain in the LDCs category until the next review in 2024. (UN DESA & Committee for Development Policy, 2021; UNCTAD, 2021).

Like many other LDCs, Kiribati's economy is heavily dependent on a few commodities, with little to no options for diversification. Being an archipelagic country in the Micronesia subregion of Oceania with a much larger water area than land, fisheries products—particularly tuna—become Kiribati's main commodities. Kiribati is a leading tuna producer in the Western and Central Pacific (WCP), which is the world's largest tuna fishing grounds. In 2020, the WCP produced 2.7 million tonnes of tuna, accounting for 54% of the global share. Kiribati territorial waters contributed 7.6% (around 209,000 tonnes) of this total amount. Apart from tuna fisheries, fishing licenses granted to foreign vessels are also one of the largest sources of fiscal income for Kiribati. In 2015, it accounted for $207.1 million, or 91% of Kiribati's GDP. For the next five years, fishing licenses' contribution experienced a decline—although it remains significant, accounting for 70% of Kiribati's fiscal revenues in 2020 (Nguyen et al., 2023; Webb, 2020).

The limited land area consisting mostly of alkaline coral with high porosity and the lack of surface water make Kiribati one of the countries with the lowest level of land-based biodiversity in the world (MELAD, 2014). This is evident from the fact that its agricultural products are limited to coconut, breadfruit, pandan, giant swamp taro, taro, sweet potato, cassava, banana, papaya, wild fig, pawpaw, screw pine, and several types of vegetables, while its livestock products are limited to pigs, poultry, and cattle (MELAD, 2022). Among these agricultural and livestock products, only coconut (and its derivative products) accounted for a considerable portion as one of Kiribati's top five export commodities—$2.55 million (coconut oil) and $1.8 million (copra) of Kiribati's total $94.5 million export revenue in 2021 (OEC, 2023).

In the manufacturing sector, companies in Kiribati are mostly small-scale enterprises specializing in fish processing, copra production, and traditional crafts and small goods for local consumption rather than international markets. In 2020, the manufacturing sector's share in Kiribati's total GDP was only 9,92%—much smaller when compared to fishing revenues, averaging about AUD185 million (around $119.5 million) or 70% of the country's GDP during 2015–2020 (Nguyen et al., 2023; O'Neill, 2024; Sawe, 2019).

Given the lack of commodities that can be used as diversification options, it is not an exaggeration to claim that the sea is the only hope for Kiribati's economy, which is why the blue economy is a big deal for the country. Unfortunately, Kiribati's heavy reliance on the sea, particularly the fisheries sector, is not balanced by the effectiveness of adequate management frameworks and conservation efforts due to environmental threats (such as pollution, marine litter, climate change, habitat destruction, and invasive species), governance issues (such as lack of resources, sectoral or transboundary partnership, dan governance integration), systematic over- and illegal, unreported, and unregulated fishing, destructive fishing methods, seabed mining and/or spatial use conflicts, and increased pressure on local resources as a result of rapid population growth (Nguyen et al., 2023; The Commonwealth, 2021).

This article argues that Kiribati's economic sustainability should not be exclusively dependent on the fisheries sector. The country can reap benefits from other sectors that can be harnessed to implement a circular blue economy. This economic model presents enormous potential benefits as it integrates environmental and economic principles, which, if properly managed, can lead to increased productivity, the creation of new jobs, improved resource use efficiency, and at the same time, the preservation of marine biodiversity—all of which would enhance Kiribati's economy and the welfare of its people. Nevertheless, numerous obstacles impede the full realization of the potential that these circular blue economy-related sectors offer.

Quite a lot of literature has discussed the blue economy in Kiribati, particularly the utilization of the tuna fisheries sector. However, research has combined this concept with the circular economy concept or focused on potential sectors that could complement the tuna fisheries sector in the Kiribati economy. Based on this research gap, this article addresses several novelty points organized into four sections, each studying a different aspect of implementing the circular blue economy in Kiribati. The first section discusses how Kiribati manages its marine resources and the country's issues in this area. The second section explores potential sectors that could be used to implement a circular blue economy in Kiribati while addressing the challenges that arise from these sectors. The third section provides an evaluation of previous programs implemented by Kiribati. Finally, the fourth section discusses the future of a circular blue economy in Kiribati.

Literature Review

The first literature to be discussed is the work of James Webb (2020) titled *Kiribati Economic Survey: Oceans of Opportunity*. Although Kiribati is among the world's poorest and most remote Pacific nations, it has tuna as its largest sector. Previously, Kiribati was categorized as a low-income country and a least developed country by the United Nations. The country had many environmental problems, and aspects of life were inferior. However, Kiribati is starting to experience a surge in economic growth from its fishing revenue as the country with the largest tuna sector. According to Webb, Kiribati's fishing license revenue was only $29.1 million in 2011, but it increased to $207.1 million in 2015, a significant increase in just four years. Webb provides exciting information on Kiribati's economy and development before the government focused on the tuna sector, making fishing revenue a game changer in Kiribati's economy. The fisheries sector was very helpful in improving Kiribati's economy to build the country. However, the problem is how the Government of Kiribati maximizes their potential in the fisheries sector. Therefore, Kiribati can continue to grow and manage it well. Webb's research (2020) supports this paper by explaining that Kiribati's seas can develop the country, and a direction is needed to manage the resources.

The second literature related to this issue is the work of Marc-Andrej Felix Mallin (2018) called *From Sea-level Rise to Seabed Grabbing: The Political Economy of Climate Change in Kiribati*, which shows that Kiribati is a Pacific Island country that has the largest exclusive economic zone (EEZ), which makes Kiribati very dependent on their maritime sector in improving the economy. Our focus in this paper is to highlight how Kiribati's policies and actors play an essential role in influencing marine governance. This paper shows that policymakers and academics often overlook the role of communities, which should play an essential role in marine and coastal policy formulation, and that it is vital for communities to participate in shaping solutions to the environmental issues that plague Kiribati's waters. The authors learned from this paper that Kiribati faces challenges in policy formulation and decision-making actors, and therefore maritime sector in Kiribati cannot be managed optimally. Therefore, Mallin's paper (2018) highlights how the sea level rise has become increasingly politicized in Kiribati and impacts its economic development.

The third literature is discussing about the blue economy from Marwan Youssef (2023) named *Blue Economy Literature Review* that provides a comprehensive overview of the blue economy concept. This article argues for the sustainable use of ocean resources to drive economic growth while preserving the health of marine ecosystems. This paper shows that in blue economy, there are diverse sectors, such as traditional sectors that included fisheries, aquaculture, marine transportation, and coastal tourism; and emerging sectors that

includes renewable energy (offshore wind, wave, and tidal), bio-technology and deep-sea mining. The authors then acknowledge that blue economy have a substantial contribution to the global economy, give livelihood support, particularly in coastal communities. From this paper, the authors also acknowledge the challenges and threats facing the blue economy, including environmental degradation and governance and policy gaps that lacks of comprehensive frameworks, inadequate enforcement and conflicting interest among stakeholders. Youssef (2023) support this paper by enlighten the main problem on the blue economy.

Methods

In this article the authors use qualitative research to understand the phenomenon of the circular economy in Kiribati by looking at the potentials that Kiribati has and the programs that Kiribati has already and/or currently doing. The authors conduct a literature review from various resources, such as books, journals, and reports as primary resources. The secondary resources will be collected from credible websites, newspapers, and related media. The authors used PRISMA methods on collecting the data. The first stage is doing identification from the literatures that has been collected from google scholar or publish or perish. The next step is data filtering as the authors acknowledge that plenty of literatures that the authors get will not support the research. The authors decided to keep those literature that discussed about circular economy and Kiribati's potential on it. Last but not least, the authors tried to make a synthesis based on the literatures that the authors have already filtered. The next chapter discuss about marine resources management in Kiribati, Potential Sectors for A Circular Blue Economy in Kiribati, Sustainable Coastal Tourism, Hydrogen as a green energy source, Waste Management, Kiribati's Effort to Face Challenges, and the Future Circular Blue Economy in Kiribati.

The research undertaken in this article is constrained by the availability of data. The authors have diligently sought the latest information from various sources, including the official website of the Kiribati government and other relevant repositories. However, the most recent data available is limited to the year 2023. This limitation is due to the fact that the collection and publication of data often lag behind real-time events. Additionally, certain data may be subject to delays in release due to factors such as government reporting cycles and the time required for data compilation and analysis. Despite these constraints, the authors have made every effort to utilize the most up-to-date and comprehensive data available.

Result and Analysis

Marine Resources Management in Kiribati

On February 11, 1982, Kiribati, along with six other Oceania countries—the Federated States of Micronesia, the Marshall Islands, Nauru, Palau, Papua New Guinea, and the Solomon Islands, signed the Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest (commonly referred to as the Nauru Agreement). This regional agreement is aimed at coordinating and harmonizing the management of tuna purse seine fisheries and fishing approaches for common stocks, while also enhancing the bargaining power of fishing license-countries and strengthening regional control of illegal fishing in the territorial waters of member countries of the agreement, known as the Parties to the Nauru Agreement (PNA) (Boyce et al., 2014; Nguyen et al., 2023).

The Palau Arrangement for the Management of the Western Pacific Fishery (better known as the Palau Arrangement), an extension of the Nauru Agreement, was agreed upon by the PNA countries on October 2, 1992. It serves as a framework that covers various aspects of tuna fisheries management measures, including regulations of effort, capacity, seasonal, and area closures. Under the Palau Arrangement, a scheme aimed at creating scarcity, improving fishing efficiency and economic profits, and ensuring the sustainability of aquatic

resources was adopted in 2007 (Yeeting et al., 2018). The scheme, which came into effect in 2012, is called the Vessel Day Scheme (VDS).

According to the VDS policy, the PNA countries are only allowed to fish within the fishing days limit specified in the Total Allowable Effort (TAE), which is approved during the PNA's annual meetings. To determine the TAE allocation, several bilateral and multilateral agreements are taken into account, with priority given to the Federated States of Micronesia agreement (FSMA) and the US Tuna Treaty (UST). Each PNA country has the freedom to utilize their allotted fishing days and may even choose to sell them to other PNA countries or distant water vessels through license agreements that will allow foreign vessels to fish in the exclusive economic zone (EEZ) of the respective country. Foreign vessels must comply with minimum terms and conditions coordinated through 'implementing arrangements', which require them to register and be licensed, report their catches, maintain log books, allow observers on board, and maintain transparency over fishing activities (Clark et al., 2021; Yeeting et al., 2018).

Kiribati ranks second in the country with the largest TAE allocation among other PNA countries, with 12,617 days out of the total allocation of 43,480 days in 2014—only behind Papua New Guinea with an allocation of 15,495 days (Nguyen et al., 2023; Yeeting et al., 2018). This suggests that there is a high volume of fishing in Kiribati's EEZ and that the country earns a considerable amount of income by selling fishing licenses to foreign vessels, considering that fishing days are sold for a minimum of $8,000 each and vessel owners seeking to obtain one must pay a registration fee of $2,400 for three years per vessel (Carreon, 2021b; Inter-American Tropical Tuna Commission, 2020).

Apart from efforts to limit the number of vessels fishing through the implementation of the VDS, Kiribati is also actively working to protect its marine biodiversity through the creation of a marine protected area, which happens to be one of the largest in the world. Kiribati is comprised of 33 islands that are divided into three island groups: the Gilbert Islands, the Line Islands, and the Phoenix Islands. Of the three island groups, the Phoenix Islands have the smallest population because apart from Canton Island with its total population of 41 people (2020 data), the remaining seven islands—Birnie, Enderbury, Manra, McKean, Nikumaroro, Orona, and Rawaki Islands—are uninhabited (Pacific Community & Kiribati National Statistics Office, 2022). There are approximately 800 known species of flora and fauna in these mostly uninhabited islands, including 200 coral species, 500 fish species, 18 marine mammals, and 44 bird species. Due to this biodiversity, the Phoenix Islands are an important area to protect.

In 2008, the Kiribati Government established the Phoenix Islands Protected Area (PIPA), an area of 408,250 km^2 that covers 11.34% of Kiribati's EEZ. The PIPA is home to one of the world's largest oceanic coral archipelago ecosystems, which includes a diverse array of marine biotas, such as bump head parrotfish, Napolean wrasse, surgeon fishes, parrotfishes, groupers, Māori wrasse, sharks, turtles, dolphins, manta rays, and giant clams—many of these species have been depleted elsewhere. The PIPA's isolation makes it one of the most unspoiled and unexplored parts of our planet, which makes it an ideal breeding site for various nomadic, migratory, and pelagic marine and terrestrial species. Its exceptional beauty and enormous contribution to ecological and biological processes in the evolution and development of marine ecosystems made the PIPA the first and only Kiribati site to be included on UNESCO's World Heritage List (UNESCO World Heritage Centre, 2023b, 2023a).

In an effort to conserve biodiversity, commercial fishing was banned on eight uninhabited islands within the PIPA or the equivalent of 3% of the total area of this marine protected area. The ban was eventually expanded, and in 2015, the Kiribati Government fully closed the PIPA to commercial fishing. This regulation was enacted to safeguard the populations of various fish species, especially the bigeye tuna, which has been severely overfished in recent years. Additionally, the PIPA Trust Fund was established through partnerships with international partners to provide long-term sustainable financing for biodiversity conservation, replace lost fishing revenues, and develop alternative sources of income for Kiribati (Nguyen et al., 2023).

The VDS and PIPA were proven to be viable and well-designed marine resources management schemes. Since its implementation in 2012, the PNA countries have seen a significant increase in profits from tuna fishing, more than ten times the amount before ($500 million per year or around $1,400 per capita for the Kiribatian population). While there has been a downward trend in the allocation of VDS days for Kiribati over the last few years, from 12,617 days in 2014 to 7,677 days in 2018, the revenues and catch levels have remained high. Moreover, the increase in the price of fishing licenses is expected to make up for the loss of VDS days. This profit presents a valuable opportunity for the PNA countries, including Kiribati, to ensure the sustainability of their fisheries resources and at the same time, promote community development and develop better and more sustainable management schemes in the future (Kesby, 2022; Nguyen et al., 2023).

The implementation of the PIPA has made a remarkable impact on the restoration of biodiversity on the Phoenix Islands. Following a complete commercial fishing ban in 2015, the PIPA water area has become a safe breeding and feeding ground, resulting in the growth of marine reserves. Reef fish, in particular, have flourished, aiding in the recovery process of atolls and coral reefs previously damaged by rising ocean temperatures. This is due to the fish feeding on algae that had smothered the corals, allowing them to recover once more (Nguyen et al., 2023). Implementing the PIPA also helps to control invasive species and allows land-based flora and fauna to return to the island and thrive after being on the verge of extinction for many years (International Institute for Sustainable Development, 2020).

The VDS and PIPA have had positive impacts, but Kiribati has not fully adhered to the standard rate of $8,000 per fishing day sale. The US and EU have allowed vessels to purchase fishing days at lower prices than the VDS benchmark price, but these rates are still better than the EU-Kiribati Fisheries Partnership Agreement (Carreon, 2021b; Yeeting et al., 2018). It seems that Kiribati, a nation with enormous potential but limited bargaining power, may lean towards partial compliance and short-term benefits that are seen as a more rational and promising choice. In the face of an opportunity to reap quick profits, Kiribati may opt to loosen its enforcement of the VDS and to a certain degree, overlook the escalating exploitation of its marine resources.

Still related to economic motivation, the total ban on commercial fishing within the PIPA boundaries has caused fishing demand to experience a significant decline, which leads to revenue loss. Since 2015, there has been a decline in fishing demand by 8%, resulting in a loss of approximately $60–140 million for purse seine fishing and $5.9 million for longline fisheries. This loss is equivalent to a decrease of 720 VDS days, which has also affected Kiribati's future allocation of VDS days (Carreon, 2021b; Nguyen et al., 2023). To prevent even greater losses in the future, the Kiribati Government decided to terminate the no-take zone and re-open the PIPA to commercial fishing in November 2021.

The Office of the President of Kiribati stated that the government's decisions prioritize the livelihoods of the people and are people-centric. They emphasized holistic options for marine protection, economic diversification, sustainable tourism, and fisheries, promoting Kiribati's blue economy and uplifting the lives of all I-Kiribati. The decision was challenging due to the PIPA Trust Fund's insufficient compensation (Carreon, 2021a, 2021b).

Regardless of the underlying reasons, this decision, as can be expected, creates a dilemma: in the short run, Kiribati's fishing sector may receive a boost and fiscal revenues will increase because of the increased fishing license sales, but in the long run, it may jeopardize the marine ecosystem and undo the conservation efforts that have been undertaken over the past decade (Nguyen et al., 2023).

Looking at the Kiribati Government's track record of compliance with the VDS, it is plausible to presume that they may prioritize their economic interests should short-term incentives prove more alluring, notwithstanding their assertion that the lifting of the fishing ban in the PIPA will not compromise their commitment to preserving marine biodiversity.

Potential Sectors for A Circular Blue Economy in Kiribati

As mentioned in the previous section, one of the objectives of the PIPA Trust Fund is to support the development of alternative sources of income for Kiribati. This implies that the fisheries sector may not be the only hope for Kiribati's economy, as there are still a number of potential sectors that the government could explore to implement a circular blue economy.

This article maps three potential sectors that Kiribati could benefit from:

Sustainable Coastal Tourism

Tourism is an important source of foreign exchange, government revenue, and employment for many small island states. However, Kiribati's tourism industry is still in its early stages (Milne, 1991). Kiribati offers unique experiences for tourists, including fishing, snorkelling, bird watching, shore excursions, and surfing on Kiritimati Island, Fanning Island, Kanton Atoll, and Tarawa. The island also showcases century-old traditions, field tours in World War II ruins, game fishing tournaments, and commemorations like the Battle of Tarawa and the Battle of Makin.

Kiribati recognizes the economic value of its natural beauty, people, culture, and heritage. Hence, they are committed to developing sustainable tourism through the Kiribati Sustainable Tourism Development Policy Framework (KSTDPF) which was launched in 2021. Sustainable tourism, as defined by the UN World Tourism Organization, considers economic, social, and environmental impacts while meeting the needs of tourists and host communities. It focuses on efficient use of resources, respect for local cultural heritage, and fair economic operations. (UNWTO, 2023). In general, the sustainable tourism framework is formed by the roles and relationships between five primary stakeholders: international bodies, national/local governments, businesses, communities, and tourists (Roxas et al., 2020).

KSTDPF itself is a policy framework that is integrated with various other policy fields and discusses a set of priorities needed to achieve seven objectives: protecting natural environment; preserving cultural and historical heritage; promoting community and social well-being; guaranteeing visitor satisfaction, health, and safety; contributing to national economic prosperity; inspiring green entrepreneurship; and influencing effective leadership (Tourism Authority Kiribati, 2021).

Through this policy framework, the Kiribati Government will collaborate with various stakeholders to address the needs of visitors, the industry, and host communities. Additionally, Kiribati aims to develop a coastal tourism industry that prioritizes environmental sustainability and empowers local communities, in addition to economic gain. Kiribati's tourism industry faces challenges due to its remote location, limited air links, and low visitor numbers. Access to neighbouring countries is difficult, and the lack of air links contributes to its low arrivals. The South Pacific Tourism Organization reported a 2017 annual review of 5,663 total arrivals, significantly lower than Fiji's 842,884 in the same year (Milne, 1991; Webb, 2020).

Another challenge for the tourism industry in Kiribati is the expensive development costs needed to maximize the environmental attraction potential of the outer islands which are not exposed to much human intervention. The development cost will subsequently affect the expenses that must be spent if one wants to visit Kiribati. This puts Kiribati at a disadvantage compared to other destinations in the region as Kiribati will rarely be the first choice for consumers and investors, leading to a low level of demand (Webb, 2020).

The Kiribati Government's limited development of tourist-oriented infrastructure is attributed to a lack of investment in upgrading facilities like hotels, restaurants, and transportation. The government cannot afford to gamble on public investment without guaranteeing its return. The Otintaii Hotel, which was supposed to support tourism, failed due to safety concerns and poor upkeep. This has led to reluctance to purchase Embraer 190-E2 aircraft for airlines (Milne, 1991; Webb, 2020). This reason is also applicable to other tourist-oriented infrastructures in Kiribati.

The availability and feasibility of tourism infrastructure will continue to be an issue as long as the Kiribati Government still deems that investment in developing sanitation, access to clean water, and basic education is more promising and rational, as the outcomes are more certain and measurable compared to investment in specific measures for an industry that may or may not eventuate (Webb, 2020). It is an acceptable logic, especially if we consider Kiribati's experience. However, it will cost Kiribati the opportunity to develop a sector that could become a 'gold mine' for its economy.

Hydrogen as a green energy source

With 3.5 million km^2 of sea area, Kiribati is a fishing paradise. However, many people may ignore another resource that can be extracted from this vast water area: hydrogen.

Hydrogen, an abundant element, is decomposed through thermal, electrolysis, solar-driven, or biological processes to obtain pure form. It can be classified into three types: gray hydrogen, obtained from fossil energy sources without carbon emissions, blue hydrogen, captured and stored underground, and green hydrogen, obtained from renewable sources without carbon emissions (Marchant, 2021; U.S. Department of Energy, 2023).

Green hydrogen plays a crucial role in decarbonization efforts. Its production process is cleaner, as it only yields water as a byproduct. Furthermore, its potential to replace fossil fuels is enormous, leading some to consider hydrogen as the "fuel of the future" that has the potential to become a multi-trillion-dollar global market.

One of the most commonly used methods for producing hydrogen is through electrolysis. Through this process, an electric current is utilized to extract hydrogen elements from water. Since water is the primary component needed, nations with substantial bodies of water may have an edge in advancing the hydrogen production industry. Kiribati, whose water area greatly surpasses its land area, possesses the potential to become a major hydrogen producer and establish a partnership with other nations striving to accelerate their energy transition. To illustrate, one kg of water consists of roughly 110 grams of hydrogen and one kg of hydrogen can contain about 33 kWh of usable, cleaner energy. With a sea area covering approximately 3.5 million km^2, one can already imagine the considerable potential for hydrogen extraction from Kiribati's waters.

It should be noted that Kiribati faces significant challenges in its pursuit of hydrogen development, primarily due to its remote and isolated location. This creates logistical hurdles, as the only feasible means of distribution is through costly shipping methods for liquid hydrogen. Furthermore, the high-tech equipment required for electrolysis and liquefaction processes, coupled with the need for top-notch storage facilities, and skilled personnel to manage production and distribution, result in considerable costs for hydrogen development.

Waste Management

Kiribati's 80% population relies on the sea for living, making ocean health crucial. Despite being the most productive and least polluted on earth, the country faces waste problems that threaten marine health. With 6,900 tonnes of waste produced annually, including biodegradable, recyclable, chemical, and medical waste, only 38% is collected by authorities, while the rest is disposed of on-site, illegally dumped into the sea or lagoon, or recycled. (Asian Development Bank, 2014; UN Environment Programme, 2019).

Lack of public access to information related to the production, import, transport, use, storage, and disposal of waste makes this a growing problem (UN Environment Programme, 2019). To address the problems, Kiribati is actively working towards developing a comprehensive waste management system to minimize the amount of waste that is disposed of in the ocean and landfills. The responsibility for waste management in Kiribati is shared among multiple stakeholders across two levels. At the national level, the Ministry of Environment,

Lands and Agriculture Development (MELAD) through the Environment and Conservation Division (ECD) oversees legal, policy, and planning aspects. Management at the national level also involves the Plant and Vehicle Unit (PVU) from the Ministry of Public Works and Utilities (MPWU) which is responsible for maintaining government vehicles used in operations, as well as the Healthcare Waste Management Committee made up of the Ministry of Health and Medical Services (MHMS) and the MELAD which is responsible for handling medical waste that is often not segregated, thus posing a threat to public health (Asian Development Bank, 2014).

Waste collection and disposal in landfills based on area are handled by local government councils, such as Betio Town Council (BTC) and Teinainano Urban Council (TUC) in South Tarawa, as the main stakeholders and private operators. The local councils provide waste collection services, where the community members place their waste in 167-litre drums or rice bags on the sides of roads and tracks which will then be transported by garbage tractors and trailers for disposal once to twice a week. Unfortunately, these services are often hindered by poorly maintained vehicles and low performance by collection workers. Additionally, these services are not provided for free. The council imposes service charges, which range from $27 per year (for private permanent houses) to $596 per year (for large commercial establishments). After the waste is collected, they are directly disposed of at landfill sites in Nanikai, Bikenibeu, and Betio which have been subsequently rehabilitated and upgraded with funding from the Asian Development Bank (ADB) through the Sanitation, Public Health, and Environment Improvement Project (Asian Development Bank, 2014).

Recycling is the focal point in the waste management system in Kiribati. In 2004, the Ministry of Commerce, Industry, and Cooperatives (MCIC), the United Nations Development Program (UNDP), and the Foundation of the Peoples of the South Pacific International (FSPI) joined forces and launched a recyclable waste system trial project, which was later privatized and operated by a local agency, One Stop Company. The project, known as the Kaoki Maange System, is a container deposit scheme, where any imported items that can be recycled will be collected and people who deposit their share of recyclable waste will be paid according to the number of items they submit (Secretariat of the Pacific Regional Environment Programme, 2021). Insufficient infrastructure makes it impossible for the recyclable materials that have been collected to be processed domestically. Therefore, these materials must be exported to countries such as Australia, Hong Kong, and China which possess more advanced technology and are able to carry out the recycling process (Asian Development Bank, 2014; UN Environment Programme, 2019).

Other than the Kaoki Maange System, the Kiribati Government has also introduced a new initiative in recent years: the 4R's Bazzar. This program seeks to encourage local communities to independently process recyclable waste and repurpose them into new products with economic value. This initiative has two primary objectives: (1) To reduce the amount of waste that will enter the landfill and the ocean, be burned, or buried—thus improving environmental health; and (2) Increase public awareness about the importance of waste management and hopefully, open up opportunities for local communities to empower themselves and obtain alternative sources of income that will grow with the assistance from and coordination with the government and the private sector (Secretariat of the Pacific Regional Environment Programme, 2021).

Kiribati's Effort in Facing the Challenges

The Kiribati government is aware of its potential in the marine sector. For example, by realizing that the marine sector is their country's primary source of income, the Kiribati government must pay extra attention to the rising sea level. This increase in seawater will hinder Kiribati's economy because it is getting closer to land, making it possible for Kiribati to sink.

A small country like Kiribati, which is surrounded by sea, considers climate change a perilous threat because an increasing number of areas are sinking, and the space for movement will be increasingly limited, both for individuals and from an economic perspective. Kiribati, a country surrounded by sea, must face existing challenges, such as rising sea levels, in order to develop its economy. Therefore, to overcome this rising sea

level problem, Kiribati created a program called the Kiribati Adaptation Program (KAP). KAP is a project initiated by the Government of Kiribati in 2003. And in implementing this program, in order to achieve the stated objectives, the Government of Kiribati collaborated with the World Bank as a donor and assisted Kiribati with financial problems related to this KAP program (Astriviany, 2020).

KAP itself is divided into three phases. The first phase was the preparatory stage, which lasted from 2003 – 2005. This phase aimed to increase public awareness of the impacts of climate change and encourage the mainstreaming of adaptation. The second phase of KAP is focused on implementing pilot projects to develop systematic analysis related to climate change issues and designing financially efficient adaptation measures, as well as integrating strategies and awareness of the impacts of climate change into economic planning and operations. The third phase, from 2010 – 2016, was the final stage of this program. After learning a lot from the previous phases, the Kiribati Government designed a program called Climate Change Adaptation (CCA) in this third phase. In addition, throughout Phase III, the Kiribati Government discussed natural disaster risks, including Disaster Risk Reduction (DDR), with a focus on climate change adaptation initiatives (Astriviany, 2020).

Hitherto, the KAP implemented by the Kiribati government has increased the Kiribati people's awareness of the climate change problem. However, the Government of Kiribati cannot satisfy with this program only, since more than this program is needed to overcome the impact of rising sea levels. As a result, the Kiribati Government needs to develop other programs based on their reflect on this program to see what is lacking and what can be improved in the following program. The rise of sea level must continue to be monitored, considering that it can significantly impact the lives of Kiribati people and their economy.

As is well known, the fisheries sector, particularly tuna, is the leading contributor to Kiribati's economic growth. According to the World Bank (World Bank, 2020b), Kiribati has the most productive EEZ regarding fisheries in the Western and Central Pacific Ocean (WCPO). As one of the fishing countries in the Pacific region, Kiribati has the highest fish catch volume compared to other Pacific countries, namely 28.4% of the total regional catch in 2016. After introducing the Vessel Day Scheme (VDS), Kiribati has experienced a significant increase in income from fishing permits and transshipment fees. This is in line with what Webb (2020) conveyed regarding how Kiribati's fisheries sector contributes to shaping and improving the country's economy.

Kiribati, on the other hand, needs to domesticate its tuna fisheries (World Bank, 2020b). Kiribati's tuna sector problems extend beyond the country's inability to domesticate its tuna fisheries. According to Greenpeace (2018), Kiribati has become a magnet for sizeable commercial fishing operators from Europe, Asia, and America. This fishing is considered over-exploited, as the sea has yet to replenish the fish, but they have been depleted due to excessive 'extraction' by foreign parties. Not only that, these 'outside' parties take food from the villagers' mouths - in other words, they take away the villagers' ability to eat and survive.

Overfishing in Kiribati severely depletes fish and harms the environment through destructive fishing practices. The increasing population and economic pressures in South Tarawa have exacerbated open fish access, leading to resource exploitation near settlements and forcing people to venture further afield to other fishing areas (Ram-bidesi, 2010).

Illegal, Unreported, and Unregulated fishing (IUUF) in Kiribati poses a significant threat to the country's economy and environment, particularly to local fishermen's livelihoods (FAO, 2023). Japan has provided technical support to Kiribati to crack down on illegal fishing vessels, with three officers supporting a program involving ship inspections and small boat approaches. This is the first program expanded by Japan to Kiribati (FAO, 2023). Kiribati has taken several steps to address the IUUF problem, in addition to collaborating with Japan through training programs. For example, Kiribati is trying to strengthen efforts to prevent and deter IUUF. Kiribati, on the other hand, has been found to have failed to prevent, deter, and eliminate IUUF (World Bank, 2020b). Additionally, Kiribati developed a monitoring, control, and surveillance (MCS) system. This system helps track fishing vessels in Kiribati waters and identify and investigate IUUF activities. In

strengthening this MCS, Kiribati then applied for funding from the World Bank, where this MCS component will later support the Ministry of Fisheries and Marine Resources Development to strengthen the management and compliance of large-scale marine fisheries, which in turn, will serve to strengthen Kiribati's participation and contribution to the Parties to the Nauru Agreement (PNA) VDS and fulfill its obligations with the West and Central Pacific Fisheries Commission (WCPFC). Kiribati's program also includes collaboration with regional partners to combat IUUF; as previously stated, Kiribati contributes to the PNA because Kiribati is a member of the PNA (World Bank, 2020a).

Kiribati not only stands by the existing cooperation but also develops a policy under the Ministry of Fisheries and Marine Resources Development (MFMRD). Due to internal and external factors, MFMRD acknowledged that managing and developing Kiribati's maritime resources became more challenging. MFMRD pointed out that the lagoon and coastal fisheries are currently facing a real threat to long-term food security as a result of population growth and the problem of overfishing - as previously mentioned - and if these issues are not taken care of at a sustainable level, it could lead to another threat to the country (Ministry of Fisheries and Marine Resources Development, 2012).

The MFMRD proposed a Kiribati National Fisheries Policy in 2012, aiming to establish realistic short-term targets for 12 years. The plan, involving government, Non-Governmental Organizations (NGOs), private sectors, Civil Society Organization (CSOs), and local communities, aims to promote responsible fishing, enhance food security, create employment opportunities, and foster sustainable livelihoods, promoting economic growth for Kiribati's current and future generations. This strategy has been transformed into strategic actions that will be prioritized over four years. This policy will provide Kiribati with a coherent and unambiguous plan to reduce poverty, improve food security, and maximize economic growth within the implementation term. The strengthening of the institutional framework is essential to Kiribati's National Fisheries Policy. As an outcome, this policy will coordinate and prioritize training, capacity building, and institutional strengthening initiatives to support the policy's Strategic Action Plan execution (Ministry of Fisheries and Marine Resources Development, 2012).

To conclude, this policy will work toward five strategic goals, which are (1) support economic growth and employment opportunities through sustainable fisheries, aquaculture, and marine resources development; (2) protect and secure food security and sustainable livelihoods for I-Kiribati; (3) ensure long-term conservation of fisheries and marine ecosystems; (4) strengthen good governance with a particular focus on building the capacity of MFMRD to implement and support fisheries management, development, and monitoring, control, and surveillance; and (5) build climate change resilience for fisheries and marines resources in Kiribati(Ministry of Fisheries and Marine Resources Development, 2012).

Kiribati has done a lot for its country to address the previously mentioned issues. The discussion will further be about Kiribati's fisheries management as one of the crucial things that Kiribati did to manage its fisheries sector. Kiribati has implemented numerous actions regarding sustainable fisheries management measures, such as establishing quotas, implementing closed seasons, and enforcing regulations on fishing gear. These measures have helped to reduce overfishing and protect fish stocks. However, there are gaps and weaknesses in fisheries management measures, particularly on the high seas and possibly further away from coastal areas (International Monetary Fund, 2023).

Kiribati has made significant efforts to address climate change and overfishing, but its success is hindered by a lack of qualified human resources, weak institutions, and policies that need a balanced management framework. The issue of excessive marine resource exploitation remains despite efforts, and addressing over-exploitation in the tuna sector will be challenging.

The Future of Circular Blue Economy in Kiribati

As an island country in the Pacific Ocean, Kiribati has implemented a circular blue economy (CBE) to achieve sustainable development and prosperity. CBE is an economic model aiming to minimize waste and maximize resource efficiency while protecting and restoring marine ecosystems. The application of CBE is very suitable in Kiribati because of Kiribati's dependence on the sea for food, livelihood, and culture. The country's vast Exclusive Economic Zone (EEZ) has several tuna stocks. Kiribati' tuna stocks are considered as the richest in the world, and its coastal communities have a long history of sustainable fishing and mariculture practices.

The Kiribati Government's implementation of the blue economy primarily focuses on the fisheries sector due to its rapid growth. However, climate change and over-exploitation pose challenges. The Exclusive Economic Zone must remain sustainable for fisheries continuity. Kiribati requires more economic diversity, arable land, and an integrated industrial value chain (Webb, 2019). This dependence on imports becomes a challenge for Kiribati to develop its economy, especially in developing a circular economy.

The authors focus on analyzing how the future of Kiribati's circular blue economy does not have to rely on existing sectors that already mentioned above. The reason for this is that if Kiribati only relies on the fisheries sector, many problems will arise, and the potential of this fisheries sector will not be eventually realized. The over-exploited tuna sector will be hard to solve, and yet Kiribati needs to grow its economic for the sake of its people's welfare. Although at first glance, Kiribati does not have any other sectors that can be used to implement this blue circular economy. Kiribati has other sectors that can be utilized to improve the Kiribati economy and do not have to depend on just one sector.

As mentioned in the discussion section in potential sectors for a blue economy, there are at least three sectors that Kiribati can develop to implement a circular blue economy in the future, namely: (1) Sustainable coastal tourism; (2) Green energy; and (3) Waste management. The government of Kiribati has recognized the value of sustainable tourism. As mentioned, Kiribati has designed the Tourism Authority Kiribati (TAK) within this tourism sector. The policy framework named Kiribati Sustainable Tourism Development Policy Framework (KSTDPF) which is conducted by the TAK.

Sustainable tourism can be a valid solution to the impacts of climate change. As stated by Palmentieri (2020), tourism is viewed not only as a source of "environmental pressure," but also as a tool for development and promotion. Recently, tourism has occupied an essential place in the sustainability debate. By building sustainable coastal tourism, Kiribati can not only overcome the problem of climate change, but also open up job opportunities for local workers and not rely only on the fisheries sector. The Kiribati Government has also focused on the other two sectors, green energy and waste management, as areas that can be developed and have the potential to benefit the Kiribati economy. According to a UNDP (2021) statement, the Government of Kiribati has begun to promote domestic renewable energy for electrical and non-electrical applications. In general, Kiribati is a leading light in the use of renewable energy in the Pacific Ocean. The use of renewable energy will assist Kiribati in reducing its reliance on imported fossil fuels, increasing energy security, and mitigating climate change.

In the waste management sector, after increasing the use of chemicals, some of which come from imports, it has been discovered that there are negative impacts on the environment and human health, especially in outdated pharmaceutical waste and chemicals. Kiribati must have information regarding the production, import, transportation, use, storage, and disposal of chemical fuels in its country. In 2019, Kiribati did not process waste or recycle it locally (UNEP, 2019). In 2021, Kiribati shows the way in waste management with the Kaoki Maange System (SPREP, 2021), which already mentioned before.

However, as discussed above, each potential sector Kiribati owns has its own set of challenges. Even so, these sectors can help Kiribati implement its circular blue economy. Specifically, a circular blue economy is an economic approach aiming to maximize the sustainable use of marine resources. For countries that rely on

their economy from the sea, such as Kiribati, developing CBE is very important for environmental sustainability and economic development. As mentioned, Kiribati is a suitable country to implement CBE, and Kiribati itself has implemented this economic system within a certain period.

Kiribati's future for CBE Kiribati should extend beyond fisheries and climate change to sustainable coastal tourism and waste management. These sectors already have a policy framework, but further development is needed to maximize their potential. The green energy sector also requires a clear policy framework for clear targets and goals.

The Kiribati Sustainable Tourism Development Policy Framework (KSTDPF) can guide Kiribati's transition towards a circular blue economy by reducing waste, promoting reuse, and promoting renewable energy. The Kaoki Maange System, which emphasizes resourcefulness, community involvement, and sustainable livelihoods, can also contribute to this transition.

The following are policy recommendations suggested by the authors for the Kiribati Government in developing new sectors related to CBE implementation:

- Strengthening existing institutions in Kiribati. Strengthening institutions will help Kiribati implement CBE – as cited from the Ministry of Fisheries and Marine Resources and Development; apart from that, it will also improve the quality of Kiribati's management so that when implementing a policy, it will produce maximum results.
- The Kiribati Sustainable Tourism Development Policy Framework (KSTDPF) is a comprehensive plan for developing and managing tourism in Kiribati sustainably and responsibly. However, some areas could receive more attention, such as the KSTDPF, which could include attention for coastal protection and infrastructure, water resource management, ecosystem protection and biodiversity, community engagement and resilience, and disaster preparedness and risk management.
- The aspect that could receive more attention for the Kaoki Maange System is the integration of Kaoki Maange System in formalizing the principles of the Kaoki Maange System in policies and regulations so the Kaoki Maange System could continue their relevance in resource management practices, providing training and support to local communities on the implementation of Kaoki Maange System in order to make the locals enhance their ability, so they could contribute to a circular blue economy, and do a more profound research and documentation of traditional knowledge that embedded within the Kaoki Maange System so that it will boost the potential application in sustainable resource management and circular economy practices.
- Kiribati should conduct a policy framework for green energy sectors that should be focused on establishing a clear regulatory framework. In contrast, the precise regulatory framework could affect the maximization, promotion, and incentivizing the adoption of renewable energy resources, encourage the adoption of energy-efficient technologies and practices in all sectors, support the development and implementation of energy storage solutions, raise public awareness and education to inform the citizens about the benefits and importance of green energy, and last but not least, integrate circular economy principles, such as waste reduction, reuse, and recycling into the energy sector.

With that in consideration, Kiribati may have a better chance to implement a circular blue economy by focusing on the new, potential sectors that have been identified instead of forcing itself to deal with a problem that is way bigger and more complex than the capacity that it possesses now. The potential sectors that have already been identified could help to grow Kiribati's economy. Therefore, Kiribati can rely on something other than its economy on tuna sectors. To maximize the potential of the new sectors, the authors already address some policy recommendations that the Government of Kiribati could implement to grow its new potential sectors.

Conclusion

Kiribati has been overly focused on the fisheries sector, as they see it as the only hope to drive their economy. However, the problems that accompany its marine resources management levels of compliance when faced with short-term benefits and the dilemma between economic interests and environmental conservation needs should have been seen as a sign that maybe it is time for the Kiribati government to start looking at a number of other potential sectors that can be utilized to develop a circular blue economy, such as sustainable coastal tourism, green energy, and waste management.

These sectors do not necessarily provide a 'magic solution' that can solve all the problems faced by Kiribati in the economic sector, given that there are a number of challenges that come with those potential sectors, especially those related to geographical barriers, funding, and lack of infrastructure and access to information. However, those challenges may seem more minor compared to the overexploitation of marine resources, which has been the biggest problem for Kiribati for years and will take a lot of time and effort before it can be overcome entirely.

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