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https://doi.org/10.59711/jims.12.110015

Artificial Intelligence in Combating Climate Change in the Pacific Island Countries: Challenges, Barriers, and Pathways Forward

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Abstract: The study examines the ramifications of the existential threat of anthropogenic climate change for the livelihoods, economic growth and the environmental sustainability in the context of Pacific Islands Countries and the role of Artificial Intelligence in combating its deleterious impact. The main objective of the research is to explore the potential of Artificial Intelligence application by the Pacific Islands Countries in addressing climate change, enhancing marine management and advancing their blue economy. In addition to reducing fish population, increasing ocean temperatures, acidification of the ocean, rising sea levels, and flooding caused by climate change, there is no dispute that climate change has adversely affected local livelihoods, the environment, and marine ecosystems. In the study, it is argued that the use of Artificial Intelligence technology enhances the Pacific Islands Countries' adaptation and resilience strategy by improving the monitoring and management of marine ecosystems and by addressing the impacts of climate change. Using predictive modeling and informed decision-making, it is concluded that the advent and advancement of Artificial Intelligence technology provides comparative reliable solutions for monitoring and managing the impacts of climate change.

Keywords: Artificial intelligence; climate change; Pacific Island Countries;

Citation: Raj, A.A.; Yang, M.H.; Yu, L. Artificial Intelligence in Combating Climate Change in the Pacific Island Countries: Challenges, Barriers, and Pathways Forward. *J. Isl. Mar. Stud.* **2025**, *3*, 110015. https://doi.org/10.59711/jims.12.110015

Received: 21 September 2024 Revised: 24 December 2024
Accepted: 20 January 2025 Published online: 23 January 2025
Editorial Assistant: Miaomiao Beth Qu

international cooperation; marine management

1. Introduction

Consensus has long been made by the Pacific Islands Countries (PICs) to advance environmental conservation and economic progress simultaneously. To this end, the PICs make public the *2050 Strategy for the Blue Pacific Continent* (2050 Strategy) that, amongst other objectives, aims to leverage technology and scientifically-based research to 'secure our ocean and derive economic benefits from its resources' in a manner that will maintain environmental integrity and drive sustainable economic prosperity and development [1–3]. The 'blue economy' is defined by the World Bank as the 'sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean's ecosystem' [4–7]. The United Nations also adopts the concept under the *Sustainable Development Goals* (SDGs) that set a target that by 2030, the economic benefits from the sustainable use of marine resources, including sustainable management of fisheries, aquaculture, and tourism will be increased to Small Island Developing States (SIDS) and least developed countries (LDCs) [8–12].

Departing radically from the normative conception of Oceania as small and scattered islands, the PICs describe the Pacific as a vast blue continent, rich in natural resources, to which the economic landscape of the PICs is closely linked [13] (p. 81). The PICs subsist heavily on its marine resources not only as a source of food but as a major source of economic activity. In this sense, it is hard to over-state the importance of a healthy Pacific ecosystem for the survival and advancement of the interests of the Pacific Islanders. This partially explains why the PICs commit themselves to the "blue economy" to advance their economic and social progress, and environmental protection. It is noted that the PICs have prioritized blue economy sector as integral in achieving their economic and social development goals outlined in the 2050 Strategy. As part of the strategy, the PICs made national as well as and regional plans to advance their blue economy by committing to a green and sustainable development, as a catalyst for the promotion of social and economic progress as well as environmental and ecosystem conservation in the region [2].

The central argument advanced in this study is that the application of Artificial Intelligence (AI) technology contributes towards augmenting the PICs' adaptation and resilience as it empowers PICs better monitor and manage marine ecosystems and ameliorate the adverse impacts of climate change. The study examines the impacts of climate change on the coastal communities of the PICs, their ecosystems and environment, and explores the possibility of the application of AI in addressing climate change, improving the management of marine ecosystems and boosting blue economy as enunciated in the 2050 Strategy. The deleterious impact of climate change on local livelihoods, environment and marine ecosystems can be evidenced through the following: a reduction in fish populations; a rise in ocean's temperature; ocean acidification; sea-level rise; and floods [14–18]. A thorough review of secondary data, sourced from think tanks' reports, academic publications, and other materials, was conducted to inform the paper's conclusions. The study concludes that the advent of and advancements in AI technology has created the conditions of possibility for comparatively reliable solutions for monitoring and managing the impacts of climate change by establishing predictive modeling and offering decision support. The study underscores the necessity for AI applications tailored to satisfy the specific needs of the PICs in combating climate change and boosting the blue economy.

Noticeably, the Pacific suffers from a significant vulnerability exacerbated by the existential threat emanating from climate change leading to a range of disasters, such as rising sea temperatures, ocean acidification and storms, which are worsened by El Niño cycles. Climate change and resultant disasters, including sea-level rise, floods and tsunamis, give rise to seminal challenges to the PICs in general and to the sustainability and resilience of the blue economy in particular. The Pacific Islands are facing devastating impacts of climate change including increasing droughts and water scarcity, coastal flooding and erosion, changes in rainfall that affect ecosystems and food production, and adverse impacts on human health [19]. Climate change has caused enormous losses to the PICs and might destroy the PICs' ocean-based economy, livelihoods, the ecosystem and biodiversity as evidenced by the markedly reduced fish populations in the South Pacific, which is detrimental to the PICs' economy and regional ecosystem [20] (p. 12).

Confronted with the aftermath of climate change, the PICs have come to the realization that to combat the challenges arising from climate change necessitates the utilization of cutting-edge technology [21,22]. Of all the breakthrough innovations, AI emerges as a pivotal force in revolutionizing the existent approach to climate change, and reshaping the paradigm of environment, ecosystem and biodiversity protection. AI has been widely used for extraction of meaningful patterns and analysis on datasets and correlations from them, which can revolutionize predictions and markedly enhance decision-making. AI can accelerate PIC's resolve in efficiently combating climate threats and better managing ecosystem in the South Pacific.

2. Climate Landscape in the PICs and its Impacts

Situated at the frontline of climate change, the PICs are more vulnerable to climate change than most countries in the other parts of the world given their limited land size, geographic location, susceptibility to tropical cyclones, and incapacity to adapt to climate change as a result of resource constraints [23]. The PICs span 25,000 islands and encompass approximately 15% of the Earth's surface albeit being labeled as "small" island countries [22]. The PICs are custodians of 20% of global Exclusive Economic Zones (EEZs), where ocean space exceeds land area by an average factor of 300 to 1 [24]. In this context, the PICs are more accurately described as large ocean developing states due to the size of their EEZs, which are rich in biodiversity and natural resources [24,25]. While the PICs' contribution to global greenhouse gas emissions is minimal (only responsible for around 0.03%), the PICs have long been disproportionately affected facing many of the compounding threats of climate change [26]. As small island countries, the Pacific Islands are amongst the most vulnerable to climate change, whose primary impacts include increased risk of inundation and coastal flooding, exacerbation of erosion, saltwater intrusion, cyclones and tsunami [27] (p. 137). The disasters caused by climate change are becoming more frequent and widespread, posing a seminal threat to local ecosystem, communities, the livelihoods and economic growth [22,28]. For instance, the sea-level rise has devastated many low-lying PICs that sit at or just above sea level, and many coastal communities in the PICs are being forced from their homes by rising sea levels and erosion, and relocating to higher ground. It is reported that 94% of households in Kiribati have been affected by natural hazards in the past decades [29].

Climate change is affecting regional ecosystems, natural food chain, and the PICs' food security, economy and tourism. The marine environment of the PICs is characterized by a diverse ecosystems, such as mangroves, coral reefs and seagrass beds, which are crucial for biodiversity and livelihoods [30]. These ecosystems are now threatened by climate change resulting in rising sea temperatures, rising sea level and ocean acidification. Therefore, climate change not only harms marine environment and life, but also disrupts economic productivity and the PICs' well-being. As noted, climate change is affecting marine organisms at multiple trophic levels, displacing wild fisheries, driving the reorganization of marine food systems, impacting fisheries, and disrupting food production with implications for food production and human communities [31]. As a result, areas in the tropics are predicted to see decline of up to 40% in potential seafood catch by 2050, and the PICs will bear the brunt of declined seafood catch [32].

The PICs are witnessing ocean acidification as a result of human-induced increased levels of carbon dioxide in the atmosphere, which are increasingly dissolving into the ocean, and resulting in a decrease in the pH levels and an increase in acidity [33]. According to the Secretariat of the Pacific Regional Environment Programme (SPREP), the pH levels of the tropical Pacific Ocean has decreased by 30% (0.11 pH units) since the early 19th century, now decreasing by ~0.02 units per decade. A further decline of 0.3 units (150% drop) is expected by the end of the 21st century [34]. It is well noted that rising ocean temperatures and especially the ocean acidification are increasingly impacting the coastal ecosystems in the South Pacific. For instance, nearly half of coral reefs in the South Pacific are currently threatened, with about 20% rated as 'highly threatened' according to the Intergovernmental Panel on Climate Change (IPCC) [34].

Rising sea temperatures are causing widespread coral bleaching in a huge swathe of the Pacific, including the Northern Marianas Islands, the Marshall Islands, Hawaii and Kiribati, which leads to the loss of coral cover and biodiversity [35]. The disappearance of coral cover in the South Pacific would increase coastal damage tenfold as they provide sand for beaches, ensure the limitation of coastal erosion, and absorb up to 97% of wave energy [34]. It is reported that bleaching of unprecedented severity has hit most of the atolls and islands of the Marshall Islands and more than 50% of coral reefs around Tahiti and Moorea of French Polynesia have been bleached [34]. Climate change-driven ocean acidification is rapidly changing Pacific ecosystems and poses a significant threat to marine life [34,36,37]. The main issues resulting from ocean acidification include the loss of biodiversity and significant losses in fisheries and mariculture production (farming marine life for food) [34,38,39].

A decline in the seawater concentration of carbonate ions make it hard for the marine life (e.g., calcifying plankton and algae, shellfish) to build their skeletons and shells with. This will lead to a reduction in the growth for many of these species and ecosystems, jeopardizing the ocean's role as a nutrition provider, and decreasing the ability of reefs to reduce erosion and the impact of storm wave [40]. The PICs have reef-dependent communities who are highly dependent on fisheries resources, vulnerable to deterioration of reef conditions, demersal and invertebrate fisheries, and aquaculture. Fish are a cornerstone of food security for the PICs, which provide 50–90% of animal protein in the diet of coastal communities across a broad spectrum of the Pacific islands [34]. Ocean acidification has therefore done harm to coral reef health, undermined fisheries and tourism in the South Pacific, and consequently, impacted the livelihoods of pacific islanders. In this context, climate change and ocean acidification have threatened PICs' economies and food security as evidenced by the loss of fisheries productivity [21].

Furthermore, climate change and climate variability pose significant challenges to groundwater systems and to freshwater supply in the Pacific Islands [41] (p. 579). Groundwater is a critical source of freshwater for island ecosystems in general, and for the PICs in particular, that heavily depend on ground water from shallow coastal aquifers and rainwater to meet their freshwater needs. These important coastal aquifers in the South Pacific are vulnerable to various threats of climate change, such as saltwater intrusion, over-extraction, and coastal erosion [42]. Moreover, the degradation of mangroves that protect coastal communities from coastal hazards (coastal erosion, tidal bores and cyclones) further exacerbates the PICs' vulnerability to erosion and storm surges [43]. These multifaceted impacts of climate change underscore the urgent need for the application of AI solutions to monitor, mitigate and manage the effects of climate change on the PICs' blue economy.

3. PICs' Climate Change Responses

Recognizing the vulnerability to climate change [44,45], the PICs are committed to enhancing the sustainability of coastal and marine systems through strengthening of its management of coastal and marine resources, thus preventing environmental degradation and preparing for the challenges posed by climate change impacts. The PICs have adopted a proactive stance in addressing climate change through a multifaceted approach and particularly through policy formulation, regional policy coordination and international collaboration. As early as 2005, the PICs galvanized their stance on climate change and adopted an action plan to carry out *the Pacific Islands Framework for Action on Climate Change 2006-2015*, in which national activities of the PICs were complemented by regional programming [46].

The PICs have endorsed the 2050 Strategy to maintain environmental integrity and drive sustainable economic prosperity and development [2]. The PICs have long been aware of the threat of climate change as stated by the Pacific Islands Forum (PIF) Secretariat (2014): "Climate change is an immediate and serious threat to sustainable development and poverty eradication in many Pacific Island Countries, and for some their very survival. By their geography and mid-ocean location they are at the 'frontline'" [47]. The PICs and regional organizations, such as PIF, Pacific Community (SPC), Melanesian Spearhead Group, and Pacific Regional Environment Program, have long been active in advancing international cooperation on climate change. The Majuro Declaration signals a united position to the Conference of Parties (COPs), and to the United Nations Framework Convention on Climate Change (UNFCCC) to seek an effective global agreement on greenhouse gas emissions [48].

The PICs are promoting and exploiting opportunities for regional collaboration to better manage mitigation, adaptation and response to climate change, and to develop and disseminate critical knowledge in support of those activities. To this end, the PICs set up *Regional Partnerships for Climate Change Adaptation and Disaster Preparedness Technical Assistance*, which covers eight countries (the Cook Islands, Fiji Islands, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu). The main objective of the Partnerships is to ensure the continued economic growth of the PICs in the face of global climate change, by reducing their vulnerability to its risks and impacts [49]. The Partnership helps the PICs to reduce risks from the effects of natural disasters, including those exacerbated by climate change by improving the Geophysical Information System (GIS) that provides decision makers with information to on hazard exposure and risk minimization [49–51]. Specifically, the Partnership supports the development of up to eight national databases, and a consolidated regional database containing risk, hazard, and vulnerability data, which is critical for the future development of a Pacific regional catastrophe insurance scheme and for informing governments on adaptation to natural catastrophes [49].

Premised on the 2050 Strategy, the PICs have sought for international cooperation for advice, financial and technological support for adaptation and mitigation efforts, given their incapacity in terms of capital, technology and knowledge to address climate change. Over the last couple of decades, PICs have been in cooperation with some regional players (e.g., China and Australia) and international organizations (e.g., the World Bank and the Asian Development Bank) to carry out vulnerability assessments as components of technical assistance or grant projects [13,14,52]. The cooperation between the

PICs and their global partners covers a wide variety of climate change-related aspects, such as policy reforms to effectively implement climate change adaptation and capacity-building to improve their knowledge and skills on climate change issues [53]. The cooperation also includes education and communication campaigns directed at policy-makers and the general public to ensure their involvement in climate change-related activities, and the dissemination of knowledge products, such as climate risk assessment tools and methods [49].

Specifically, the cooperation focuses on a comprehensive analysis of the impacts of climate change, and the economic costs and benefits of climate change adaptation and mitigation initiatives [49]. The adaptation and mitigation efforts made by the PICs in cooperation with regional players and international organizations are primarily directed at developing renewable energy (e.g., wind and solar power) and reducing emissions [49,54,55]. In order to fight climate change, the PICs have approached the UN for assistance. The UN has helped the PICs prepare for climate adaptation, notably by creating a fund to help with the creation and execution of national adaptation plans of action. Some PICs, such as Kiribati, Samoa, the Solomon Islands, Tuvalu, and Vanuatu, have completed national adaptation plans of action and received support from the LDCs Fund set up by the UN [56]. A number of adaptation, mitigation, and policy-making initiatives are carried out by the PICs, such as the Pacific Adaptation to Climate Change Project, which is coordinated by the UNDP [57]. The PICs have demonstrated their commitment to international collaboration in the fight against climate change by actively participating in international agreements including the UNFCCC, the Kyoto Protocol, and the Paris Agreement [58,59].

In addition, the PICs have collaborated with the World Bank and the Asian Development Bank (ADB) on various climate change initiatives, including financing climate adaptation projects, facilitating the preparation of guidelines for climate proofing of infrastructure projects and assessing the feasibility of catastrophe risk financing [60,61]. The UNFCCC Adaptation Fund and other international organizations, like the World Bank and the ADB, have provided multilateral aid to the PICs. These organizations view climate change, environmental degradation, and natural disasters as the main challenges facing PICs. The international cooperation helps the PICs address climate change in terms of financing and technical needs, and supports their planning and implementation of the climate-responsive development plans. The PICs perceive blue economy and sustainable growth as the pillar of its development agenda with climate change adaptation and mitigation as key drivers of the blue economy.

To improve their ability to handle climate change, the PICs launched the Pacific Climate Change Program (PCCP) through ADB's *Regional Capacity Development Technical Assistance* [49]. Fiji, Papua New Guinea, Solomon Islands, Timor-Leste, and Vanuatu are among the PICs that collaborate with the ADB on the *Coral Triangle Initiative*, which offers financial and technical assistance to improve their management of marine and coastal resources and climate change adaptation. The Initiative's goal is to determine how climate change is affecting coastal and marine resources at the regional and national levels and to provide guidance for sustainable management of these resources. The Initiative also aims to increase the PICs' ability to engage and raise awareness about climate change adaptation and sustainable environmental management [49]. Moreover, the PICs have worked with the World Bank and ADB to assess the feasibility of establishing a Pacific Catastrophe Risk Insurance Facility by initiating *the Pacific Islands Disaster Risk Reduction and Disaster Management Framework for Action* [62]. The goal of the project is to create a database on the PICs' exposure to natural hazards, which will be used to inform the World Bank's catastrophe risk insurance modeling [49].

The PICs have collaborated with the Global Climate Change Alliance of European Union (EU) on the project of the Global Climate Change Alliance Plus Scaling up Pacific Adaptation (GCCA+ SUPA). The project is aimed at scaling up climate change adaptation measures in specific sectors supported by knowledge management and capacity building initiatives [63]. The project (2019-2023) enjoys € 14.89 million in funding from the EU and implemented by the SPC in partnership with the SPREP and the University of the South Pacific (USP), and in collaboration with the Cook Islands, Federated States of Micronesia (FSM), Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Tonga and Tuvalu [63]. These international collaborations provide a platform for knowledge exchange, technology transfer, and financial support, bolstering the PICs capacity to implement effective climate action strategies [21].

The PICs have increasingly recognized the significance and potential of AI to revolutionize climate change mitigation and adaptation. AI-powered tools can enhance monitoring and prediction capabilities, optimize resource management, inform decision-making processes, and ultimately contribute to a more sustainable and resilient blue economy [64–67]. To fully harness the potential of AI, the international community and the PICs need to develop policies and regulatory frameworks that address the ethical, social and economic implications of AI deployment in the context of climate change as well as address the challenge of digital divide [68,69]. These frameworks ensure transparency, accountability, and equitable access to AI technologies, while addressing potential risks and biases associated with AI algorithms [70–72]. Targeted investments in AI research and development, capacity building, and infrastructure are essential to create an enabling and inclusive environment for AI innovation and entrepreneurship in the climate change domain [21,69]. By integrating AI into climate policy, the PICs are likely to unlock new opportunities for data-driven decision-making, resource optimization, and innovative solutions to address the complex challenges posed by climate change as Gesami and Nunoo note [21]. This integration can pave the way for a more sustainable and resilient blue economy, ensuring the long-term prosperity of coastal communities and the preservation of vital marine ecosystems [21,73].

4. PICs' AI Landscape

Much of the available government capacity in the South Pacific is focused on climate change mitigation and adaptation as a result of the existential threat that the climate crisis poses to countries in the Pacific [74]. One of the main obstacles in dealing with climate change is creating efficient adaptation techniques to reduce the risks and effects of climate change [75–77]. To create effective adaptation programs, governments and communities need access to precise and pertinent information [76]. Mitigation and adaptation to climate change requires novel and effective approaches in view of the complexity and variety of the challenges arising from climate change. AI has swiftly evolved into a crucial tool for enhancing the development of innovative strategies to address climate change, and has been significantly employed to mitigate and adapt to its effects. AI has shown great potential in substantially benefiting some spheres, such as the detection of high-risk locations for climate-related calamities, and the creation of adaptation plans for communities and sectors [78]. AI-enabled solutions provide advantages for climate change adaptation, such as pinpointing susceptible regions and creating measures to safeguard infrastructure and populations from the impacts of climate change [79].

One application case is the real-time monitoring and analysis of the impacts of environmental events by employing sensors driven by AI [80]. Environmental monitoring is used to observe the overall quality of an environment, environmental factors, and the influence of a specific action. Such types of monitoring practices may be set up to identify irregularities or specific situations and then send alerts, which enables more effective reaction and management of the impacts [81]. Utilizing AI to assess data like climate models, satellite images, and weather patterns enables governments and communities to create precise adaption strategies customized to the specific hazards in certain locations [82]. AI can also be used to forecast the potential impacts of rising sea levels by detecting the patterns and correlations that is hard to be detected by humans. In a similar vein, predictive models developed by AI may help decision makers to formulate policies and strategies to better protect environment and communities. Furthermore, AI has the potential to maximize resource use and decrease emissions, which may help lessen the effects of climate change [83]. AI's primary advantage lies in its capacity to swiftly and precisely evaluate vast quantities of data. This makes it a crucial tool for pinpointing places most susceptible to the effects of climate change, including those prone to flooding, landslides, or drought [84].

As widely noted, the employment of AI in marine management and ecosystem protection needs to gain entry to the data on marine resources and ecosystem in the South Pacific. However, the PICs are poorly prepared for the employment of AI in addressing climate change as AI thrives on high quality and large datasets and the PICs are lagging behind in AI research and development. According to *Government AI Readiness Index 2022*, the PICs' average score is well below the global average for this year's index and are at much earlier stages of AI readiness [74]. The PICs lack the physical and technological infrastructure needed to develop AI as reflected by their limited access to undersea internet cables and mobile broadband. The PICs have limited resources for adaptation and resilience, and limited access to affordable and reliable connectivity to promote digital literacy [85]. The PICs lack digital infrastructure, such as advanced sensor networks, to produce adequate real-time data for AI to work effectively on marine management and ecosystem conservation [86]. The application of AI by the PICs in combating the climate change is hence rife with challenges as data collection and management practices in the PICs are markedly underdeveloped due to limited resources that results in poor quality and incomplete datasets.

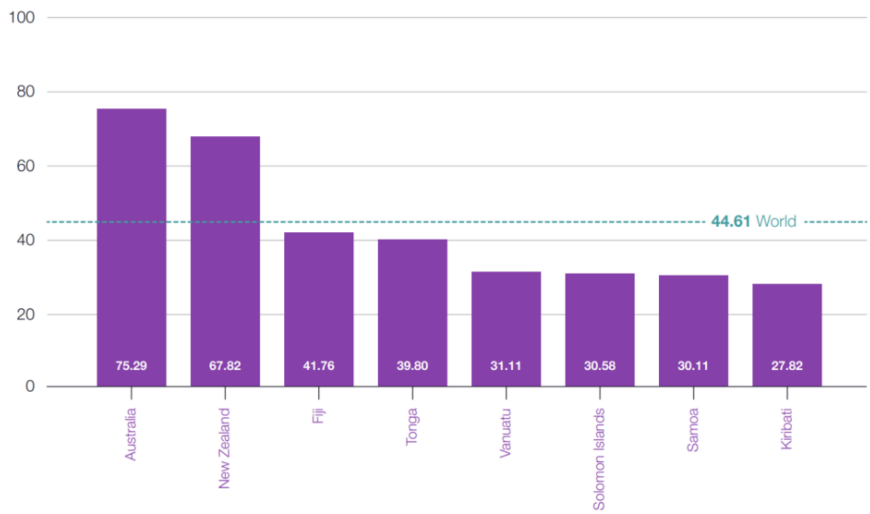

Figure 1. Government AI Readiness Index 2022 (the PICs) [74]

Moreover, the PICs are short of technological capacity and technical expertise due to the constraints in education and infrastructure, which are imperative for the application of AI in marine management [87]. In this context, it is hard for the PICs to attract the AI talents, or train the local people to operate and manage AI systems due to the economic hardship, limited education resources and brain drain. The lack of domestic talent is obviously one of the challenges faced by the PICs to employ AI to combat climate change. The PICs need to increase investment in education and digital infrastructure, and enhance technological capacity building to overcome these challenges, and enable AI to work effectively in the region. As small island countries, the PICs need to coordinate their disparate stance on the application of AI in addressing climate change, and develop AI on a regional basis to strategically pool their resources, such as technology, data and skilled professionals, which are required by AI development. In doing so, the PICs can collectively create more robust AI systems than they might individually, given their geographical proximity and shared regional challenges, and thereby effectively employ the systems to combat climate change.

The PICs may build larger and more diverse datasets by pooling data at a regional level, which may help improve the accuracy and reliability of AI systems as AI depends on data for functioning. In this way, the PICs can work together to produce AI models capable of predicting and responding to natural disasters caused by climate change, as well as aiding in preparedness and mitigation strategies. Data sciences and AI can help the PICs gain access to real-time information on climate change, natural disasters and other environmental calamities that threaten their livelihoods and existence. This data can influence decision-making processes about conservation efforts and other measures that promote long-term sustainability, as well as facilitate forecasting to anticipate future trends and potential threats [88]. By harnessing the power of AI, PICs can become more resilient to climate change and natural disasters. With the help of innovative solutions, PICs can make strides towards reaching their goals in addressing climate change.

Moreover, the PICs' cooperation with international organizations (e.g., the World Bank) and international players (e.g., the United States) could play a significant role in obtaining expertise and empower the PICs' in harnessing their resources to address climate change. The international cooperation contributes to developing AI systems in the South Pacific and helps international players and international organizations understand local contexts and needs. The International Telecommunications Union is rolling out an initiative in the Pacific that will help deliver digital services in education, agriculture and health in support of recovery through the 'smart islands' project to boost digital transformation in the hardest-to-connect communities [88].

There is huge potential for the PICs to take advantage of AI-based technologies to achieve climate-related goals though AI has not yet been widely employed outside of a few prominent use cases. One such use case is the SPREP (2022)'s Strandings of Oceania database [89], which is hosted by Flukebook and uses AI to identify user-reported stranded whales and dolphins, helping researchers track species diversity and identify possible threats. The SPC, another intergovernmental institution, is creating Digital Earth Pacific, an AI-assisted tool that will furnish decision-makers with current and historical satellite imagery. For example, some companies and NGOs in the fishing sector, which the PICs rely upon economically, are already using AI-based surveillance technology to monitor workers aboard fishing vessels [90] (p. 3). Though there have been a few encouraging developments, the PICs risk being left behind in terms of AI readiness.

5. Conclusion

The PICs are facing a range of challenges due to their size, isolation and vulnerability to external forces, which include rising sea levels, extreme weather events and economic instability. The PICs are confronting major challenges arising from climate change that jeopardizes not only their coastal economies and ecosystems, but also their efforts in pursuit of a blue economy. The impacts of climate change, including sea level rise, floods, ocean acidification and tsunami, pose considerable threat to the livelihoods, sustained economic growth and marine environments in the South Pacific. There is little contention that the PICs are in dire need of innovative technologies to combat climate change and forge effective solutions for regional environment conservation and sustained blue economy. Of the numerous breakthrough technologies, AI emerges as a transformative tool that can help address the impacts of climate change, and shows great potential in effective monitoring and managing regional marine resources. It is well noted that AI technologies can significantly help the governments and general public in the Pacific understand the impact of climate change and the significance of blue economy, optimize marine management strategies, and improve decision-making on climate-related issues. The PICs are becoming increasingly cognizant of the significance of AI application in marine monitoring and management, prioritizing their blue economy sector as a pivotal catalyst for sustainable economic and social advancement.

Concerted efforts made by scholars, governmental officials and the general public in the PICs are of significant importance if the application of AI is to be effectively used to address climate change. International collaboration and support are essential due to the PICs' low resources and restricted access to AI technology. The synergy between the PICs and their international partners will contribute to combating the challenges arising from climate change, improving marine management and advancing blue economy in the region. Regional cooperation and solidarity will be integral and the PICs must work together with their international partners to prioritize the establishment of data collection systems that are capable of collecting real-time data on climate change and marine ecosystem. A robust and comprehensive data collection system will lay the groundwork for the application of AI in the climate-related spheres. The PICs and their international partners should attach importance to the development of predictive models by employing AI algorithms to bolster their efforts in addressing climate change, protecting ecosystems and advancing the blue economy.

Supplementary Materials: Not applicable.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Hoffmann, B.D.; Brewington, L.; Andreozzi, P.; Boudjelas, S.; Day, M.D.; Ero, M.; Jackson, T.; Martin, C.; Montgomery, M. Three New Strategies for Improving Biosecurity and Invasive Species Management to Build Resilience in Pacific Islands. *NeoBiota* **2024**, *92*, 193–210, doi:10.3897/neobiota.92.122103. [Crossref]
2. Pacific Islands Forum. *2050 Strategy for the Blue Pacific Continent*; 2022; ISBN 978-982-202-079-3. Available online: https://forumsec.org/2050 (accessed on 5 August 2024).
3. Deng, M.; Ye, F.; He, Y.; Jiang, X.; Deng, Y. Pilot Study on the Implementation of China-Pacific Island Countries Marine Financial Cooperation. *Hainan Finance* **2022**, 51–62. [Google Scholar]
4. World Bank Group. What Is the Blue Economy? Available online: https://www.worldbank.org/en/news/infographic/2017/06/06/blue-economy (accessed on 5 August 2024).
5. Smith-Godfrey, S. Defining the Blue Economy. *Marit. Aff. J. Natl. Marit. Found. India* **2016**, *12*, 58–64, doi:10.1080/09733159.2016.1175131. [Crossref]
6. Silver, J.J.; Gray, N.J.; Campbell, L.M.; Fairbanks, L.W.; Gruby, R.L. Blue Economy and Competing Discourses in International Oceans Governance. *J. Environ. Dev.* **2015**, *24*, 135–160, doi:10.1177/1070496515580797. [Crossref]
7. Lee, K.H.; Noh, J.; Khim, J.S. The Blue Economy and the United Nations' Sustainable Development Goals: Challenges and Opportunities. *Environ. Int.* **2020**, *137*, 1–6, doi:10.1016/j.envint.2020.105528. [Crossref]
8. Spalding, M.J. The New Blue Economy: The Future of Sustainability. *J. Ocean Coast. Econ.* **2016**, *2*, 1–21, doi:10.15351/2373-8456.1052. [Crossref]
9. Pang, S.; Abdul Majid, M.; Perera, H.A.C.C.; Sarkar, M.S.I.; Ning, J.; Zhai, W.; Guo, R.; Deng, Y.; Zhang, H. A Systematic Review and Global Trends on Blue Carbon and Sustainable Development: A Bibliometric Study from 2012 to 2023. *Sustainability* **2024**, *16*, 1–31, doi:10.3390/su16062473. [Crossref]
10. Deng, Y.; Randall, J.; Ye, F. Island Ecological Restoration and Management Practices Based on Nature: Conference Report. *Mar. Policy* **2022**, *143*, 1–4, doi:10.1016/j.marpol.2022.105188. [Crossref]

11. Deng, Y.; Čuka, A.; Fu, Y.; Wu, J. Multiple Paths towards Eco Islands and Blue Development: Conference Report. *Mar. Policy* **2023**, *149*, 1–5, doi:10.1016/j.marpol.2023.105526. [Crossref]
12. Arifin, Z.; Joelianingsih, J.; Deng, Y.; Aryanto, N.C.D. Small Island Futures: A Conference Report on the Pathways to Resilience and Development. *Mar. Policy* **2024**, *167*, 1–4, doi:10.1016/j.marpol.2024.106266. [Crossref]
13. Lei, Y.; Sui, S. China-Pacific Island Countries Strategic Partnership: China's Strategy to Reshape the Regional Order. *East Asia* **2022**, *39*, 81–96, doi:10.1007/s12140-021-09372-z. [Crossref]
14. Deng, Y.; Zhen, F. China's Research on Paciffc Island Countries (1978-2020). *China Oceans Law Rev* **2022**, 109–133. [Google Scholar]
15. Huang, B.; Deng, Y.; Zhang, X. Study on the Path and Direction of China-Fiji Climate Change Cooperation. *J. South China Sea Stud* **2018**, *4*, 101–108. [Google Scholar]
16. Doney, S.C.; Ruckelshaus, M.; Emmett Duffy, J.; Barry, J.P.; Chan, F.; English, C.A.; Galindo, H.M.; Grebmeier, J.M.; Hollowed, A.B.; Knowlton, N.; et al. Climate Change Impacts on Marine Ecosystems. *Annu. Rev. Mar. Sci.* **2012**, *4*, 11–37, doi:10.1146/annurev-marine-041911-111611. [Crossref]
17. Hossain, A.; Reza, I. Climate Change and Its Impacts on the Livelihoods of the Vulnerable People in the Southwestern Coastal Zone in Bangladesh. In *Climate Change and the Sustainable Use of Water Resources*; Leal Filho, W., Ed.; Climate Change Management; Springer-Verlag Berlin Heidelberg: Berlin, Heidelberg, 2012; pp. 237–259 ISBN 978-3-642-22265-8. [Google Scholar]
18. Hernández-Delgado, E.A. The Emerging Threats of Climate Change on Tropical Coastal Ecosystem Services, Public Health, Local Economies and Livelihood Sustainability of Small Islands: Cumulative Impacts and Synergies. *Mar. Pollut. Bull.* **2015**, *101*, 5–28, doi:10.1016/j.marpolbul.2015.09.018. [Crossref]
19. Mcleod, E.; Bruton-Adams, M.; Förster, J.; Franco, C.; Gaines, G.; Gorong, B.; James, R.; Posing-Kulwaum, G.; Tara, M.; Terk, E. Lessons From the Pacific Islands – Adapting to Climate Change by Supporting Social and Ecological Resilience. *Front. Mar. Sci.* **2019**, *6*, 1–7, doi:10.3389/fmars.2019.00289. [Crossref]

20. Charlton, K.E.; Russell, J.; Gorman, E.; Hanich, Q.; Delisle, A.; Campbell, B.; Bell, J. Fish, Food Security and Health in Pacific Island Countries and Territories: A Systematic Literature Review. *BMC Public Health* **2016**, *16*, 1–26, doi:10.1186/s12889-016-2953-9. [Crossref]
21. Gesami, B.K.; Nunoo, J. Artificial Intelligence in Marine Ecosystem Management: Addressing Climate Threats to Kenya's Blue Economy. *Front. Mar. Sci.* **2024**, *11*, 1–11, doi:10.3389/fmars.2024.1404104. [Crossref]
22. Almulhim, A.I.; Alverio, G.N.; Sharifi, A.; Shaw, R.; Huq, S.; Mahmud, M.J.; Ahmad, S.; Abubakar, I.R. Climate-Induced Migration in the Global South: An in Depth Analysis. *Npj Clim. Action* **2024**, *3*, 1–12, doi:10.1038/s44168-024-00133-1. [Crossref]
23. Morgan, W.; Carter, S.G.; Manoa, F. Leading from the Frontline: A History of Pacific Climate Diplomacy. *J. Pac. Hist.* **2024**, *59*, 353–374, doi:10.1080/00223344.2024.2360093. [Crossref]
24. Powers, M.; Begg, Z.; Smith, G.; Miles, E. Lessons From the Pacific Ocean Portal: Building Pacific Island Capacity to Interpret, Apply, and Communicate Ocean Information. *Front. Mar. Sci.* **2019**, *6*, 1–7, doi:10.3389/fmars.2019.00476. [Crossref]
25. Appeltans, W.; Dujardin, F.; Flavell, M.; Miloslavich, P.; Webb, T. Biodiversity Baselines in the Global Ocean. In *The open ocean: Status and trends*; UNESCO IOC, Ed.; 2016; pp. 220–238. [Google Scholar]
26. Parsons, C. The Pacific Islands: The Front Line in the Battle against Climate Change. Available online: https://new.nsf.gov/science-matters/pacific-islands-front-line-battle-against-climate (accessed on 8 August 2024).
27. Mimura, N. Vulnerability of Island Countries in the South Pacific to Sea Level Rise and Climate Change. *Clim. Res.* **1999**, *12*, 137–143, doi:10.3354/cr012137. [Crossref]
28. Xiao, Y.; Zhang, H.; Ma, K.; Perera, H.A.C.C.; Ramli, M.Z.; Deng, Y. Exploring the Relationships between Tradeoffs and Synergies among Island Ecosystem Service Bundles: A Study on Zhoushan Archipelago Located on the Southeast Coast of China. *Sustainability* **2024**, *16*, 1–15, doi:10.3390/su16010394. [Crossref]
29. Oakes, R.; Milan, A.; Campbell, J. *Kiribati: Climate Change and Migration - Relationships Between Household Vulnerability, Human Mobility and*

Climate Change; United Nations University (UNU), 2016. Available online: https://collections.unu.edu/view/UNU:5903#viewAttachments (accessed on 10 August 2024).

30. Carlson, R.R.; Evans, L.J.; Foo, S.A.; Grady, B.W.; Li, J.; Seeley, M.; Xu, Y.; Asner, G.P. Synergistic Benefits of Conserving Land-Sea Ecosystems. *Glob. Ecol. Conserv.* **2021**, *28*, 1–21, doi:10.1016/j.gecco.2021.e01684. [Crossref]
31. Teshome, M. Charting the Systemic and Cascading Impacts of Climate Change on Marine Food Systems and Human Health. *BMJ Glob. Health* **2024**, *8*, 1–6, doi:10.1136/bmjgh-2023-014638. [Crossref]
32. Marine Stewardship Council. Climate Change and Fishing. Available online: https://www.msc.org/what-we-are-doing/oceans-at-risk/climate-change-and-fishing (accessed on 10 August 2024).
33. Wu, H.C.; Dissard, D.; Douville, E.; Blamart, D.; Bordier, L.; Tribollet, A.; Le Cornec, F.; Pons-Branchu, E.; Dapoigny, A.; Lazareth, C.E. Surface Ocean pH Variations since 1689 CE and Recent Ocean Acidification in the Tropical South Pacific. *Nat. Commun.* **2018**, *9*, 1–13, doi:10.1038/s41467-018-04922-1. [Crossref]
34. The Pacific Community. Ocean Acidification: A Tide of Challenges for Pacific Islanders. Available online: https://www.spc.int/updates/blog/2022/08/ocean-acidification-a-tide-of-challenges-for-pacific-islanders (accessed on 11 August 2024).
35. Mathiesen, K. Major Coral Bleaching in Pacific May Become Worst Die-off in 20 Years, Say Experts. *The Guardian* 2014. Available online: https://www.theguardian.com/environment/2014/dec/19/major-coral-bleaching-pacific-may-worst-20-years (accessed on 11 August 2024).
36. Talukder, B.; Ganguli, N.; Matthew, R.; vanLoon, G.W.; Hipel, K.W.; Orbinski, J. Climate Change-Accelerated Ocean Biodiversity Loss & Associated Planetary Health Impacts. *J. Clim. Change Health* **2022**, *6*, 1–12, doi:10.1016/j.joclim.2022.100114. [Crossref]
37. Wang, B.; Hua, L.; Mei, H.; Wu, X.; Kang, Y.; Zhao, N. Impact of Climate Change on the Dynamic Processes of Marine Environment and Feedback Mechanisms: An Overview. *Arch. Comput. Methods Eng.* **2024**, *31*, 3377–3408, doi:10.1007/s11831-024-10072-z. [Crossref]
38. Lacoue-Labarthe, T.; Nunes, P.A.L.D.; Ziveri, P.; Cinar, M.; Gazeau, F.; Hall-Spencer, J.M.; Hilmi, N.; Moschella, P.; Safa, A.; Sauzade, D.; et al.

Impacts of Ocean Acidification in a Warming Mediterranean Sea: An Overview. *Reg. Stud. Mar. Sci.* **2016**, *5*, 1–11, doi:10.1016/j.rsma.2015.12.005. [Crossref]

39. Falkenberg, L.J.; Bellerby, R.G.J.; Connell, S.D.; Fleming, L.E.; Maycock, B.; Russell, B.D.; Sullivan, F.J.; Dupont, S. Ocean Acidification and Human Health. *Int. J. Environ. Res. Public. Health* **2020**, *17*, 1–18, doi:10.3390/ijerph17124563. [Crossref]
40. Agostini, S.; Harvey, B.P.; Wada, S.; Kon, K.; Milazzo, M.; Inaba, K.; Hall-Spencer, J.M. Ocean Acidification Drives Community Shifts towards Simplified Non-Calcified Habitats in a Subtropical−temperate Transition Zone. *Sci. Rep.* **2018**, *8*, 1–11, doi:10.1038/s41598-018-29251-7. [Crossref]
41. Bouchet, L.; Thoms, M.C.; Parsons, M. Groundwater as a Social-Ecological System: A Framework for Managing Groundwater in Pacific Small Island Developing States. *Groundw. Sustain. Dev.* **2019**, *8*, 579–589, doi:10.1016/j.gsd.2019.02.008. [Crossref]
42. The Pacific Community. Pacific Island Atolls Fixed on Water Security. Available online: https://www.spc.int/updates/news/media-release/2024/06/pacific-island-atolls-fixed-on-water-security (accessed on 16 August 2024).
43. Wells, S.; Ravilious, C.; Corcoran, E. *In the Front Line: Shoreline Protection and Other Ecosystem Services from Mangroves and Coral Reefs*; UNEPA World Conservation Monitoring Centre, 2006. [Google Scholar]
44. Bruno Soares, M.; S. Gagnon, A.; M. Doherty, R. Conceptual Elements of Climate Change Vulnerability Assessments: A Review. *Int. J. Clim. Change Strateg. Manag.* **2012**, *4*, 6–35, doi:10.1108/17568691211200191. [Crossref]
45. Thomas, K.; Hardy, R.D.; Lazrus, H.; Mendez, M.; Orlove, B.; Rivera-Collazo, I.; Roberts, J.T.; Rockman, M.; Warner, B.P.; Winthrop, R. Explaining Differential Vulnerability to Climate Change: A Social Science Review. *WIREs Clim. Change* **2019**, *10*, 1–18, doi:10.1002/wcc.565. [Crossref]
46. Secretariat of the Pacific Regional Environment Programme (SPREP). *Pacific Islands Framework for Action on Climate Change 2006-2015 (2nd Edition).*; Apia, Samoa, 2011. Available online:

https://library.sprep.org/content/pacific-islands-framework-action-climate-change-2006-2015-2nd-edition (accessed on 23 August 2024).
47. Pacific Islands Forum Secretariat. The Role of PIFS in Climate Change. Available online: http://www.forumsec.org/pages.cfm/strategic-partnerships-coordination/climate-change/ (accessed on 23 August 2024).
48. Pacific Islands Forum. Majuro Declaration for Climate Leadership. Available online: https://forumsec.org/publications/majuro-declaration-climate-leadership (accessed on 25 August 2024).
49. Asian Development Bank. *Climate Change in the Pacific: Stepping Up Responses in the Face of Rising Impacts*; 2010. Available online: https://www.adb.org/publications/climate-change-pacific-stepping-responses-face-rising-impacts (accessed on 25 August 2024).
50. Manfré, L.A.; Hirata, E.; Silva, J.B.; Shinohara, E.J.; Giannotti, M.A.; Larocca, A.P.C.; Quintanilha, J.A. An Analysis of Geospatial Technologies for Risk and Natural Disaster Management. *ISPRS Int. J. Geo-Inf.* **2012**, *1*, 166–185, doi:10.3390/ijgi1020166. [Crossref]
51. Newman, J.P.; Maier, H.R.; Riddell, G.A.; Zecchin, A.C.; Daniell, J.E.; Schaefer, A.M.; Van Delden, H.; Khazai, B.; O'Flaherty, M.J.; Newland, C.P. Review of Literature on Decision Support Systems for Natural Hazard Risk Reduction: Current Status and Future Research Directions. *Environ. Model. Softw.* **2017**, *96*, 378–409, doi:10.1016/j.envsoft.2017.06.042. [Crossref]
52. Sui, S.; Yu, L. Ontological Security in China–Pacific Islands Countries (PICs) Geopolitics. *J. Isl. Mar. Stud.* **2024**, *1*, 1–23, doi:10.59711/jims.11.110010. [Crossref]
53. United Nations Development Programme *China's South-South Cooperation with Pacific Island Countries in the Context of the 2030 Agenda for Sustainable Development, Series Report: Climate Change Adaptation*; 2017. Available online: https://www.undp.org/china/publications/chinas-south-south-cooperation-pacific-island-countries-context-2030-agenda-sustainable-development-series-report-climate-change (accessed on 28 August 2024).

54. Sen, S.; Ganguly, S. Opportunities, Barriers and Issues with Renewable Energy Development – A Discussion. *Renew. Sustain. Energy Rev.* **2017**, *69*, 1170–1181, doi:10.1016/j.rser.2016.09.137. [Crossref]
55. Venema, H.D.; Rehman, I.H. Decentralized Renewable Energy and the Climate Change Mitigation-Adaptation Nexus. *Mitig. Adapt. Strateg. Glob. Change* **2007**, *12*, 875–900, doi:10.1007/s11027-007-9104-7. [Crossref]
56. United Nations Climate Change. National Adaptation Programmes of Action. Available online: https://unfccc.int/topics/resilience/workstreams/national-adaptation-programmes-of-action/introduction (accessed on 1 September 2024).
57. Secretariat of the Pacific Regional Environment Programme. Climate Change Resilience. Available online: https://www.sprep.org/programme/climate-change-resilience (accessed on 1 September 2024).
58. Deng, Y.; Zhang, H.; Pratap, A.; Failou, B.; Hussain, A.; Putri, H.M. Integrating Climate Change into Global Ocean Governance: The ITLOS Advisory Opinion on the Specific Obligations of State Parties to the United Nations Convention on the Law of the Sea. *J. Isl. Mar. Stud.* **2024**, *1*, 1–17, doi:10.59711/jims.11.110011. [Crossref]
59. Sun, R.-S.; Gao, X.; Deng, L.-C.; Wang, C. Is the Paris Rulebook Sufficient for Effective Implementation of Paris Agreement? *Adv. Clim. Change Res.* **2022**, *13*, 600–611, doi:10.1016/j.accre.2022.05.003. [Crossref]
60. World Bank. Acting on Climate Change & Disaster Risk for the Pacific. Available online: http://documents.worldbank.org/curated/en/354821468098054153/Acting-on-climate-change-and-disaster-risk-for-the-Pacific (accessed on 1 September 2024).
61. Asian Development Bank. Regional Partnerships for Climate Change Adaptation and Disaster Preparedness. Available online: https://www.adb.org/projects/documents/regional-41187-012-0 (accessed on 3 September 2024).
62. Asian Development Bank. *Disaster Risk Reduction and Management in the Pacific*; 2013. Available online: https://www.adb.org/publications/disaster-risk-reduction-and-management-pacific (accessed on 4 September 2024).

63. The Pacific Community. Global Climate Change Alliance Plus - Scaling Up Pacific Adaptation. Available online: https://gem.spc.int/projects/gcca-supa (accessed on 4 September 2024).

64. Alam, M.; Khan, I.R.; Siddiqui, F.; Alam, M.A. Artificial Intelligence as Key Enabler for Safeguarding the Marine Resources. In *Artificial Intelligence and Edge Computing for Sustainable Ocean Health*; De, D., Sengupta, D., Tran, T.A., Eds.; The Springer Series in Applied Machine Learning; Springer Nature Switzerland: Cham, 2024; pp. 409–451 ISBN 978-3-031-64641-6. [Google Scholar]

65. Ning, J.; Pang, S.; Arifin, Z.; Zhang, Y.; Epa, U.P.K.; Qu, M.; Zhao, J.; Zhen, F.; Chowdhury, A.; Guo, R.; et al. The Diversity of Artificial Intelligence Applications in Marine Pollution: A Systematic Literature Review. *J. Mar. Sci. Eng.* **2024**, *12*, 1–25, doi:10.3390/jmse12071181. [Crossref]

66. Soori, M.; Jough, F.K.G.; Dastres, R.; Arezoo, B. AI-Based Decision Support Systems in Industry 4.0, A Review. *J. Econ. Technol.* **2024**, S2949948824000374, doi:10.1016/j.ject.2024.08.005. [Crossref]

67. Aldoseri, A.; Al-Khalifa, K.N.; Hamouda, A.M. AI-Powered Innovation in Digital Transformation: Key Pillars and Industry Impact. *Sustainability* **2024**, *16*, 1–25, doi:10.3390/su16051790. [Crossref]

68. Cowls, J.; Tsamados, A.; Taddeo, M.; Floridi, L. The AI Gambit: Leveraging Artificial Intelligence to Combat Climate Change—Opportunities, Challenges, and Recommendations. *AI Soc.* **2023**, *38*, 283–307, doi:10.1007/s00146-021-01294-x. [Crossref]

69. Adebayo Olusegun Aderibigbe; Peter Efosa Ohenhen; Nwabueze Kelvin Nwaobia; Joachim Osheyor Gidiagba; Emmanuel Chigozie Ani Artificial Intelligence in Developing Countries: Bridging the Gap Between Potential and Implementation. *Comput. Sci. IT Res. J.* **2023**, *4*, 185–199, doi:10.51594/csitrj.v4i3.629. [Crossref]

70. Oluwabukunmi Latifat Olorunfemi; Olukunle Oladipupo Amoo; Akoh Atadoga; Oluwatoyin Ajoke Fayayola; Temitayo Oluwaseun Abrahams; Philip Olaseni Shoetan Towards a Conceptual Framework for Ethical AI Development in IT Systems. *Comput. Sci. IT Res. J.* **2024**, *5*, 616–627, doi:10.51594/csitrj.v5i3.910. [Crossref]

71. Cheong, B.C. Transparency and Accountability in AI Systems: Safeguarding Wellbeing in the Age of Algorithmic Decision-Making.

Front. Hum. Dyn. **2024**, *6*, 1–11, doi:10.3389/fhumd.2024.1421273. [Crossref]

72. Olatunji Akinrinola; Chinwe Chinazo Okoye; Onyeka Chrisanctus Ofodile; Chinonye Esther Ugochukwu Navigating and Reviewing Ethical Dilemmas in AI Development: Strategies for Transparency, Fairness, and Accountability. *GSC Adv. Res. Rev.* **2024**, *18*, 050–058, doi:10.30574/gscarr.2024.18.3.0088. [Crossref]
73. *Scientific Innovations for Coastal Resource Management*; Ramos, J., Drakeford, B., Leitîao, F., Eds.; Advances in environmental engineering and green technologies (AEEGT) book series; IGI Global: Hershey, PA, 2024; ISBN 9798369324363. [Google Scholar]
74. Rogerson, A.; Hankins, E.; Nettel, P.F.; Rahim, S. *Government AI Readiness Index 2022*; Oxford Insights: London, England, 2022; pp. 1–60. Available online: https://oxfordinsights.com/wp-content/uploads/2023/11/Government_AI_Readiness_2022_FV.pdf (accessed on 13 September 2024).
75. Singh, C.; Iyer, S.; New, M.G.; Few, R.; Kuchimanchi, B.; Segnon, A.C.; Morchain, D. Interrogating 'Effectiveness' in Climate Change Adaptation: 11 Guiding Principles for Adaptation Research and Practice. *Clim. Dev.* **2022**, *14*, 650–664, doi:10.1080/17565529.2021.1964937. [Crossref]
76. Antwi-Agyei, P.; Stringer, L.C. Improving the Effectiveness of Agricultural Extension Services in Supporting Farmers to Adapt to Climate Change: Insights from Northeastern Ghana. *Clim. Risk Manag.* **2021**, *32*, 1–13, doi:10.1016/j.crm.2021.100304. [Crossref]
77. Abbass, K.; Qasim, M.Z.; Song, H.; Murshed, M.; Mahmood, H.; Younis, I. A Review of the Global Climate Change Impacts, Adaptation, and Sustainable Mitigation Measures. *Environ. Sci. Pollut. Res.* **2022**, *29*, 42539–42559, doi:10.1007/s11356-022-19718-6. [Crossref]
78. Rutenberg, I.; Gwagwa, A.; Omino, M. Use and Impact of Artificial Intelligence on Climate Change Adaptation in Africa. In *African Handbook of Climate Change Adaptation*; Leal Filho, W., Oguge, N., Ayal, D., Adeleke, L., Da Silva, I., Eds.; Springer International Publishing: Cham, 2021; pp. 1–20. ISBN 978-3-030-42091-8. [Google Scholar]
79. Bag, S.; Rahman, M.S.; Rogers, H.; Srivastava, G.; Pretorius, J.H.C. Climate Change Adaptation and Disaster Risk Reduction in the

Garment Industry Supply Chain Network. *Transp. Res. Part E Logist. Transp. Rev.* **2023**, *171*, 1–22, doi:10.1016/j.tre.2023.103031. [Crossref]

80. Blessing Ameh Digital Tools and AI: Using Technology to Monitor Carbon Emissions and Waste at Each Stage of the Supply Chain, Enabling Real-Time Adjustments for Sustainability Improvements. *Int. J. Sci. Res. Arch.* **2024**, *13*, 2741–2757, doi:10.30574/ijsra.2024.13.1.1995. [Crossref]
81. Narayana, T.L.; Venkatesh, C.; Kiran, A.; J, C.B.; Kumar, A.; Khan, S.B.; Almusharraf, A.; Quasim, M.T. Advances in Real Time Smart Monitoring of Environmental Parameters Using IoT and Sensors. *Heliyon* **2024**, *10*, 1–22, doi:10.1016/j.heliyon.2024.e28195. [Crossref]
82. Chen, Y.; Zou, X.; Li, K.; Li, K.; Yang, X.; Chen, C. Multiple Local 3D CNNs for Region-Based Prediction in Smart Cities. *Inf. Sci.* **2021**, *542*, 476–491, doi:10.1016/j.ins.2020.06.026. [Crossref]
83. Mihiretu, A.; Okoyo, E.N.; Lemma, T. Climate Variability Trends-Community Perspective-Livelihood Adaptation Strategy Nexus in the Arid-Tropics, Ethiopia. *J. Arid Environ.* **2023**, *210*, 1–9, doi:10.1016/j.jaridenv.2022.104929. [Crossref]
84. Nost, E.; Colven, E. Earth for AI: A Political Ecology of Data-Driven Climate Initiatives. *Geoforum* **2022**, *130*, 23–34, doi:10.1016/j.geoforum.2022.01.016. [Crossref]
85. Reddy, P.; Sharma, B.; Chaudhary, K. Digital Literacy: A Review in the South Pacific. *J. Comput. High. Educ.* **2022**, *34*, 83–108, doi:10.1007/s12528-021-09280-4. [Crossref]
86. USAID. Pacific Islands Digital Ecosystem Country Assessment. Available online: https://www.usaid.gov/digital-development/pacific-islands-deca (accessed on 13 September 2024).
87. Vierros, M.K.; Harden-Davies, H. Capacity Building and Technology Transfer for Improving Governance of Marine Areas Both beyond and within National Jurisdiction. *Mar. Policy* **2020**, *122*, 1–14, doi:10.1016/j.marpol.2020.104158. [Crossref]
88. Mata'afa, F.N. Bridging the Digital Divide in Pacific Island States. Available online: https://www.aspistrategist.org.au/bridging-the-digital-divide-in-pacific-island-states/ (accessed on 15 September 2024).
89. Secretariat of the Pacific Regional Environment Programme. Strandings of Oceania Database. Available online: https://pacific-

data.sprep.org/dataset/strandings-oceania-database (accessed on 17 September 2024).

90. Fujii, I.; Okochi, Y.; Kawamura, H. Promoting Cooperation of Monitoring, Control, and Surveillance of IUU Fishing in the Asia-Pacific. *Sustainability* **2021**, *13*, 1–23, doi:10.3390/su131810231. [Crossref]