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Climate change, vulnerability and well-being in the Pacific region

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ABSTRACT

The Pacific region has experienced vast adverse effects from climate change impacting the peoples' livelihoods both in these nations' urban and rural areas. Countries association between socio-economic performance and livelihoods have been adversely impacted by climatic hazards and vulnerabilities on nations' economic performance impacting the societal outcomes. An assessment of the Pacific's climate change, vulnerability and well-being is presented in general and a case study of Fiji in particular. The Pacific islands require resources invested in environmental education, and climate change and trade policy linkages to benefit the islands, future returns to individuals and higher levels of satisfied basic needs to reduce vulnerabilities.

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1. Introduction

The Pacific region's terrestrial ocean system reflects the combination of urban, rural and land-use activities which provides the economic activities of agriculture, manufacturing and services sectors for trade in the region and rural subsistence sectors for well-being. The Pacific Islands Countries (PICs) have experienced various effects of climate change induced by natural disasters of intense tropical cyclones, floodings, droughts and heat waves that have placed pressures on the agriculture, fisheries, manufacturing and tourism sectors over time. These vulnerabilities have exposed the nations' adversities through infrastructure damages such as roads and electricity supply; damage to farms, houses, business sectors and housing and loss of livelihoods (Gounder, 2011). 'Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020' (Intergovernmental Panel on Climate Change (IPCC), 2023, p.4). Global greenhouse gas emissions have continued to rise from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries and among individuals (Campbell, 2009). The vulnerabilities faced by the people have led to adaptations to climate change policies making them sensitive to shifts in environmental conditions with a focus on vulnerability reduction.

The world's largest Pacific Ocean's geography is mainly small islands and atolls which makes these countries more vulnerable to extreme weather events and rising sea levels. These associated climate change factors have affected the natural ecosystems and livelihoods as well as affecting global issues such as food security, biodiversity and sustainable development (Callari, 2023). Roughly half of the world's population currently experiences severe water scarcity for at least part of the year due to a combination of climatic and non-climatic drivers (IPCC, 2023). The prevalent effects of climate change and severe adverse impacts on economic growth and socio-economic development

have caused inherent vulnerabilities in the PICs. The small Pacific Island economies share a crucial characteristic of inter-connection with the natural resources and their reliance on the agriculture and fisheries sectors for sustainable livelihoods and income reliance from the tourism sector. Their dependence and sensitivity to shifts in environmental conditions are substantial on land and water (Keen & Fejo, 2023).

The long-term effects of climate change on human welfare are becoming urgent as the rising sea levels have led to both rural and urban populations being affected by adverse effects of weather patterns and the nation's decline in economic growth besides their socio-economic development. Concerns about climate change have adversely impacted the progress on poverty reduction as its long-term effects of climate change on human welfare (World Bank, 2012). The South Pacific region is prone to adverse weather effects impacted by hurricanes and cyclones. Substantial changes in the atmosphere, ocean, cryosphere and biosphere have risen that have changed weather exhibiting climate extremes and substantial adverse impacts, and related losses and damages to nature and people (IPCC, 2023). While the vulnerable island nations have generally contributed the least to current climate change, they are disproportionately affected by the effects of cyclones, droughts and floodings over time.

The erratic changes in weather patterns and increased climatic variability that many PICs have experienced have led to significant adverse impacts on agricultural productivity in terms of reduced income and food availability at the household levels. For example, Fiji is prone to adverse climatic burdens and based on the effects of Cyclone Ian in January 2014 it caused damage of US\$48 m ([wikipedia.org/wiki/List_of_Category_5_South_Pacific](https://en.wikipedia.org/wiki/List_of_Category_5_South_Pacific)). Vulnerabilities, adaptations and resilience in the case of Fiji are noted in this study with implications for other Pacific Island nations. The paper presents an empirical analysis based on Fiji's household's well-being and assesses the factors based on socio-economic factors given that Cyclone Ian's impact caused a significant adverse impact on the economy and its people. Using the Household Income and Expenditure Survey (HIES) 2013–2014 dataset for a sample of 6,020 households, and a sub-set of poor households the socio-economic variable analysed here reflects the vulnerability of the households.

2. Vulnerability, well-being and outcome

People's health and education are core values as they enable people to realise their potential as productive members of society and reduce vulnerability. In this perspective, peoples' well-being is linked to their standard of living for better housing, food security, water and sanitation for their healthy lifestyle in addressing the households' functions for their livelihoods with social norms and values. The Pacific Islands' cultural aspects of the households, villages, regional linkages and practices are intertwined for the overall well-being of community settlements. This secures the resilient structures and inter and intra-community cooperation of exchange and cooperation. With the knowledge-based economy and high productivity environment, education is seen to have generated higher earnings on average. The returns are large in low-income and middle-income countries, especially for women (World Bank, 2019).

Vulnerability notions have been noted worldwide in the cases of natural disasters, climate change impacts, environmental security, demography and epidemiology. Fiji over time has faced various political, economic, climatic and social disasters and the recent impact of coronavirus resulted in a decline in income and well-being. An estimation in the case of Fiji is undertaken using the Household Income and Expenditure Survey 2013–2014 dataset to address vulnerability and well-being. The monetary effects shown in equation (1) are based on 6,020 households and a subset of poor households to address the effect of education on income poverty reduction that includes rural-urban households and integrates the poor household category. The logistic approaches based on the heteroskedasticity method of two-stage instrumental variables (IV) and probit methodology for the identification and estimations are applied (see Lewbel, 2012, and the literature cited therein). The

Table 1. Monetary effects of well-being.

Variable	LnY Level 2SLS (Full Sample, Col.1)	Standard Error	LnY Poor Households (Col. 2)P
<i>School</i>	0.095***	0.016	0.013*** (0.004)
<i>Age</i>	0.023***	0.005	0.036*** (0.007)
<i>Age</i> ²	-0.0002***	0.000	-0.003*** (0.001)
<i>Female</i>	-0.22***	0.041	-0.461*** (0.073)
<i>Ethnicity</i>	-0.004*	0.008	-0.112*** (0.031)
<i>Children</i>	0.116***	0.02	0.106*** (0.009)
<i>Rural</i>	-0.329***	0.028	-0.11** (0.028)
Observations	6020		1109
<i>R-Square</i>	0.164		0.198

Notes: ***, ** are significance levels at the 1%, 5% and 10%, respectively.

functional descriptions are as follows:

$$\begin{aligned} \ln Y = & \alpha_0 + \alpha_1 \text{School}_i + \alpha_2 \text{Age}_i + \alpha_3 \text{Age}_i^2 + \alpha_4 \text{Female}_i + \alpha_5 \text{Ethnicity}_i + \alpha_6 \text{Children}_i \\ & + \alpha_7 \text{Rural}_i + \alpha_8 \text{Poor}_i + \mu_{1t} \end{aligned} \quad (1)$$

where $\ln Y$ is the log of households' total annual income; *School* is the household head's completed years of schooling; *Age* is the household head age of; *Age*² is the squared of household head's age; *Female* is the dummy variable for the female household head; *Ethnicity* takes the value of 1 if the household head is Indo-Fijian and 0 for Fijian; *Children* is the number of children who are 14 years of age or under; *Rural* is the households in rural areas; *Poor* is the poor household, μ_{1i} is random error terms; i is 1, ... N, households.

Based on the monetary models the impact of education on well-being is analysed by applying equation (1). Returns to investment in education are critical in all regions of the nation to meet human capital goals (Psacharopoulos & Patrinos, 2018). The monetary results (Table 1) are based on the two-stage least squares and ordinary least squares methods applied for the full sample (Col 1) and the reduced form for the poor households (Col 2). The estimated coefficients (Col. 1 and 2) for the returns to education increase the household head's income by 5.5% and 1.3%, respectively. The household heads' educational attainments (*School*) contribute to higher levels of income; thus, schooling is an effective instrument where an increase in the household head's income contributes to poverty reduction in Fiji. The results reflect that higher levels of education (years of schooling) provide a dynamic platform for people to attain higher income which could raise the awareness of health prevention activities critical to improve well-being. Younger household heads (*Age*) income increases, while the older household heads' (*Age*²) decisions on education and health expenditures are low which ultimately reduces the household's human capital and income.

A *Female* household head shows a lower income level as income earned by the male household head is higher. It implies that inequality issues affect the female household heads leading to their lower income levels. The *Ethnicity* coefficient shows that the income level of Indo-Fijian household heads is lower than Fijian household heads as also for living in *Rural* areas earn lower income. The HIES 2013/2014 report that 49.2% of Fiji's population resides in rural areas (Fiji Islands Bureau of Statistics, 2015, p. 3). The number of children positively contributes to the household's income. The *Poor* household results (Table 1, Col. 2) indicate that the years of education (*School*), younger household heads (*Age*) and the number of children raise the total income of the households by 1.3%, 3.6% and 11%, respectively. In the case of the *Poor* households, several factors of these households that lead to a reduction in income outcomes are the older household heads (*Age*²), the *Female* and *Indo-Fijian* household heads and those residing in the *Rural* areas. These factors contribute to substantial decreases in income, respectively, as these characteristics adversely affect the households' poverty conditions.

3. Policy response and challenges

The human activities through emissions of greenhouse gases have unequivocally caused global warming. Adaptation, mitigation and understanding of climate change are critical policies for improving the prediction of climate change-related events and improving the understanding of addressing climate-related challenges. Adaptation is a crucial response to minimise the adverse impacts of climate change. The Pacific Island nations through its various associated climate difficulties and adversities require external assistance from the international organisations for an effective response to address the impacts of climate change for adaptation and mitigation strategies. The use of participatory processes also enables consensus-building and social interaction, therefore, connecting people with diverse interests and resources (Woolcock & Narayan, 2000). The United Nations, World Bank, International Monetary Fund and several non-government organisations indicate the importance of addressing climate change through targeted government assistance that could contribute to building more positive attitudes and competencies and creating opportunities as a source of economic productivity to facilitate households' personal and economic well-being with a social perspective (Rodriguez & Loomis, 2007).

Human capital policies in rural areas are vital to reduce vulnerability and enhance inclusive and sustainable economic growth to improve people's living standards and their participation in economic growth. Labour is an essential asset and education enhances the possibilities of attaining and retaining formal employment and higher income levels and facilitates health prevention activities. It improves the standard of living through human capital investment, thus improving well-being. Expanding schooling attainments and provision of socio-economic resources are important to prevent people from falling into poverty and have a positive influence on their well-being and meet the Sustainable Development Goals (SDGs) in the Pacific region. It is crucial to invest in the organisational capacity of the poor and assist all communities and social groups. The vulnerabilities and challenges posed by climate change in the Pacific require sustainable practices, adaptive capacity building and resilience development.

People's health and education have intrinsic value as it enables them to realise their potential as productive members of society and it is a central driver of sustainable growth and poverty reduction, thus reducing the level of vulnerability and enhancing resilience in the communities. Those living in rural areas are affected due to low-income levels and remote areas that affect their standard of living. Fiji's human capital index (HCI) was 0.50 in 2019 and has a similar value to its island neighbours of Samoa, Tonga and Vanuatu (World Bank, 2021). Employees' knowledge, skills, know-how and good health have substantial positive impacts on their earning levels. Human capital investment in both education and health resources and rural areas is necessary to acquire skills and training required to enhance the individuals' capital which is a critical means for well-being.

4. Conclusion

Climate change has adverse economic, social and environmental effects impacting land, labour, capital, food and water security and impacting the nationals and the nation's capacity to meet many of the SDGs by 2030. While the agricultural and manufacturing productivity increased in some of the developing countries in Asia, Africa and Latin American countries, the Pacific Island nations' vulnerability was many folds due to rising sea levels and several climatic impacts that led to lower economic growth and socio-economic development. The Pacific Island nations require resources invested in environmental education, and climate change and trade policy linkages to benefit the Pacific Islands, future returns to individuals and higher levels of satisfied basic needs to reduce vulnerabilities. This can lead to addressing disaster management to positively influence communities' vulnerability, particularly resilience and knowledge about their environment and infrastructure investments.

Addressing the vulnerability issues, well-being and resilience in the Pacific region requires policies that should be aimed at combining traditional and contemporary actions and policies to address the

harmful climate effects, human capital development and resource allocation in both rural and urban areas for disaster management. Other interlinked effective policies to be considered are investments in infrastructure, disaster management, technologies and trade policies. Environmental and climate change issues and policies need to be introduced in schools to increase the awareness of addressing disasters and addressing the issues of land, labour and capital resources to reduce vulnerabilities and improve well-being. It is crucial for the governments and societies in the Pacific Island nations to improve skill attainments and in collaboration with developed countries at the regional and global levels to address climate change impacts on agriculture, fisheries, food security and the households' insecurities.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

A dataset is not released due to the confidentiality of the household data from the provider.

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