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SHORTAGE OF FOOD AS A FACTOR OF SOCIETAL PROBLEMS IN THE PACIFIC ISLAND NATIONS

Master's thesis
International Relations and European-Asian Studies

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Tallinn 2020

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LIST OF ABBREVIATIONS

FAO	Food and Agricultural Organization
FSM	Federated States of Micronesia
GDP	Gross Domestic Product
IPCC	Intergovernmental Panel on Climate Change
KOFA	Kiribati Organic Farmers Association
MDGs	Millennium Development Goals
NCDs	Non-Communicable Diseases
PAA	Priorities Action Agenda
PICTs	Pacific Island Countries and Territories
PIF	Pacific Islands Forum
PINs	Pacific Island Nations
PNG	Papua New Guinea
SLA	Sustainable Livelihood Approach
SPC	Secretariat for the Pacific Community
UN	United Nations
VAD	Vitamin A Deficiency
WHO	World Health Organization

ABSTRACT

Climate change has become one of the significant factors, which started contributing to a common agenda for the Pacific Island Nations (PIN) in recent years. Floods, droughts, an increase in sea level, soil erosion, malnutrition, lack of clean water supplies, and severe health problems have caused social issues of pan-regional concern. Insecurity and uncertainty in sustainable food reserves force people to migrate from these islands. Alongside the shortage of food, several other challenges, including the deficiency of protein and some vitamins in the primary food resources, have an influence on social instability. Apart from other factors, the lack of vacant land, - as well as climatic adjustments, represent some of the main 'drivers' of increased dependency on imported food in the island countries such as, for example, the Republic of Kiribati.

Due to the abovementioned reasons, this paper is focused on food insecurity as the basis of socio-political problems in the PINs, leading to perpetual migration from the territories. The problems originated from the food deficiency in the region, and the challenges that people face to get food and fresh water were investigated. For the comparative reason, the Republic of Kiribati and the Republic of Vanuatu are taken as case-studies. The research supports putting forward a solution to the ongoing problems to secure food reserves by adaptation measures, which will be much more resilient and to provide those people with sustainable food reserves in the future in order to prevent social instability in the region.

Keywords: climate change, food shortage, food insecurity, social instability

INTRODUCTION

Climate change is a widely discussed matter in the field of international relations, which, in its turn, analytically 'feeds' both agenda-setting and policy-making processes. Overall effects, as well as both real and perceived consequences, have already become everyday objects for data collection by different schools of thought, global and regional organisations, and separate governments. Droughts, severe weather conditions, soil erosion, floods, air pollution, sea level increase, temperature rise, storms, cyclones, and acidification of the oceans are proven to be associated with climate change. Arguably, in spite of the fact that a majority of these changes are directly related to exact sciences and nature-originated spatial relationships, they can also comfortably 'dwell' within an argumented discussion on vertical interactions where society makes an effective impact on the environment, be it an impact with a positive or a negative connotation. This situation frames a range of platforms to interlink the phenomenon of climate change with debates on environmental refugees, vulnerable social groups, strategic narratives, geo-strategy, strategic communication, and security.

On a more concrete note, for example, climate change is influencing the life of small island nations, and some of those are to disappear in the foreseeable future. Responding to this challenge, the Pacific Islands Forum (PIF), an inter-governmental body that has been assigned to the task of enhancing effective cooperation between countries and territories of the Pacific, has now adopted a strategic narrative that unifies 'climate change' and 'disaster risk management' into its Assessment Reports on the theme (IPCC 2014). Indeed, the factor of sea level rising on these islands would irreversibly affect the local people's lives, making it impossible to be maintained on those territories. For example, according to credible research conducted on the subject, "[s]atellite altimeters have monitored sea level trends near Kiribati since 1993, finding an average rise in sea level of 1-4 mm a year (ABM & CSIRO, 2011), with sea level projected to continue rising in the future" (Allgood, McNamara 2017, 375).

Climate change is a threat to the marine environment of the region. As the geographical location enables, the main food resource for the islands' population is fish. Besides being the leading food

resource in the Pacific Islands due to their geographic location, fish also contains protein and vitamins that are essential for the human body. It has been argued that fish and seafood products contain important nutritional elements, and those products provide almost 20 per cent of the average daily protein intake of about 3.1 billion people (Tacon, Metian 2018, 16). Hence, one of the most important food sources can be under threat because of the situation. Some islands are facing more severe problems than others because of climate change. For example, as argued, the salinisation of soil and freshwater resources, at the same time, the rising sea level are influencing food and water security and the overall sustainability of the livelihoods of the population of i-Kiribati (Allgood, McNamara 2017, 371). In this case, it might lead people to look for a place to migrate from the islands. Survey-based research confirmed that the most popular reason for considering future relocation was environmental conditions, comprising 53 per cent out of all cases (Allgood, McNamara 2017, 379). Furthermore, objectively, high temperatures and extreme weather events increase the risk of spreading infections that are the outcome of poor hygiene in the region. Moreover, increasing the level of salinity of the water damages the crops and diminishes the freshwater supply. Thus, the lack of fresh water supplies and food scarcity have been claimed to be the reason triggering the process of migration of the population. The whole issue is not only about the threat of the disappearance of the islands, but also the elimination of particular cultures, languages, and communities that are unique for the world.

Climate change is being discussed by different schools of thought. For example, Keohane and Victor (2011, 7) underlined that the international system lacks "integrated regime governing efforts to limit the extent of climate change". Weiss and Burke (2011, 1057) argued that climate change can easily generate a drive towards establishing a range of "more legitimate and authoritative intergovernmental organisations within a world society that would be more effective at solving common problems than those operating within today's more fragmented international society". In his turn, Sofer (2015) made a generalisation on traditional realists who do not necessarily treat climate change as a security threat, while arguing that "as climate change intensifies existing conflicts and exacerbates instability, states are increasingly being forced to grapple with and defend against it, just as they would a hostile adversary". Adopting a grand take on the phenomenon, Herman (2019) discussed a possibility for the climate change-associated debate to push it further towards establishing a new world order. Nevertheless, a more 'down to earth' research on conceptualising a range of very concrete challenges that are directly associated with a no less concrete region – for instance, food shortage in the Pacific Island Nations (PINs) – is very rare.

At the same time, as specified in the aforecited *AR5 Synthesis Report: Climate Change 2014*, climate change-generated issues with food and water security are becoming core objects of policy-making among the PINs, which are mostly categorised by the United Nations (UN) as "vulnerable" or "extremely vulnerable" (Kaly *et al.* 2005). These issues are, with inevitability, leading to myriads of consequences; therefore there is a justified necessity for academia, without giving up on grand theorising, to start testing claims on and then detecting and analysing some interlinkages existing 'on the ground', where people live and suffer. Certainly, a proper boundaries-forming theoretical framework is also one of the requirements for discussing the findings, but such a framework should be sharpened up for producing a more applied as well as practical outcome of research to be well understood on a regional and/or organisational levels.

In such a context, for example, an argument could be thrown for testing that the shortage of food gradually becomes a new major factor that leads to migration of the PINs' population from the islands. There is nothing academically naïve in underlining that the lack of the locally-organised production of food leads to the people of the PINs discovering even a lower level of vulnerability. What did not end up as an existential problem for France, – the country's share of agriculture, fisheries and forestry in GDP dropped from 10.53% in 1960 to 1.62% in 2018 (Statista Research Department 2020) – has a very different outcome for Vanuatu. According to the data recorded by WHO, Kiribati, Samoa, Solomon Islands, Tuvalu and Vanuatu are categorised as least-developed countries, and the other countries and areas are classified as developing countries (WHO Country Cooperation Strategy Brief, 2013).

In the case of the dependence of imported food, it can weaken the already vulnerable economies of those countries. The declined economy might lead to problems in both domestic and foreign relations of the region-bound countries. Moreover, the land in access might become smaller on the islands because of the climate-related changes, and it might exacerbate the living conditions of people. Migration might be the only choice of the population with poor living conditions provided that the food shortage is the case. If the people of these islands move from their lands, it will limit the sovereignty of their nation for the future – migration might result in serious problems in terms of territory-bound sovereignty being lost by those nations. Then, of course, it will be up to grand theories to pick up from there, but, for the PINs, it will be too late. Therefore, the impact of all these changes needs and should be detected and analysed, since the situation has now direct relevance to the security of a large region. For this reason, in the case of testing the hypothesis of this paper, it can be claimed that food shortage might lead to migration.

The following two research questions will be examined in the context of the aforementioned claim: "What aspects of the climate change phenomenon are affecting food supply and food industry?" and "To what extent socio-political stability (or, for that matter, lack of it) is influenced by food insecurity in Kiribati and Vanuatu?". The paper will, firstly, determine and examine a range of aspects of the climate change phenomenon that are evidently affecting the food supply and food industry in these small islands. Then, the thesis will explore the current socio-political *status quo* in both Kiribati and Vanuatu. A comparative analysis of the two island nations will be conducted in order to objectively determine similarities and differences between these genuinely Pacific nations of different ethno-geographic backgrounds.

Discussion-wise, the food security theory-related parameters (Yaro 2004) will be employed to use the Sustainable Livelihood Framework's clusters in order to establish a range of important evidence-based causal interlinkages in the context of this paper's main argument. Five segments of the Sustainable Livelihood Assets (human, social, natural, physical, and financial) will be studied for the chosen two countries of the Pacific. This discussional approach will, with necessity, underline a distinctly applied nature of the paper. Should Sustainable livelihood approach (SLA) be extrapolated onto the region of the Pacific, it can significantly assist the regional governments as well as the PIF in the process of sharpening their policies and policy proposals up to achieve a better level of concentration on a range of truly existential matters. In a significant addition, once completed, this paper is planned to be sent as a modest analytical material to the Fiji-based PIF Secretariate, via Fijian Embassy in Brussels. On methodology, this paper is to extensively employ statistical data, discourse analysis, and comparative table-building technics to arrange its data-gathering process for a more comprehensive understanding of the aforementioned Livelihood Assets existing in the two countries and, to an extent, within the Pacific. Both primary and secondary data is used in the process.

Firstly, as has been mentioned before, the paper will find out the changes that occurred as a result of climate change on the islands. Followingly, the problems including unavailability of soil to crop, the challenges for standards of hygiene, food and vitamin deficiency, and food poisoning due to high temperature will be discussed in the paper. All of these problems occur as a result of climate change on these islands. Then, the adverse effects of these changes on food supply will be examined. Apart from these problems, climate change influences the economy as well. As the prices increase, people start facing difficulties. Subsequently, the case studies will be undertaken. In that chapter, the costs of relocation, including social and cultural costs, will also be investigated

for Kiribati and Vanuatu. The research will also support taking some measures in order to prevent the future consequences of climate change in the region. Further detailed discussion on the issue will be continued. Finally, the conclusion will present an overview of the paper and the results of the analysis of the data presented for this research. The conclusion will also provide a viewpoint for future investigations on the issue.

1. THE IMPACTS OF FOOD SHORTAGE ON HUMAN SECURITY IN THE PACIFIC COUNTRIES

Although there are sufficient food resources in the world, food deficiency still remains a serious problem threatening the PINs. Those vitamins, minerals, and other essential substances systemise important parts of living organisms, and they contain the core element of the life cycle. A study of Tacon and Metian (2018, 15) finds that the estimation of the Food and Agricultural Organization (FAO) presented insufficient levels of dietary energy intake during the period between 2014–2016 in more than 795 million people. That case might become an invisible danger for the people who suffer from a caloric deficiency in their daily intake continuously. Since it does not show immediate results, it might not have been identified by people on time. Hence, the potential threat might lead to a severe outcome for the next generations in the world. These elements are the initial signs of food insecurity. Food insecurity itself can trigger other problems in society. As argued (Tacon and Metian 2018, 15), the risk of critical health problems, including diet-related diseases as well as cardiovascular problems, occurs due to the deficiencies in daily nutrition. The more the deficiency in daily nutrition is, the higher the rate of non- communicable diseases arise.

The problem is more serious in the areas where the weather conditions have more negative effects on agriculture and the marine environment. The main food resources for the population of those areas are in danger. Due to the estimations, since the ice-sheet melting (recently approximately 3 mm per year) rise, sea-level rise could, in fact, increase one meter or more by the end of this century (McMichael, Lindgren 2011, 407). The rise in sea level and the erosion of soil, which occurs due to the sea level rise, challenge the agricultural production in the coastal areas, including the islands and the small nations. Likewise, the situation might jeopardise the marine environment in the coastal areas. Considering the sensitivity of the marine creatures towards the changes in atmospheric conditions, one can claim that the human diet might lack some fish species, as well as the protein that those products contain.

1.1. Climate-related changes on the islands

There have been case studies investigating weather and climate events starting from the late 1980s (Hay, Mimura 2010, 7). As stated in the statistics of the number of disasters for the Pacific Islands region for the same time period, there is an increasing trend in the number of disasters in the region (Hay, Mimura 2010, 6). Furthermore, the research shows that most of the disasters in the area are weather and climate-related, and the risk of disasters is unevenly distributed (Hay, Mimura 2010, 6). It suggests that the threat caused by disasters differs from place to place. Also, the consequences of various climate-related disasters vary depending on the region.

While considering the previous statistics concerning the issue, the estimations regarding the future situation demonstrate the continuous future impacts of climate change on the islands. Credible research estimates that by 2080 flood risks for the population of islands will be 200 times higher than the situation without global warming, which results in a 70 per cent loss in the world's coastal lands (Barnett, 2003, 12). The problem occurred a long time ago, and it is continuing. Also, the studies prove that it might remain in the future as well.

Besides other problems that occur as a result of climate change, food insecurity remains a constant hazard for the population of the islands. Based on this fact, it can be predicted that the weak economy on these islands gradually results in food insecurity. The main sources of income on these islands are agriculture, fishery, and tourism industry depending on the territory. The role of the tourism industry in the island nations is also significant; hence it includes 49 per cent of GDP in Palau, 47 per cent in the Cook Islands, 17 per cent in Vanuatu, 15 per cent in Kiribati, and Tonga, and 13 per cent in Fiji (Barnett 2011, 230). Nevertheless, the tourism industry has an indirect effect on the food security of the islands. It contributes to the overall economy of the islands, and the stable economic situation would allow them to survive when there is a serious threat of food shortage in the region.

Taking into account the above, if the climate-related changes occur more frequently, those industries will decline in the future. Hence, the tourism industry will shrink in the future in the case of continuous extreme weather conditions. Tourists will look for safer places to go. Those places will not be as attractive as it used to be because of environmental problems.

1.2. Shortage of food and water supplies

According to the definition of food security by the FAO, it is a "situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Schmidhuber, Tubiello 2007, 19703). Researchers dealing with food security also consider food sovereignty when they study food security and access to food resources. They believe that food sovereignty is "the right of people to produce, distribute and consume healthy food in and near their territory in an ecologically sustainable manner" (Mawyer, Jacka 2018, 242).

While discussing the food supplies of the islands, the four key dimensions of food supplies should be studied, which have been explained by the scientists, including availability, stability, access, and utilisation of food (Schmidhuber, Tubiello 2007, 19703). Those four dimensions cover the notion of sufficient food supplies for people. The first dimension – availability of food – has been defined with the general availability of the agricultural system to provide enough food supply for the population. The second dimension – stability of food supply – has been defined with the situation in which people do not suffer from lack of access to adequate food supplies either due to the income shock or lack of enough sources. According to the research on global food security, climate variability has been shown as an essential cause for the unsteady access for food. The third dimension – access to the food supply – has been defined as access by individuals to the food resources as consumers. The last dimension – utilisation of food supply – has been described as food safety and the quality of food resources (Schmidhuber, Tubiello 2007, 19703). In this case, in order to discuss sustainable food security, all the dimensions of food supplies for the population should be considered. These four dimensions of food supplies help researchers study the whole process for food security.

The quantity and quality of food supplies should be studied to understand the food security issue on these islands, and these concepts are included in the availability, stability, access and utilisation of food supply. Although the quantity of food is considered to be much more significant than the quality in some cases, the absence of essential vitamins and minerals might cause malnutrition, which leads to some diseases in the future. In terms of quantity, it can be claimed that climate change reduces the suitability of lands to grow crops in the PINs, which leads to a severe decline in the amount of food produced. Drier areas are becoming arider and decreased soil productivity

is becoming one of the major elements for the lack of food. Furthermore, a change in temperature provides a suitable environment for the survival of pests, which will attack the crops.

When the quantity of food resources is mentioned, the importance of agriculture and fishery for the economy, as well as its influence on the stability of food supply, should not be neglected. The very first economic concern is the availability of conditions for agriculture and fishery. Moreover, some other factors also influence agricultural production, such as the increase in carbon dioxide in the atmosphere. It has been estimated that even if excess greenhouse gas emissions were limited now, the average global temperature would still increase by an estimated 0.7°C. Hence, the health effects of this will be partly dependent on the level of current emissions in the future (Woodruff *et al.* 2006, 568). On the other side, climate change can be considered as the reason for food insecurity in terms of the quality of food supplies. Elevation of carbon dioxide damages the quality of food, as it reduces the level of protein concentration in the diet (Schmidhuber, Tubiello 2007, 19704). The quality of food is measured with the sufficient level of its components and the number of important elements that the food contains. Another important aspect regarding the quality of food is the storage of food, which in changing weather conditions. Obviously, extreme weather conditions will raise food poisoning cases. Some studies have approved the effects of temperature on common forms of food poisoning, including salmonellosis, human shellfish, and reef-fish poisoning (ciguatera) (Schmidhuber, Tubiello 2007, 19705).

Not only food poisoning cases will be increased, but also food and water-borne diseases and diarrheal disease will occur. Poor hygiene, which has been originated by flood and drought, can impinge on the health conditions of people. As reported by the studies done, salmonella and cholera bacteria spread more rapidly at higher temperatures, one in the animal gut and food, and the other in the water, respectively (McMichael *et al.* 2006, 862). Lack of sanitation in the regions make the utilisation of food and water resources impossible. Food contamination worsens the situation in the areas where malnutrition already exists. For that reason, food inequality might become one of the major security issues for those areas.

The food security and food sovereignty of people have already been mentioned previously. In the case of these islands, in order to ensure food security, food production must also become secure on the islands, since agricultural production influences food security in the PINs. Traditional food production fell, and the demand for local products is diminishing. The problem is more severe in the Pacific Island region, which consists of 22 countries and territories. The aftermath of the

situation caused the demand for packaged imported foods (Charlton *et al.* 2016, 2). As food production decreases on the islands, it necessitates the demand for imported food in the PINs. The researches show that there is a difference between Papua New Guinea (PNG) and the Solomon Islands with the levels of reliance on imported foods, compared to Fiji and the Federated States of Micronesia (FSM). As PNG and the Solomon Islands have low levels of dependency from imported foods; however, Fiji and the FSM have a high level of reliance from imported foods (Allen, 2015, 1345). The level of dependency from imported foods varies from place to place in the region.

Considering the elements that imported food contains, the quality of food might become a major concern for the people. The situation leads to the introduction of some diseases in the region. Packaged food, which is considered as poor-quality (Charlton *et al.* 2016, 22) imported food, contains fatty or sugar-sweetened elements. As has been mentioned before, the quality of food is an important factor in the context of food security. As a result of the consumption of this food, the risk of some diseases might occur. Researches indicate that non – communicable diseases remain the main reason for between 60 per cent and 80 per cent of death in the region (Charlton *et al.* 2016, 2). Although these diseases might not occur because of the lack of access to food, they might occur as a result of food insecurity in these territories.

These issues are the main indicators of a decline in the quality of the food supply that threatens food security. According to FAO statistics, Oceania, which includes the Pacific Islands, has been recorded with an increase in the prevalence of undernourishment from 5.5 per cent to 6.2 per cent between 2005 and 2018 (FAO …2019). The influence of deficiency in the quality of food might worsen the living conditions among the population on the islands. In addition to that, the environmental consequences of climate change mostly affect the low - income population around the world. Those families will become even more vulnerable towards the changes. Climate change will change their way of life, their health as well as their income in the coming future. Farmers and fishers might lose their places to work. Also, in the case of an increase in food prices, the quantity of food will be diminished for the low-income population. Further to this, dependence on imported food will increase. These economic problems affect their living conditions, and they might become even more vulnerable. Those challenges are some of the societal problems that can have a further impact on the migration of the population.

Another problem is the rise in the sea level, which increases the risk of inundation in the region. As a result of inundation, saltwater damages the freshwater lenses in the region. Hence, environmental extremes affect the fresh water sources, which are crucial for life. Besides the concerns regarding the agricultural products in the area, it should also be considered that the fish and seafood products maintain significant importance in the Pacific Islands, too. Fish constitutes a significant part of the market – based economies in the Pacific region as well. Since climate change damages the marine environment, it increases the concerns about protecting fishery and water quality in the region. Not only fish remains as one of the main food resources, but also fishing is a traditional way of life of the population. Fish and shellfish species are foundational for these societies as a supply of protein and essential elements (Savo *et al.* 2017, 877). One of the major problems of climate-related changes is that the shortage of food will lower the strong immunity of people to diseases. Another aspect is the lack of labour productivity due to the insufficient food supply and vicious diseases. All these have a significant impact on the economy and living conditions of local people on the islands.

1.3. Climate-related changes and their impact on fish consumption

As pointed out in the report of the WHO, daily protein intake should be approximately 0.7 g per kg body weight per day (Bell *et al.* 2009, 65). Studies show that Pacific Island Countries and Territories have a significantly high level of fish consumption; in six PINs of Micronesia and Polynesia, the level needed to supply was 50 per cent of the protein requirements (Bell *et al.* 2009, 65).

The research suggests that as stated in FAO food balance sheets, twenty-two of the thirty countries officially referred to as low-income food deficient countries in the world where fish contribute more than one-third of the total animal protein supply (Kawarazuka, Bene 2011, 1928). Also, the same research claims that fish encapsulates the digestible protein that is approximately 5–15 per cent higher than plants have. The various species of fish have different nutrient content, and in addition to that, fish has a more balanced concentration of essential amino acids and a high concentration of lysine. In addition to this, the research highlights the fact that fish also contains lipids composition, which is beneficial for the adult health system and development of a child at an early age (Kawarazuka, Bene 2011, 1929). These factors suggest that without providing enough

animal protein supply, there might have a deficiency in children, which leads to health problems. The increase in health problems among the population might lead to social instability in the region. Therefore, the lack of fish consumption might be the reason for the migration in the long-term.

The below data (see *Table 1*) indicates the consumption of fish in the PINs and the animal protein that fish contains. The table represents the percentage of fish consumption, which is very high in the PINs. From here, it can be seen that even though there are other marine animals than fish, fish is the important food source for animal protein in the PINs. According to the data presented on the table below, fish contains more than 75 per cent of the total animal protein supply for the overall population of these islands.

Table 1. Contributions of fresh fish to fish consumption and all fish consumed to total animal protein, in Pacific island countries and territories (PICTs), determined by household income and expenditure surveys (HIES)

PICT	% Consumption comprising fresh fish				% Animal protein		
	HIES			SES			
	national	Urban[a]	rural	coastal	national	urban	rural
Melanesia							
Fiji	59	45	66	92	–	–	–
New Caledonia	–	–	–	85	–	–	–
Papua New Guinea	77	76	77	87	–	–	–
Solomon Islands	90	80	90	97	92	83	94
Vanuatu	60	38	65	72	56	43	60
Micronesia							
FSM	92	91	97	76	82	83	80
Kiribati	92	91	93	95	84	80	89
Nauru[b]	96	–	–	75	71	–	–
Palau	78	75	81	93	52	47	59
Polynesia							
Cook Islands	81	75	86	89	35	27	51
French Polynesia	82	76	86	93	65	57	71
Niue[b]	–	–	–	66	–	–	–
Samoa	–	–	–	74	–	–	–
Tonga[b]	80	–	–	87	–	–	–
Tuvalu	98	97	99	98	71	41	77
Wallis & Futuna[b]	98	–	–	91	–	–	–

Source: Bell *et al.* (2009, 66)
Notes: For coastal fishing communities, contributions of fresh fish to total fish consumption were determined from socio-economic surveys (SES).
a Includes frozen fish in some PICTs.
b Represents entire PICT.

The amount of total animal protein supply in low-income food deficient countries is very high. It suggests that in the case of a lack of marine sources to provide fish, it will lead to a serious shortage of important nutrients in these countries. Due to the nutrient content of the fish, the level of deficiency can be easily seen if there is a decline in the amount of fish consumption.

According to the calculations of scientists, environmental changes have increased since the end of last century. *Figure 1* describes the changes in sea surface temperature (SST), surface oxygen concentration, pH and net primary production (NPP) between 1980 and 2000 (Asch *et al.* 2018, 287). A rise in the sea surface temperature can be observed from the Figure. The Figure presents the changes which help to calculate further estimations for the upcoming years.

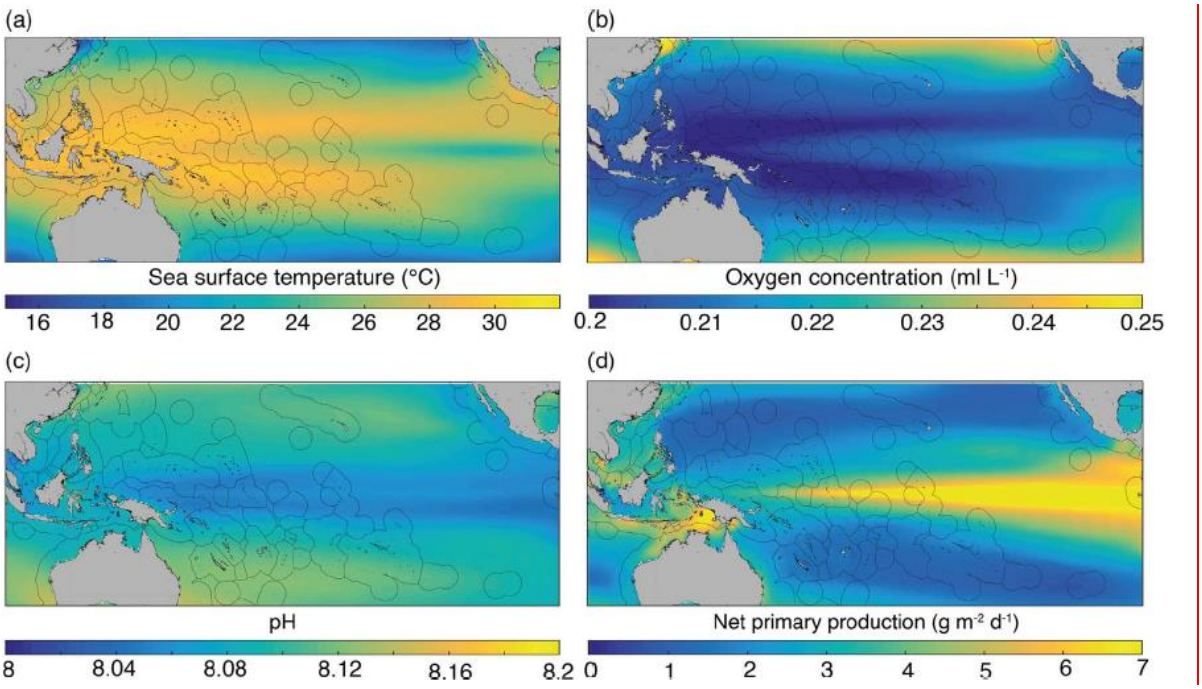

Figure 1. Map of mean values of physical and biogeochemical variables for the period 1980 2000. (a) Sea surface temperature (SST), (b) surface oxygen concentration, (c) pH, (d) net primary production. Black lines indicate the Economic Exclusive Zones (EEZs) of Pacific Island countries and territories (PICTs)
Source: Asch *et al.* (2018, 287)

Figure 2 presents the estimation for the changes in sea surface temperature (SST), maximum catch potential (MCP), pH level and net primary production (NPP) between 2040-2060 and 2080-2100 (Asch *et al.* 2018, 289). Loss of local species in the marine environment is estimated to increase during the period in the countries recorded. It can be observed that these countries are affected by climate change, and the future impacts of climate change will be much more dangerous for these countries.

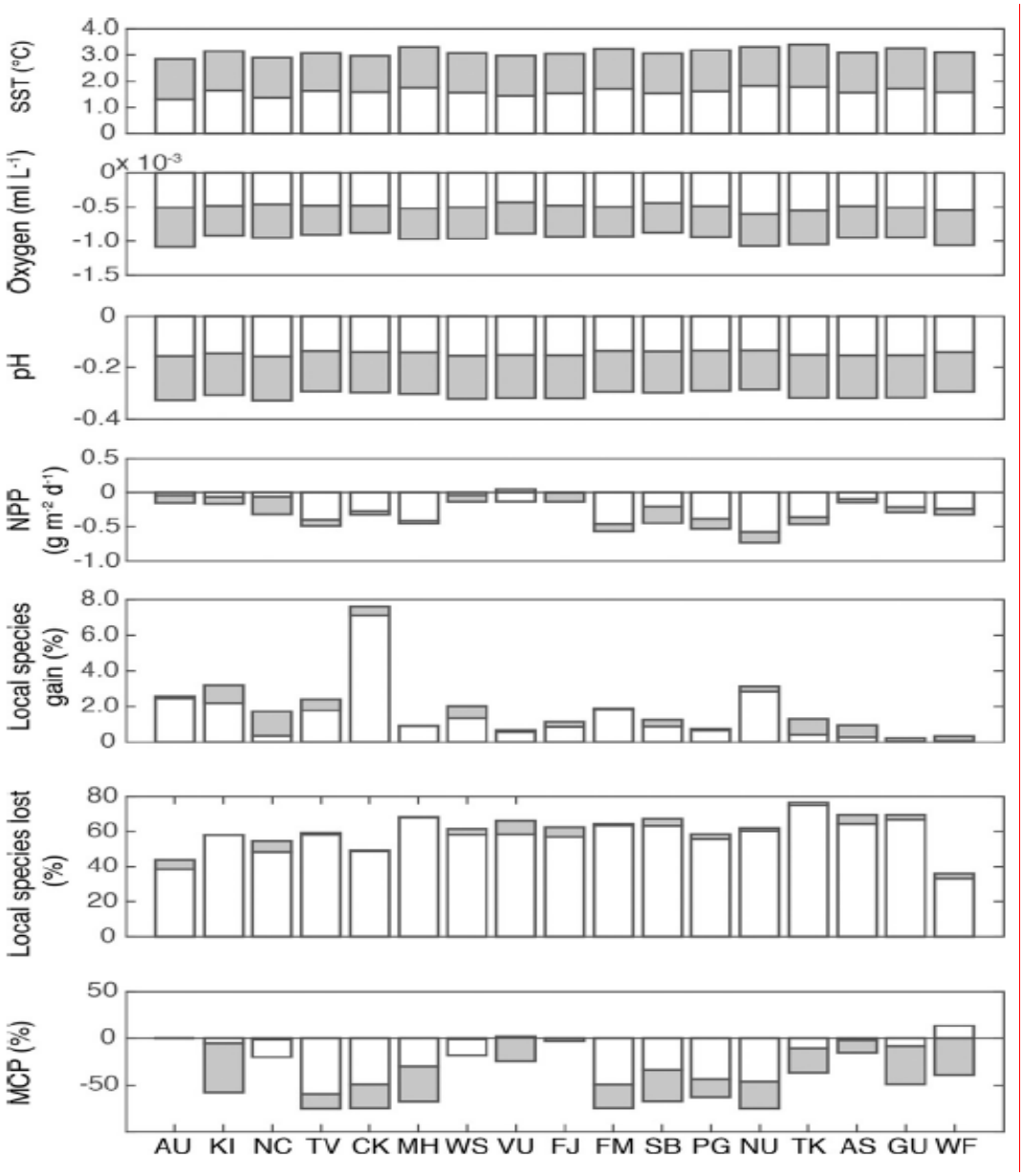

Figure 2. Projected changes in ecosystem drivers, biodiversity and maximum catch potential at the country level. Changes are shown for the 2040–2060 (white bars) and 2080–2100 (grey bars) time periods, where the per cent change is calculated relative to the 1980–2000 baseline under the RCP 8.5 scenario. Abbreviated country names: AU - Australia, CK - Cook Islands, FJ - Fiji, KI - Kiribati, MH - Marshall Islands, FM - Micronesia, NC - New Caledonia, NU - Niue, PG – Papua New Guinea, WS - Samoa, SB - Solomon Islands, TV - Tuvalu, VU - Vanuatu, TK - Tokelau, AS - American Samoa, GU - Guam, WF - Wallis and Futuna.
Source: Asch *et al.* (2018, 289)

Figure 3 indicates the changes in the percentage of adult obesity among the population of PINs between 2000 and 2016. As can be seen from the chart, there has been an upward trend in adult obesity in the region during these years. In the overall view, health statistics and the pieces of evidence prove that Pacific faces with the common problem including obesity throughout the Pacific, Vitamin A Deficiencies (VAD) in Kiribati, the FSM and Marshall Islands, and anaemia among women and children in Fiji as well as an increase in diabetes in the region (Owen 1999, 4). From here, it can obviously be seen that climate change affects the population in terms of sufficient food consumption.

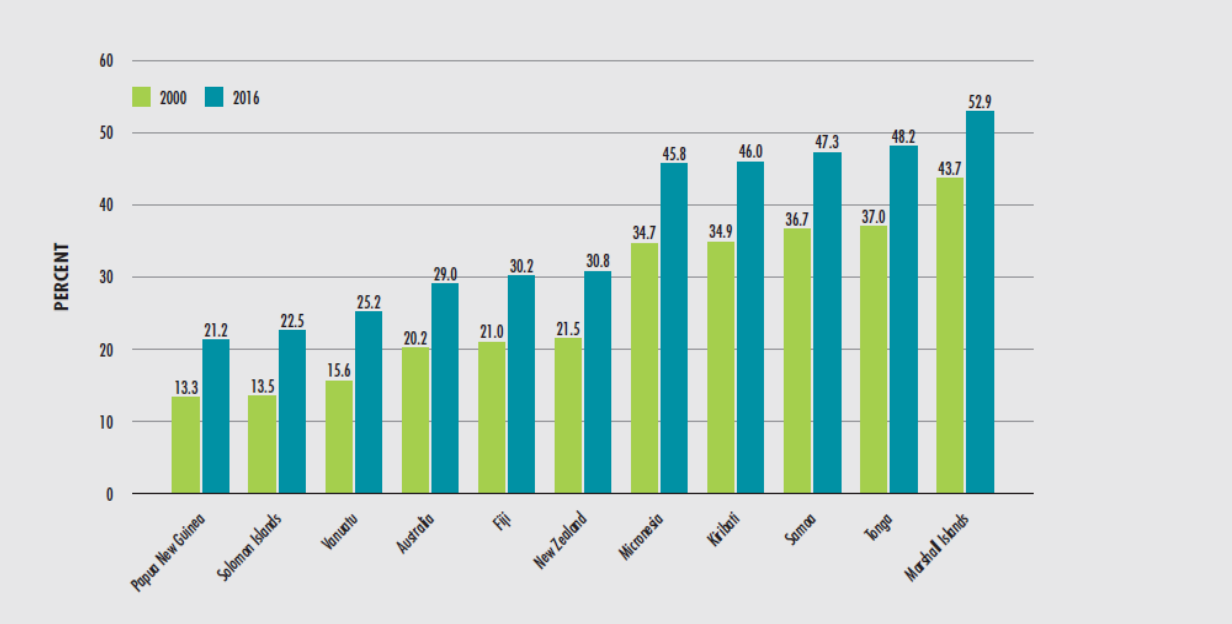

Figure 3. Trends in the prevalence of adult obesity in the Pacific, by country, 2000 and 2016
Source: FAO (2019, 17)

Vitamin deficiency causes severe effects on people, especially on children. Children are the most vulnerable members of the community. They are more likely to be affected by the situation. Since their immune system is not resistant to frequent changes compared to adults, they can get more infected with serious diseases. The WHO provides the statistics regarding diseases stating that 88 per cent of the burden of disease that can be connected to climate change has a negative influence on children who are younger than 5 years of age (Levy *et al*. 2015, 314). The data show that vitamin deficiency is a consequence of food insecurity, which leads to social problems in the future.

Vitamin deficiency is not limited to the lack of nutrients in fish. Lack of agricultural products and a decline in the consumption of local food can cause vitamin deficiency among the population. These problems might cause social instability as the consequences of these problems affect the living conditions of the population of the islands.

Coming to the aspects of the climate change phenomenon which affect the food supply and food industry on the islands, it can be claimed that due to the extreme weather conditions and climate-related events, agriculture and fishery which are the main food resources of the islands become vulnerable to the change. Concerning agricultural production, it can be argued that climate-related changes reduce the growth of crops and damage agricultural production, as some plants are not resilient to extreme changes. When the production of food declines, the situation becomes challenging for some workers. Besides this, some families grow crops for their daily intake. In this case, they will also become imported food dependent. Hence, the main food supply of the islands might cease to function, and the food industry might become dependent on imported food.

When it comes to the fishery, pollution and coral bleaching are one of the main concerns regarding fishing in the area. Since fishing is very traditional for the islands' population, it contains a considerable amount of their diet. Climate-related changes influence fishery and agriculture. Consequently, the situation weakens the economy of the island nations. Additionally, climate change affects the health conditions of the population and the labour productivity on these islands, which are also important aspects of climate change influencing the food industry.

This paper underscores that, although urbanisation can be pointed out to be one of the reasons for the declining consumption of local food, the effects of climate change remain considerable for the consumption of imported food among the population. Since urbanisation is typical for cities around the world, the impacts of climate change have more severe effects on these islands. It suggests that urbanisation might influence the current situation of these islands; however, the negative effects of climate change seem to have more direct impacts on the food supply on the territories in focus.

2. THE CASES OF KIRIBATI AND VANUATU

In this chapter, the author will discuss the case studies of Kiribati and Vanuatu. Both Kiribati and Vanuatu are classified as least-developed countries (WHO Country Cooperation Strategy Brief, 2013). They are island nations both located in the South of the Pacific Ocean, while Kiribati is situated on the North-East of Vanuatu. Vanuatu is one of the island nations which consists of small islands located in the South of the Pacific Ocean. The people of Kiribati are predominantly Micronesian; however, the people of Vanuatu are Melanesian. Although these nations are culturally different, their location explains some similarities in terms of climate-related changes and their impacts on people. The economy mainly depends on agriculture and fisheries in Kiribati, while in Vanuatu tourism also comprises the economy. Both of the countries are members of the Pacific Islands Forum, parties of the Kyoto Protocol, and the Paris Agreement.

As was mentioned in the previous chapter, one of the main problems that occur on these islands is the global sea-level rise. The projected sea-level increase raises concerns about future issues in the region. The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report estimated the increase in global sea levels of between 18 and 59 centimetres by 2100 (Lawler, Patel 2012, 128). The rise in sea levels was increasing at a rate of 3.9mm per year for Kiribati (1992–2010) and 5.6 mm per year for Vanuatu (1993–2009) (Lawler, Patel 2012, 128). Scientific research shows that the shorelines of the sand islands of atolls are very dynamic, even without any particular sign of climate change or significant storm action (Connell 2003, 96). It explains the severity of the problem when there is a sign of climate change in these areas.

Kiribati is a small island nation which is located in the North East of Vanuatu. The country is one of the Pacific Island nations which faces challenges due to climate change. The 2010 census demonstrates that the population of Kiribati was 103,058, and half of the population lives in South Tarawa, which is the capital island (Schutz *et al.* 2019). Kiribati includes 33 coral atolls, and it is located in the north of Fiji (East, Dawes 2009, 339). The economic situation of Kiribati and Vanuatu indicates that the economy of these island nations has been influenced by climate change. Thus, the data reveal that Kiribati and Vanuatu were in the first ten in the ranking of losses per

GDP between 1996 and 2015, by being in the fourth and seventh place in the ranking, respectively (Kreft *et al.* 2016, 24–25).

The study shows that a decline in agricultural production might also endanger food security in the region. At the same time, people might lose the habit of growing crops for their daily needs because of changes in their traditional lifestyle. The study claims that this situation leads to food insecurity in Kiribati. This paper indicated that climate-related problems seem to have more severe consequences for the country. Considering that the changes in the lifestyle of people might occur in every city due to the urbanisation process, climate change has more influence on the country.

While discussing the situation in the case of Kiribati, East and Dawes argued that food security continues to be the main issue in both rural and urban settlements of the country, because of the remote and isolated location (East, Dawes 2009, 344). Since food security is the major challenge here, the country has implemented some measures. The locally-based Kiribati Organic Farmers Association (KOFA) is a quasi-government organisation that helps to succeed in the long-term sustainability of home gardening in South Tarawa (East, Dawes 2009, 350). The organisation already has the support of the Government of Kiribati, and it provides technical assistance and low-cost agricultural supplies to local farmers (East, Dawes 2009, 350).

It has already been discussed in the previous chapter that climate change and the shortage of food supply lead to various challenges, including health problems and mortality rates in the PINs. NCDs, principally cardiovascular diseases, diabetes, cancers, and chronic respiratory diseases caused 36 million of the global deaths in 2008, which makes 63 per cent of the total death rate (Lachat *et al.* 2013, 2). However, the situation is much more difficult on these islands. Thus, VAD is a significant public health risk in Kiribati, while in Vanuatu, iodine deficiency and related goitre are endemic (Parry 2010, 484). Different regions have different challenges in the process. Recent data show that VAD in women of reproductive age may raise morbidity and mortality during pregnancy and the early postpartum period (2– 4) (West 2002, 2857S). Also, severe maternal VAD may result in increased death in the first months of life (5–7) (West 2002, 2857S).

There are some measures that have been suggested to reduce the negative effects of the problems. Those measures, including the UN Millennium Development Goals (MDGs), have been proposed to increase the quality of living conditions. Kiribati failed to achieve the UN MDGs; however, Vanuatu recorded mixed outcomes (Picciotto 2018, 532). A similar conclusion was recorded for

the achievements of primary education (MDG2) (Picciotto 2018, 532). Vanuatu was recorded as being on track to meet the MDG 1 hunger target (FAO… 2014, 3). The MDG4 on the reduction of child mortality was not achieved by Kiribati and Vanuatu (Picciotto 2018, 533). Combating HIV/AIDS, malaria, and tuberculosis (MDG6) and ensuring environmental sustainability (MDG7) had mixed results (Picciotto 2018, 533).

2.1. Socio-political, cultural and economic costs derived from the problem

The research indicates that the development has proceeded at different levels in these countries throughout the region. Out of nine PINs ranked in the UN Human Development Index, Kiribati and Vanuatu were recorded as two of the three countries in the middle category (Picciotto 2018, 531). It suggests that the two countries are in the process of development while not in the high category in this process.

The debates on the climate-related issues among the scientists have already been stated before in this paper. Climate-related changes have also been reported in press releases. However, the case of Kiribati is more visible in the news compared to Vanuatu. The news carried by BBC mentions that the UN's IPCC mentioned Kiribati as one of the six Pacific Island nations most threatened by rising sea levels and added that the island could become uninhabitable by 2050 (People urgently… 2020). In addition to this, a press release delivered the news regarding President Taneti Maamau saying his Government believes findings of the IPCC that small island states like Kiribati will be slowly affected by the serious impact of Climate Change, however, dismisses the sinking narratives which several scientists have argued about Kiribati (President of Kiribati challenges… 2019).

After having information regarding the development of these countries and the common issues related to climate change, the problem itself can be studied. The next step is to see how the current situation is on these islands concerning the main food intake of the residents. The main diet of the population of Pacific Island has already been discussed in the 1st chapter. The problems driven by the lack of a sufficient level of vitamins and minerals are apparent, and the diseases caused by vitamin deficiency become more common in the region. Scientific studies claim that processed food, which contains a high amount of saturated fat and refined carbohydrates imported from

abroad, contributed to the global rise in obesity on the islands (Zyriax *et al*. 2018, 5). These changes also make people vulnerable to future changes.

One of the problems that occur is xerophtalmia, which is derived from VAD and leads to different health problems in children. The research finds that children with mild xerophthalmia have at least four times greater mortality rate than the others (Danks *et al.* 1992, 215). Another issue is that statistics tell that people in Kiribati have a shorter lifespan than those in other Pacific islands (Locke 2009, 174). Kiribati National Statistics Office reported that the estimated life expectancy at birth was at 58.9 for males and 63.1 for females in 2005 (Locke 2009, 174).

Lack of available land and difficult conditions for agricultural production have already been mentioned. These are some of the reasons behind the dependence of imported food, which has contributed to an over 50 per cent incidence of diabetes among adults, and increased rates of gout, hypertension, coronary heart disease, specific cancers and stroke (Locke 2009, 174). The research statistics on children studied the children with helminthiasis, and it was found out that those children are 3.6 times more likely to be stunted, 2.4 times more likely to be underweight and 2.0 times more likely to be anaemic than children without the infections (Hughes *et al*. 2004, 168). Likewise, the statistics also display that the children with anaemia were 2.4 times more likely to be stunted and 1.8 times more likely to be underweight than other children (Hughes *et al*. 2004, 168).

All these statistics and arguments require a detailed review of the information on the food security issue. Therefore, there is a need to discuss this according to the dimensions of the food supply in Kiribati and Vanuatu. Concerning the availability of food, the first dimension of the four dimensions of food supplies has been mentioned in the previous chapter, and the table below displays the availability of wheat and rice in PINs. The availability of food has been measured by considering FAO balance sheets and other sources of information including Ministries of Commerce and Trade, the Pacific Forum Secretariat, FAO, the Secretariat for the Pacific Community (SPC), food importers and exporters and other sources, in collaboration with WHO, FAO and UNICEF country offices (Hughes 2006, 4). As can be seen from the table, Kiribati has more availability rates for wheat and flour compared to Vanuatu.

Table 2. Availability of wheat and rice in PINs (g/capita/day, kcal/capita/day and per cent of total energy) 2000

Country	Energy	Wheat and flour			Rice		
	kcal	g/day	kcal/day	%	g/day	kcal/day	%
Fiji Islands	2556	258	674	26%	139	548	21%
Kiribati	2223	151	398	18%	148	533	24%
New Caledonia	3075	261	718	23%	54	221	7%
New Zealand	2929	191	569	19%	18	67	2%
Papua New Guinea	2760	82	258	9%	103	355	13%
Vanuatu	2746	60	159	6%	136	496	18%

Source: Hughes (2006, 6)

Although the availability of wheat and rice does not give a specific answer about the precise amount of consumption of them, it provides data to compare two islands in terms of available food supply for people to food resources. The further steps of the dimension, including stability and utilisation of food, are at risk due to the climate-related problems in these islands, and access to food might also become challenging gradually because of the gaps in the other dimensions of the food supply.

2.2. Relocation of people as a result of the problem

Connell (2012, 134) states that in Kiribati, the President has observed: "[w]e keep moving back from the shoreline. In a country like Kiribati, with very narrow islands, the room to move back is very limited". It is the indicator of the severity of the problem. The geographic structure of the island limits the likelihood of infrastructure for living because of the climate-related changes. If it continues, the outcome will be inevitable. The scientific studies show that Kiribati has the lowest expectations of adaptation and is preparing for the failure of adaptation by examining methods for the relocation of people (Barnett 2017, 7). This evidence reveals that the migration of the population might become inevitable in the future.

Barnett and Adger (2003, 327) claim that climate change poses a threat to national sovereignty, including the right to self-determination, since it may impact human welfare and human rights (Barnett, Adger 2003, 327). A threat to the nation-state is a potential danger for the future of the population, which means they might lose not only their land but also their nation as a whole

community. It includes their traditional lifestyle, culture, and language. It leads to the loss of national sovereignty. Human welfare and human rights are the fundamental rights that are regulated by the Universal Declaration of Human Rights.

As was stated in The Universal Declaration of Human Rights 1948 "[e]veryone has the right to a nationality" (Article 15.1), "[e]veryone, as a member of society, has the right to social security and is entitled to realisation, through national effort and international co-operation and in accordance with the organisation and resources of each State, of the economic, social and cultural rights indispensable for his dignity and the free development of his personality" (Article 22) and "[e]veryone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control" (Article 25.1). The existing problem might be a threat to the abovementioned human rights. If the problem continues, it might lead to social instability due to the impact of the situation on human rights on these islands. In this case, social instability might cause further problems within the countries, which might be a potential threat to sovereignty.

Owing to the problems related to climate change, shortage of food might be unavoidable for the population on these two islands. Thus, they will need to find somewhere else to live. The relocation of the population might be considered as one of the solutions to the problem. However, as it was mentioned in the previous paragraph, it might risk the security and the rights of these people. The national sovereignty, social security, and social and cultural rights of these people should also be taken into consideration in the case of relocation of these people. If migration is the case, all the abovementioned rights should be ensured for the people who will migrate.

2.3. Problems that people face during migration

All of those challenges give rise to migration and uninhabitable islands left by people. Obviously, migration will not occur without problems. If there is migration, the difficulties that people will face before and after migration are inevitable. Nevertheless, since the problem continues, some of

the issues related to migration can be solved in order to mitigate the process. For this reason, these problems will be discussed in the next paragraphs.

During migration, people might need additional health care, which makes the problem much more complicated. People might become more vulnerable to diseases and other health problems. Besides this, the cost of medical services might be another challenge for immigrants (Schutz *et al.* 2019, 25). Due to the different economic status, it is a potential threat to people in this case. These challenges might trigger serious concerns on both sides. Some of the abovementioned challenges also influence the host country. The cost of medical services might affect the host country and its economy. Language barriers and the lack of communication between immigrants and the locals might be problematic for managing and providing medical services. In the case of the diversity of the practices used for treatment, the problem might have an influence on both sides as well.

2.4. Possible measures to prevent future problems

The health condition of people, as well as previously mentioned dietary problems and the overall decline in the traditional way of life, involve economic aspects of the issue and weaken the economy. As it leads to a downturn in the economy, it might have some negative consequences in interstate relations. Intercommunication among states is the main factor that impacts the political economy and the politics of the country. The existing situation might cause severe results for these two states in terms of politics.

Governments took some possible measures in order to prevent the continuation and the increase of the existing problem. The government office of Kiribati provided services on climate change issues and carried out an assessment for the current issue. A climate change and disaster risk management rapid assessment report done by the government office of Kiribati notes that for 2011, 2012 and 2013 around 15.7 per cent of the national budget was allocated to programs related to climate change; however, around 17 per cent of the national budget was allocated to disaster risk management programs in Kiribati (Climate change … 2020).

With respect to the lack of vitamins and minerals, the conclusion of the studies discloses some facts and solutions regarding the vitamin deficiency problem. The findings of the primary study

laboratory in Fiji proposed that seven Kiribati pandanus cultivars, one taro cultivar and native fig contain significant levels of provitamin A carotenoids and it is capable of meeting all or half of projected daily vitamin A requirements for non-pregnant, non-lactating adult women in the normal case of consumption (Englberger *et al*. 2006, 642). Although it was calculated for the standard case of food consumption, it might cover a huge part of food sources for the significant amount of population, which mitigates the problem.

When it comes to the case of Vanuatu, the policy of Vanuatu delivers some objectives for the development of the health system of the country. Four broad policy objectives that guide health service delivery in Vanuatu was mentioned in the Annual Development Report of Vanuatu in 2011 by the Ministry of Health Sector Strategy 2010—2016 and the Priorities Action Agenda (PAA) 2006-2015 (Annual Development Report 2012, 48). Those objectives include improvement of the health status of the residents, providing equitable access to health services at all levels of services, improvement of the quality of services provided at all levels, promoting good management, and the effective and efficient use of resources (Annual Development Report 2012, 48).

Also, previous records indicate that some countries have already implemented measures. These measures include establishing sector-based working groups that encompass line ministries, civil society, the private sector, and donors to set priorities around climate change and disaster risk reduction (Lawler, Patel 2012, 132). In addition to that, some governments and international financial institutions have allocated funds for climate change mitigation and adaptation activities (Lawler, Patel 2012, 132). The allocation of these funds will have a significant solution to the problem from the economic aspect. Furthermore, as Picciotto claimed, expanding labour mobility in Vanuatu and Kiribati would help to deal with unemployment (Picciotto 2018, 538). That might support the development of social welfare in the region and would ensure security for the population.

In order to mitigate the negative consequences of the existing problem, some other measures should be taken as well. Society is the leading part of the implementation process, and they should be involved in the adaptation process. The adaptation measures should be done by including the people of these countries as these people can provide the answer to the questions regarding the reasons for relocation. In that case, as Barnett (2017, 11) stated, it would give them an opportunity for self-determination. Besides this, the health system should also be prepared based on the needs of the population to achieve the well-being of society. Also, people should be literate and should

be aware of the problems in order to deal with it within and together with the community. Education is the core element for dealing with the problem. Disaster preparedness is one of the significant adaptation measures, too (Picciotto 2018, 538).

The FAO suggests some measures to implement for improving social security in urban areas. As the cities and their food systems influence their surroundings, and the actions can reduce the problems that occurred, including the issues related to the use of land, food production, environmental management and consumption, and so on (FAO… 2016). Minimising city waste, preserving biodiversity, improving air quality, and microclimate are stated in the information presented by FAO as benefits of policy and planning in addition to food production and social benefits to prevent further problems (FAO… 2016). Since they can have an impact on the environment, taking these actions will have concrete results for the future.

As was reported in the IPCC Fifth Assessment Report, adaptation measures should be taken, including social, institutional, structural, land use planning, ecosystem management, livelihood security, poverty alleviation, and human development (IPCC… 2014, 96). All these fields have significant importance in human life, and imposing these necessary measures will help to provide the security of the population of these islands. They will also support the rights and sovereignty of these people. Ensuring the rights of these people will protect their nation in the future, which is the core element for these small states. National sovereignty might lead people to strengthen all aspects of security in their life.

As some measures are being taken currently, there are also some challenges listed in the reports. The regional report of the Pacific Community (SPC) outlines the difficulties in implementing measures in Kiribati, which appear due to the lack of capacity, including the technical human capacity and the capacity to analyse data effectively (SPC... 2019, 39). Additionally, the report highlights that only 5 per cent of the funding was allocated for agriculture and food security in Kiribati (SPC... 2019, 39). Vanuatu, also being in the same report, was mentioned for the lack of human capacity to implement the action plans (SPC... 2019, 49).

In brief, Kiribati and Vanuatu are island nations that showed almost similar results in the study. Kiribati, which is a small island nation, is more likely in danger because of the sea level rise. The impact of climate change is more evident in Kiribati, the changes are more severe on the island, and the situation is more visible in the news and reports. Accordingly, the population of Kiribati is

more vulnerable to environmental changes. The achievements of MDGs differ, thus Kiribati failed to achieve the MDGs, while Vanuatu showed different results for each MDG.

Nevertheless, both of the islands have a vitamin deficiency, malnutrition, climate-related health problems, and dependence on imported food. The quality and quantity of food are of the issue for both of the islands. The potential threat to national sovereignty can be considered for both of the islands. The considerable level of risk to security and human rights is high in both countries. Overall, both of them face challenges and deal with solving environmental problems. Despite the fact that migration is a common problem among PINs, Kiribati displays a more severe case of migration compared to Vanuatu. The consequences of the situation are becoming more visible.

3. DISCUSSION: IN SEARCH FOR AN APPLIED APPROACH

The initial claim of the research paper stated food shortage as the major factor for migration and the societal problems related to migration on the Pacific Islands. Generally, different factors can influence the decision of people to migrate. Although it is very challenging to categorise the causes of migration for each case, the population of the PINs have common reasons for migration. Environmental degradation became a major challenge for the PINs, and it leads to poor living conditions. Those changes can be push factors for the migration on these islands. The ongoing problems might increase the cases of migration on these islands. When it comes to the notion of migration of population, the immediate effects of a food security issue on these islands should also be considered. As stated previously, the four dimensions for sufficient food supplies should be considered in the discussion of food security (Schmidhuber, Tubiello 2007, 19703). Availability, stability, access and utilisation of food supplies are affected by climate change on these islands. Food insecurity can increase problems such as vitamin deficiency and diseases on these islands as well as problems affecting the economy. As climate change has an immediate impact on food production in the PINs, poor living conditions of the population becomes a potential challenge for the future of the islands. Hence, the migration issue becomes the topic of discussion. Although some adaptation measures have been taken, those measures do not provide certainty for the prevention of future challenges. The scientists dealing with climate change state that the possibility of atoll islands to become uninhabitable is a significant, socially construed fact (Barnett 2017, 6).

Each island has a different level of migration in the PINs. Some islands are more at risk of disappearance. For this reason, adaptation measures can impact on a different level for each island, and for some islands, migration can be considered as the possible option in the future. The studies suggest that if relocation is an option for these people, it will need to be planned. Thus, people can have time to accommodate and adapt the idea of relocation to experience less trauma during the process (Barnett 2017, 8). However, the author believes that the relocation of the population might cause a problem rather than a solution for the future. Relocation of the population means loss of particular culture, daily habits, tradition and language as well as material objects such as home and land even if the planning of the relocation might ease the trauma. All of these problems have a

direct influence on people in terms of human rights, national sovereignty and protection of intangible assets of these nations.

In short, the already collected data has been presented in the paper to detect the ongoing issue on the islands. The given data reveals that there is an issue on the Pacific Islands, which is linked with climate change. In addition to this, it is obvious that the abovementioned issues are not the new cases for the islands as the climate-related changes have occurred since the end of the XX century. On the ground, the issue that is linked with climate change damages the environment, which provides the production of the leading food supply of the PINs. Climate change reduces the availability of lands for agricultural production, and it increases the risk of a potential loss of the marine environment. For that reason, it can be argued that the food supply and the food industry are directly affected by climate-related changes on these islands. The ongoing process influences the political and economic system on these islands. As a result of the problem, migration flows become a common issue for the PINs, and the situation creates instability in society. It might lead to further instability for these island nations in terms of state sovereignty, national sovereignty, and security of their population in the future.

Where to from now? Departing from useful theorising of Yaro (2004), there is a certain practical effect that could be found in employing the Sustainable Livelihood Framework's elements in the process of determining a particular set of analytical boundaries for this discussion. *Figure 4* outlines where the already mentioned set of essential clusters are to be schematically placed in the process of giving the already collected data some sort of analytical interlinkages. More specifically, in the context of the scheme, this paper's primary interest is on the cluster, which is related to Livelihood Assets, namely, human, social, natural, physical, and financial clusters.

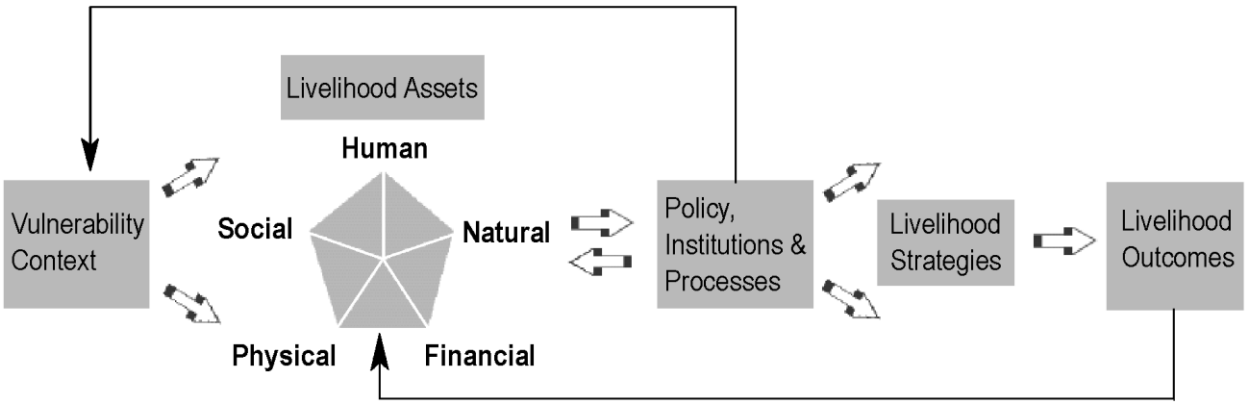

Figure 4. The Sustainable Livelihood Framework
Source: Yaro (2004, 28)

In order to achieve sustainable livelihood strategies, tangible and intangible assets that have been mentioned in the Figure should be taken into consideration. Therefore, the case studies of this paper can be analysed by studying the livelihood assets of two countries according to five assets of this framework. Analysing the data by following the five segments will give the exact conclusion based on the Sustainable Livelihood Framework. At first, the human asset can be measured according to the Figure. The data provides information regarding the lack of human capacity to implement the project in Vanuatu, and lack of technical human capacity to implement the activities in Kiribati to fight against climate change. Thus, some additional measures need to be taken with the purpose of making the human asset more sustainable to follow the framework. The next asset is a social asset, which includes social structure, social differentiation, language, and so on. The data indicate that Kiribati has a food security issue in both rural and urban areas. Furthermore, the locally-based organisation has been established in Kiribati, which might reflect the component of social assets. It is noticed from the data that Vanuatu delivered the policy for the development of the health systems. It provides information regarding social structure. Also, the attitude of people toward the traditional way of life and dependence on imported food are also widespread in Kiribati and Vanuatu. High population density of both countries can be highlighted in the sense of social assets. The result of little political distance between the population and the state has been considered to analyse social assets. Natural assets can be measured by studying sea level, climate change, quality of soil, crop production, and marine environment for the life of sea creatures in the case of these two countries. The data gathered from various sources indicate that these two countries have a high level of vulnerability towards the abovementioned issues. In order to measure the financial assets of livelihood in these countries, it is important to review the level of crop production and fishery as well as their major income, food sources, infrastructure, and the level of agricultural practice, which are also socio-economic factors. Crop production and fishery have been the necessary elements for the economy and the main source of income in both of these countries. That means the more problem occurs in these fields, the higher risk of vulnerability becomes in terms of financial assets. When it comes to the food sources of these islands, the main sources of local food and the increasing dependence on imported food in these countries have already been mentioned before. The data also present information regarding the tourism industry, which has been developed in Vanuatu together with agriculture and fishery. Even though the tourism industry contributes to the economy and the total income of the country, the tourism industry is also considered as vulnerable. With regard to physical assets, the quality of soil, the quality of sand, geography, climate, temperature, land, and water can be measured for agriculture and fishery. In the case of two countries, the data reveal that the sand of the atoll islands is very

dynamic, which means the risk of damage to the land is very high in both of the countries. The geographic structure of Kiribati might restrict the infrastructure of the island for living. In the context of geography, Kiribati is vulnerable to the risks due to the isolated location. Changes in climatic conditions and extreme weather temperatures are the current challenges in both of these countries. The data give information regarding the availability of land for agriculture that is becoming an issue due to the sea level rise and soil erosion in these countries. Water and sanitation are the main sectors for which aid has been accessed, as access to fresh water is the major concern for Kiribati, even though Vanuatu is also dealing with the climate change and measures for mitigation.

In order to follow the sustainable livelihood framework, the five segments of livelihood assets have been examined by the data presented on Kiribati and Vanuatu. The data have been compared to the five sections of livelihood assets, and it indicates the points where there are some areas to improve in order to follow the sustainable livelihood framework in both of these countries. From here, it can be concluded that there are some areas to improve in terms of human, natural, financial, and physical assets. The data on social assets present some information on the implementation of measures. However, there are some issues that can make the social assets of these countries vulnerable. Hence, in the overall view of the theory, it can be assumed that the vulnerability of people is high in both countries with little differences. As a consequence, the issues mentioned above reveal the areas to improve in livelihood assets that cause vulnerability for the livelihood in these countries. For that reason, since there are some areas to improve, which limit to follow the sustainable livelihood framework, the situation causes instability in these societies in terms of food security issue.

The factors, such as the differences between the location and the impact of climate change, have been taken into consideration while choosing the case study in order to obtain the exact data. Both of these countries showed similar results in terms of climate-related problems; however, the current situation in Kiribati is riskier as it is evident from the data presented. The differences between these two countries and the comparison of these countries with other PINs answer to the research questions of this paper. It uncovers some data to discuss the hypothesis of this research paper.

As it was stated in the hypothesis, lack of food, which occur as a result of climate change, leads to migration and other societal problems in the PINs. From the data presented for the research, it is also apparent that food shortage is leading to a variety of issues in these island states. Thus, extreme

weather conditions and sea-level rise reduce agricultural productivity and the favourable environmental condition for the fishery in the coastal areas. These are the two primary sources of the food supply in these islands noted in the paper previously. Furthermore, the economy also depends on mainly these two sources, and it suggests that these two factors are linked to each other. Hence, it is not only a threat to food sources of the islands, but it is also a threat to the economy. It indicates that the weakened economy might threaten the possibility of importing foods in the future as well, which has a close link with foreign relations of these countries.

The quality and quantity of food are subject to the discussion while dealing with the food supply in the PINs. Consequently, it endangers the life of people there and worsens living conditions for local people. The comparative case study of Kiribati and Vanuatu conducted in this research paper showed only small differences between these two countries in terms of climate-related problems. The case of Kiribati recorded with a more severe case of undernourishment, which means there are more serious problems to happen and also more necessary measures to be taken. However, both of the countries are in danger due to climate-related problems. The remote and isolated locations of these islands highlighted for assessing food security issues as well. This research proves that although some other factors are affecting the food security of these islands, climate-related problems adversely affect the food supply in the Pacific Islands. Overall, all of the abovementioned elements might lead to economic and political problems.

It shows that the problem currently exists on these islands, and it will continue to exist in the future as well. Therefore, the research also proves that in this case, people start migrating because of the food insecurity in these countries, which will have further social impacts. The data indicate that Kiribati is at risk of being uninhabitable in the future because of the sea level rise. This situation might lead to severe results for the island nations and the countries where these people are migrating. The challenges mainly include social, cultural, and economic issues for the migrants. Hence, these problems lead to the notion of environmental refugees for the future, which might undermine political stability on these islands. It might also challenge the international system, and adopting the new notion of environmental refugees might become an issue for the future.

In response, it has already been mentioned that international organisations are dealing with the existing problems regarding climate change. Policies and Plans are being implemented by these countries. With the assistance of funding sources, the allocated financial aid is accessed to plan disaster risk management. However, these two countries have not indicated a high level of

achievement in MDGs, which mainly deal with poverty, hunger, disease, and literacy. It reduces the possibility of preventing these challenges effectively. At the same time, as it is visible from the regional report of the Pacific Community (SPC), the implementation of action plans and policies requires more steps to be taken.

Thus, it can be visible from the abovementioned factors that the administrative capability of the countries is essential for the implementation process. The results of the report for climate change and disaster risk management might indicate the need for some changes. These problems might provoke governments to new policy-making and changing of the structure. Without these changes, all of these problems might trigger social instability in the region, as it prevents reducing migration in the long term because of ongoing climate-related problems. It also avoids mitigating other social problems caused by these factors. Since the prevention measures will not be able to stop the process of climate change, the impact of current issues on food security will remain. This research shows that lack of capacity to deal with climate-related changes and food shortage will result in societal problems which are not only limited to migration. It might cause further problems within the state, which is a potential threat to the solidarity and sovereignty of a nation.

CONCLUSION

This research has been conducted to examine the relations between the lack of food and migration in the PINs. The aim of the study was to find out the reasons for the movement of the population, which might lead to social instability in these island nations. The paper contains research, which is more into policy-shaping, and it includes a significant degree of practicality. It was hypothesised that the shortage of food leads to migration in the PINs. It was claimed that the lack of food is a major factor in the migration of the population due to climate-related changes. The reason behind the claim was the climate-related changes on these islands, which have also been examined in the research paper. It has been argued that since the climate-related changes limit the production of food in the PINs, the population of these islands will become dependent on imported food, and it will cause severe outcomes for the economy of these countries. Likewise, from the political point of view, it might lead to social instability within the states, and it might challenge the political relations as well as intercommunication among countries in the future. The hypothesis has been confirmed after the analysis of the data in the research process, at the same time, the research has revealed the fact that the shortage of food does not only cause migration but also causes further problems. The study showed that the shortage of food is the reason for the societal problems in these countries. Thus, primarily the research has examined the level of the impact of climate change in the PINs. It has been observed that the level of impact of climate change was very high in the PINs. Therefore, after presenting data on the effects of climate change on these countries, the potential threat of climate change on food security has been investigated. The research also contains data on the main food supply and the main food industry of these islands in order to know the reason behind the shortage of food in the PINs.

As has been mentioned in the paper, two major food resources of these island nations are agriculture and fishery, which are directly affected by climate-related problems. Climate change reduces suitable land resources for agricultural production. Extreme weather conditions weaken the agricultural production and fishery in the territory, and it worsens the living conditions. As a result of these problems, the level of vitamin deficiency increases in the region, which leads to an increase in the mortality rate as well as non-communicable diseases. Undernourishment and vitamin deficiency are a considerable threat for children who are the most vulnerable members of the population. Subsequently, the cases of two island nations, Kiribati and Vanuatu have been studied in the research paper. Even though these two islands are located in the South Pacific, their

different geographical position, distinct environment, and cultural differences of inhabitants make those islands good candidate for this case study. Since the studies have been previously conducted only to a very limited extent, some elements used in the paper date back to the previous decades. The case studies have significant importance in finding out the reason behind the migration of the population. As a result of the study, the impact of food shortage on social stability in Kiribati and Vanuatu has been investigated to find out the relations between the shortage of food and migration on these islands.

Dependence on imported food is visible in both of the islands. Also, the case study indicated that the quality and the quantity is one of the major concerns for both of the countries. The case of Kiribati showed more severe results, including the migration of the population and achievements of the MDGs. The presented data have been discussed in the framework of the theory of food security (Yaro 2004). Five segments of the Livelihood Assets have been analysed in the context of Kiribati and Vanuatu in order to see the gaps in the Sustainable Livelihood Framework in these islands. The analysis of the Livelihood Assets in these two countries provides the information, which indicates the existing situation and the current challenges regarding those five segments, including human, social, natural, financial, and physical assets. After examining these five clusters, the results showed that there are some areas to improve, including human, natural, financial, and physical assets. Both countries have a lack of human capacity to implement some measures to reduce climate change. In terms of natural assets, these two countries have demonstrated risks to obtain natural assets. The risks are due to the rise in sea level, climate change, reducing the quality of soil, lack of suitable conditions for the production of crops, and adverse effects of climate change on the marine environment. At the same time, lack of physical assets, including the available land, the quality of sand, and soil, leads to further challenges in these countries. Geography, in other words, the isolated location of Kiribati and lack of fresh water in Kiribati, are also important elements for assessing the current situation. While analysing the financial assets of these countries, major income and food sources, as well as the infrastructure of these countries, have been studied. Because of the vulnerability of natural assets, the primary food sources and income of these countries have also been affected. On the other hand, both of these countries have different results in terms of social assets. Food security is a common problem for Kiribati, regardless of the region. Also, in both cases, Kiribati and Vanuatu took some measures, such as establishing a locally-based organisation and implementing policies, respectively.

All of these elements present the information regarding the situation in order to assess the Livelihood Assets in these countries. From the theoretical point of view, it can be concluded that some factors, which have been included in the discussion of this paper according to five segments of the theory, make these countries vulnerable. For this reason, the argument of the existence of the shortage of food on these islands has been analysed. The relations between the shortage of food and migration of the population from these islands to other places have been proved in the research paper after close examination of the problems according to the theory of food security. However, Kiribati has a higher level of risk to become uninhabitable in the future because of the sea level rise. This research indicates that the food supply of the PINs is affected by climate change in terms of agricultural production and fishery. The case studies show that social stability in these two countries is influenced by food shortage. Vitamin deficiency and diseases cause problems in these countries. With regard to the argument of the paper, it can be concluded that the claim of the research paper has been proved, which means the shortage of food has been shown as a major factor for migration in the PINs.

The potential problems, which occur during migration, have been mentioned in the research paper. Besides this, social instability seems inevitable in the case of migration. At the same time, this situation leads to further challenges within and among the countries. The measures have been taken by international organisations have been studied in the research paper. However, the research shows that the implementation of action plans and policies by these countries requires further steps. Therefore, new policy-making and changes in the structure to deal with the problem have been discussed in the paper. The threat to human rights, national sovereignty, and solidarity might lead to serious results in these countries in the case of social instability. In order to deal with the problem, there should be proper changes in the implementation of the measures. Further research is required to analyse the new policy-making and structural changes that have been mentioned before in order to find the best solutions for the ongoing problem. Analysing those changes and assessing the risks and the benefits of these solutions might help to fight against the future threat of climate change in the PINs.

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