

## The Influence of Socio-Demographic Characteristics of Fiji Dairy Farmers on their Climate Change Adaptation

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### ABSTRACT

Climate change is the biggest threat to the dairy industry and the agricultural sector, particularly in the small and developing country like Fiji. Fiji is one of the countries where dairy farmers contribute a lot to the economy and make it run by providing quality milk. The influence of socio-demographic characteristics on climate adaptation is vital for developing strategies that support dairy farmers in adapting to climate change. All know the importance of dairy farmers in Fiji as milk is the most usable product sold in every house in Fiji. People count it as a need for themselves, and the babies need it the most. However, when the price fluctuates in the market, it directly affects the dairy farmers back in the villages. They are happier to export milk or milk products such as cheese and yogurt as from that the milk production factories make a profit and so the dairy farmers back in the village. This study investigates the influence of socio-demographic characteristics of Fiji such as gender, age, ethnicity, education level, income, location, etc, and its dairy farmers, and how dairy farmers adapt to climate change. The importance of dairy farming in Fiji. Following with how farmers adapt to the climate change methods will also be discussed in this study together with the effects of climate change on the dairy industry/farmers. Overall, the study will highlight the importance of dairy farming in Fiji and the importance of considering the socio-demographic characteristics of dairy farmers, when developing the climate change adaptation methods in Fiji. When one understands the factors that influence the adaptation methods of climate change, the government or NGOs can develop their targeted interventions to help support all dairy farmers in adapting to climate change, at the same time maintaining the sustainability of the dairy industry in Fiji.

**Keywords:** Adaptation, Inventions, Maintaining, Socio-Demographic, Sustainability.

### INTRODUCTION

Fiji is a small and developing island nation in the Pacific that is most vulnerable to the impacts of climate change. The country's dairy industry stands strong because of the dairy farmers out in the villages. Fiji is also a significant contributor to its economy by producing not only quality milk but also producing other dairy products such as cheese, yogurt, and butter. Not only in Fiji but some dairy products are also exported to other countries from where Fiji makes a lot of profit and as the dairy farmers.

Climate change is getting worse day by day and it is expected to have a significant impact on dairy farming practices (Hansen, 2012). Rainfall patterns, heat stress, and drought are the major factors contributing to affecting dairy farmers in Fiji and around the globe. It is not welcome news for the dairy industry that in coming years the climatic conditions will be worse, and the dairy farmers will face a lot more than they are facing now.

Socio-demographic characteristics of dairy farmers in Fiji play a crucial role in adapting to the changing climate. According to (Tadulala, 2023) and the University of the South Pacific found that the socio-demographic characteristics of dairy farmers in Fiji play a vital role in their ability to adapt to climate change. For instance, the study was about the age, gender, education level, location, farm size, and the ability of dairy farmers to adapt to climate change. Researchers found that younger farmers easily adopt the new farming technologies compared to the older farmers who are still using the old traditional method of practicing dairy farming.

However, female farmers were also adopting new technologies and practicing new technologies. The level of education provided has also played a crucial role in climate change adaptation. The new generation of farmers who have higher levels of education are more likely to have access to information about the different climatic conditions that affect the dairy industry. They are aware of climate change's impacts and are more likely to adopt the changes.

The location of the farm is also important for climate change adaptation. For example, the farmers who have their farms located at higher levels of rainfall and low-temperature fluctuations are more likely to adapt to climate change. Whereas farmers whose farms are in low levels of rainfall and higher levels of temperature fluctuations face more difficulties in adapting to climate change. Farm size also makes a difference in dairy farming and plays a role as larger farms have more resources available and are easily able to adapt to climate change (Agriculture, 2014) (Bart Minten, 2022).

## **METHODOLOGY- MATERIALS AND METHODS**

### **Study Site**

Viti Levu and Vanualevu islands (the biggest islands in Fiji) with high dairy farmer densities will be used in this study. Selected islands are characterized by high concentrations of dairy farmers with varied forms of farming. It has dairy producers ranging from small, medium, and large-scale production systems. The data on the farms is already available, random sampling will be used to identify the target farmers.

### **Study Design and Sample Size**

The questionnaire will capture aspects of smallholder dairy farmers' socio-demography (gender, age, marital status, educational level, household size, and experience in dairying) to relate them to their climate change adaptation. Further, the questionnaire will consider respondents' perceptions of observable climate changes concerning temperature and rainfall.

### **Data Collection**

It will have questions capturing knowledge measures on aspects of climate change and climate change effects on smallholder dairying. Finally, the questionnaire will have questions on sources and types of support respondents got to enable them to adapt to climate change and seek to establish respondents' satisfaction with services from climate change information sources and what could be done to improve the usefulness of the information from the same.

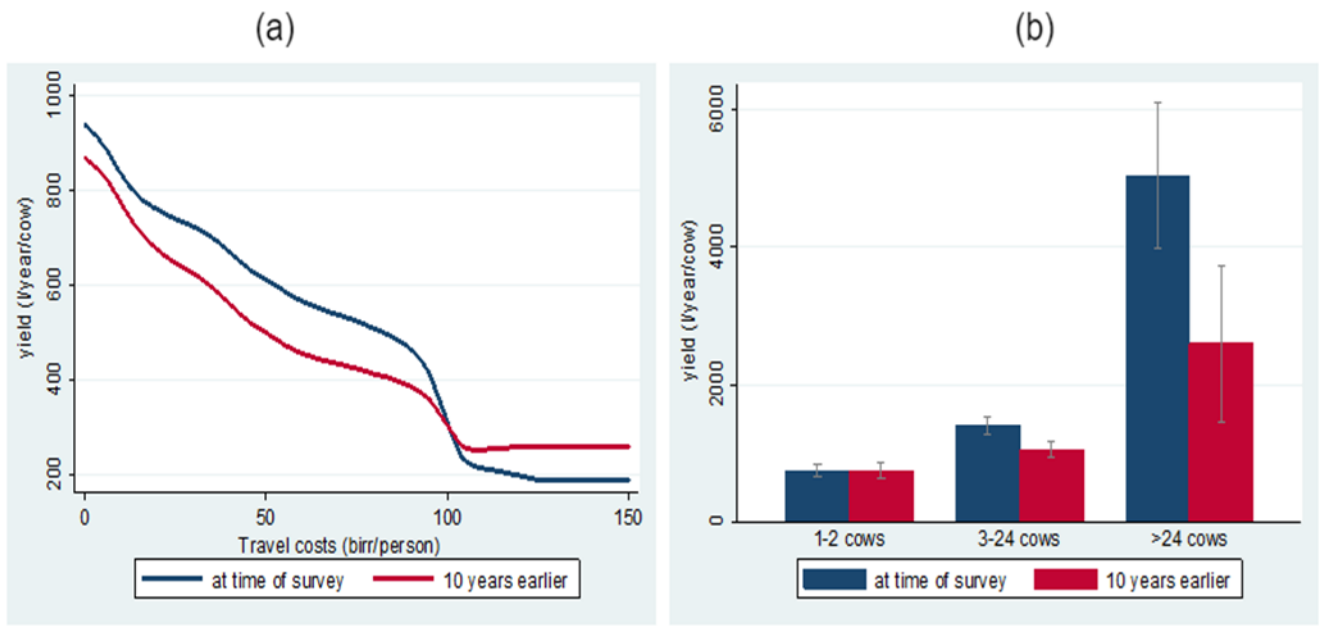
### **Data Analysis**

Socio-demographic factors will be subjected to descriptive statistical analyses to determine percentages, minimum and maximum values, means, and standard deviation of respondents for various variables. Binary logistic regression analysis will then be undertaken to determine whether there will be any significant relationships between smallholder dairy farmers' socio-demographic characteristics and their adaptive strategies to climate change effects. Each of the measures of adaptation to climate change effects will run against each of the socio-demographic characteristics singly and then jointly with the findings being presented.

## **RESULTS**

### **Discussions**

#### ***Differences in Dairy Productivity by Remoteness and by Farm Size***



**Figure 1.** The two graphs show the difference in dairy productivity by remoteness and by farm size.

**Source:** Differences in dairy productivity by remoteness and by farm size.

***History of Dealing with Climate Change – as Older Dairy Farmers Faced Climate Stress***

Rural old community dairy farmers face a lot more problems than today’s dairy farmers face. From the knowledge of the history of natural disasters before the 1970s. Today we understand climate change and can adapt to the changes and work towards it, in the old days dairy farmers were not taught about climatic conditions and they faced a lot in producing milk (Patrina Dumaru et al, 2011). Government assistance also seemed less for dairy farmers in the beginning compared to now government supports dairy farming as much as possible.

***Table Showing the Climate Stress Faced by Dairy Farmers in the Olden Days***

**Table 1.** Table showing the climate stress faced by dairy farmers in the olden days.

<u>Year</u>	<u>Event and Activities</u>
<u>1972</u>	<u>Cyclone Bebe – majority of livestock and cattle died</u>
<u>1972-1974</u>	<u>Construction of the Suva–Nadi Highway caused the livestock to face water problems as dairy farmers having farms there</u>
<u>1982</u>	<u>Cyclone Meli – again many cattle died, especially the ones farmers used to milk every day.</u>
<u>1987</u>	<u>Severe drought – where dairy farmers faced a lot in providing enough water for the cattle and other livestock.</u>
<u>1987</u>	<u>Fiji went under Coup – communities were affected severely as they were not able to transport milk and it was a great loss for all</u>
<u>1994</u>	<u>Again, severe drought – affects the whole of dairy farmers.</u>

**Source:** History of dairy farmers facing climate stress.

***Overview of Livestock Production in Fiji***

The animal health and production division provided an overview of livestock production in Fiji. The agriculture sector plays a very important role in economic development, contributing to 15% of GDP with 5% livestock production. The agriculture sector is composed of not only cattle farming for milk production but also other animal farming for meat production and fruit and vegetable farming.

The dairy farming sector has major implications for employment creation and food security. Looking at the price of imported dairy goods in Fiji, it is a blessing that Fiji owns its dairy farms in interior villages from where people benefit and get enough protein for themselves and the younger generations. The dairy farms in Fiji are mostly based in the interior of the Central division (Rewa, Serua, Namosi, Tailevu, and Naitasiri). Beef producers are all around Fiji and some are found in very remote areas. Beef and cattle farming is done in the range from semi-subsistence to semi-commercial level.

According to Bob Godfrey, Ph.D. Professor – Animal Science Assistant Director cattle breeds include Friesian, Jersey, (beef) Santa Gertrudis, Brahman, Hereford, Limousine, and Charolais among others with many

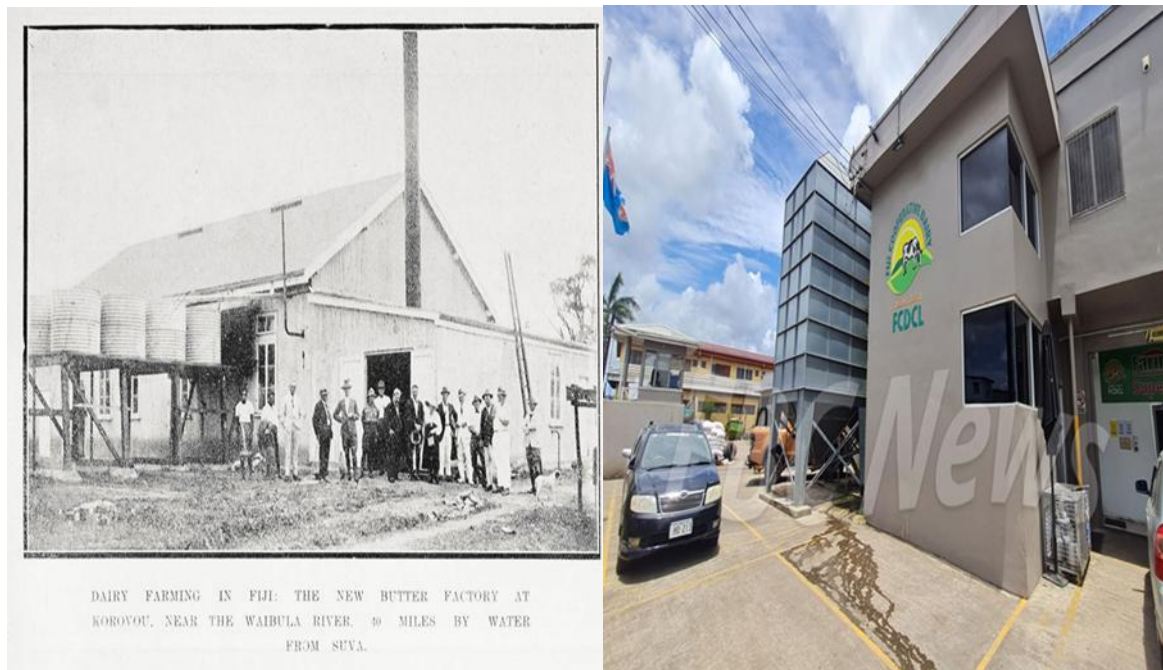
crossings among other cross breeds. Fiji's total stock was 22,533 heads of dairy cattle and 134,411 heads of beef cattle in 2009. The establishment was done in 1974, in the House of Representatives approved the co-operative dairy companies as Rewa Cooperative Dairy Company Limited (RCDCL). At first, it was owned by 220 farmer stakeholders, since RCDCL became the major provider of local dairy products. Fiji has the Rewa Co-operative started in 1924, the factory was at Waila, Nausori, Fiji did exported butter to England and Canada in the 1930s.

The result from Rewa Cooperative Dairy Company Limited (RCDCL) Milk consumption is approximately 74,430,000 liters yearly. It was also noticed that upon so much consumption only 16% of this demand is met by local production of milk by dairy farmers. The RCDCL serves dairy farmers and collaborates with the government for industry development and in 2009 started the restructuring of the industry. This separated the processing and the production areas.

Since then, the whole of Fiji has consumed milk and milk products from the RCDCL till today. In 2015 the targeted production was 15 million liters of raw milk and the production at the farm side was decreasing, the reason was climate change where dairy farmers were facing high feed costs, low pasture quality, low milk prices, low production per cow, one milking per day, high calf mortality, irregular farm services, high milk spoilage, and land tenure problems. Since then, the price of milk and milk products increased in 2016. Every year farmers were affected by rainfall, high temperatures, floods, drought, and hurricanes and the greatest threat was when the milk was produced and brought up to the dairy industry and it got rejected because of the quality of the milk. The counting was that a one-degree increase in temperature would result in a 2% decrease in production, which got all dairy farmers in shock.

According to Rewa Co-operative Dairy Company Limited (Company, 1994) in 2009, the disease brucellosis was a continuing problem in cattle. Looking at the seriousness of the brucello disease, RCDCL arranged one veterinarian per division (4 veterinarians altogether) but now there is less disease spread and it is under control. The RCDCL is specialized in dairy production now, providing training to the farmers and teaching them adaptation methods. They also encourage new farmers to adapt to new technologies as much as possible and teach the older ones about the adoption of new technologies provided those technologies make work easy.

### ***Old vs New Picture of Rewa Co-operative Dairy Company Limited***



**Figure 2.** Old vs New Picture of Rewa Co-operative Dairy Company Limited.

**Source:** Old vs New Picture of RCDCL.

### ***Importance of Dairy Farming in Fiji***

Dairy Farming is a large production sector in Fiji that is important and earns a living for farmers, industry workers, communities, and other families as well. Dairy farming is a contributor to the Fijis economy, from where the industry generates millions of dollars in revenue each year. Dairy farms ensure food security by providing milk to almost every family in Fiji, whether it is raw or processed. The industry processes and people also buy milk products such as cheese and butter.

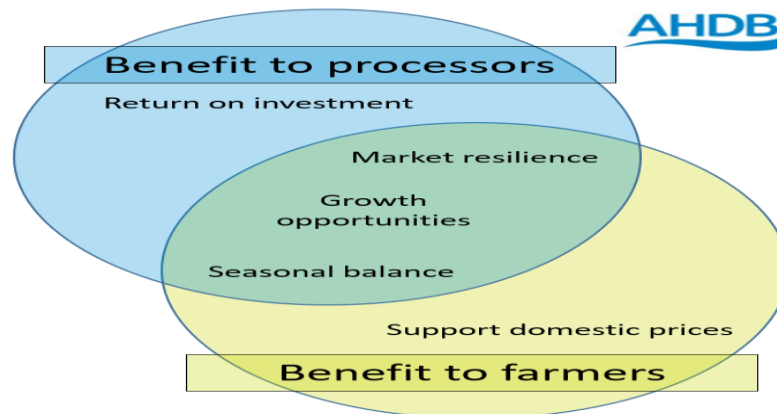
Dairy products provide an important source of nutrition to all Fijians, such as the most needed ones, the children, and pregnant women (Hanna Górska-Warsewicz et al, 2019). The essential nutrients dairy milk and

products provide are calcium, protein, and vitamins. Dairy farming provides cultural significance to Fijians and traditional farming is still prevalent. Through dairy farming, rural development is made possible in Fiji, such as areas where economic opportunities may be limited.

Many dairy farmers in rural areas have a chance to improve their lives through the production of quality and quantity of healthy milk. Improve the family standards of living, children's educations, and best health care services. Dairy farming is known as one of the sustainable sectors in Fiji and through promoting sustainable farming the sector can reduce the country's carbon footprint and promote sustainable biodiversity. This sustainable biodiversity can be used by the cows for feeding and to rest in high temperature and heat stress seasons.

Exportation helped the dairy farmers and dairy industries to benefit as the dairy products are exported to many countries such as Australia, New Zealand, and other Pacific Islands (Gooderham, 2021). With the help of the government and respective NGOs, the dairy farm can become a larger scale farming and production in Fiji.

### ***Exportation Benefits to Farmers and Processors***



**Figure 3.** The diagram shows the exportation benefits to farmers and processors

**Source:** How do dairy farmers benefit from increased exports.

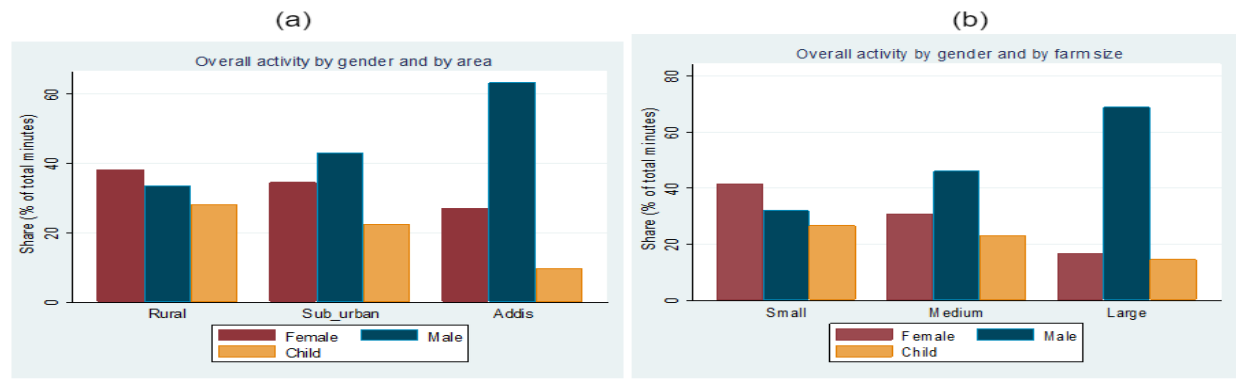
### ***Socio-Demographic Characteristics Influence on Dairy Farmers in Fiji***

Socio-demographic characteristics regarding dairy farming provide employment opportunities for dairy farmers and many other Fijians who stay especially in rural areas, where there are limited job opportunities. This prevents the well-being of rural communities and reduces poverty. Dairy farming provides income generation for many Fijian farmers.

Large-scale farms utilize industrial methods to intensify production is becoming more significant worldwide at the same time farmers earn a lot for their families and themselves (Beke, 2018). It supports and improves the living standard of farm-based families and contributes to the economic growth of Fiji. Dairy farming produces and provides fresh dairy products in Fiji. The rural communities who have limited access to supermarkets can benefit the fresh milk from farms. Dairy farming is fun at times with families and communities coming together to spend time and do dairy farming at the same time. Such as sharing farming ideas to increase production and sharing values.

However, cultural preservation is important for dairy farmers as a rural community in preserving Fiji's cultural heritage and promoting sustainability and cultural diversity (Abramson, 1999). Dairy farming has driven the rural development practices in rural communities because of the milk production in large quantities. From the large income the communities together liaising with the government, dairy farmers can make proper roads and build other infrastructure required. In communities, women are given a chance to do farming and help in other dairy farming activities as laborers to produce milk in large quantities. This practice also promotes gender quality in rural communities.

### ***Contribution of Women by Farm Size and Urban Proximity***



**Figure 4.** The two graphs show the contributions of women by farm size and urban proximity.

**Source:** Contribution of women by farm size and urban proximity.

Graph shows the sales travel time and dairy farmers located closer to urban areas who get more revenue than the farmers in remote areas. (b) shows a positive relation between revenue from dairy sales and farm size. Large dairy farms earn so much more revenue than smaller farms.

Moving on, involving youths in dairy farming will broaden the knowledge of young people to learn and participate in farming, which will be useful throughout their lives. This promotes youth empowerment and reduces migration from rural communities (Nation, 2014). The rural communities coming together and working as one known as community engagement is helpful for all generations as all have a chance to learn from each other and keep producing enough milk for industry in Fiji and exporting. Dairy farming is an important sector in Fiji's agricultural industry, though it implies significant implications for the socio-demographic characteristics of the population. It helps families and communities in so many ways and most importantly contributes to Fiji's economy.

Socio-demographic characteristics are any personal and social characteristics of a particular individual that can easily influence their behavior such as lifestyle and attitude. The socio-demographic characteristics of dairy farming are relevant to age, as nowadays there are more younger farmers between the ages of 20 to 40 who may be able or are adopting new technologies (Kinsella, 2018). However, older farmers aged between 40 and 60 years have zero experience in new technologies.

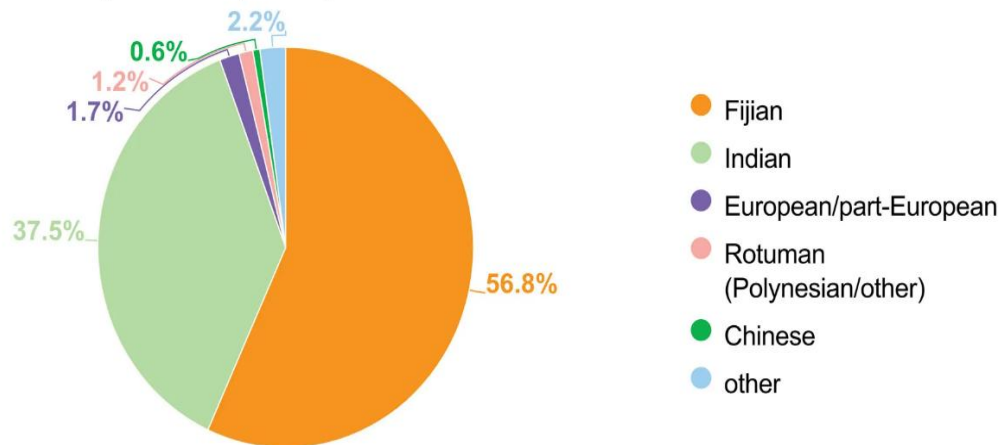
Gender as women nowadays is also contributing to dairy farming and other farming practices in Fiji. For instance, Naitasiri Women in Dairy Group is a group of women who are dairy farmers who share their farming skills, knowledge, challenges, and experiences (Fiji, 2018). Yet they may face challenges such as access to new technologies and market fluctuations and information. Education about dairy farming enhances the farmer's knowledge and skills towards farming. Education can also help to adapt to new farming technologies. Occupation is also counted as a secondary occupation for Fijian farmers, but many have other primary occupations as well in other sectors.

Moreover, the income level can influence the adoption of new technological practices. It can sometimes affect the competitiveness of Fijian dairy products (Valentina Maria Merlino et al, 2023). Family size matters as larger families may require more resources compared to small and medium-sized families to manage dairy farming practices. Socializing and networking with other farmers, or buyers helps to facilitate bonding and sharing knowledge. Cultural beliefs influence dairy farming, for example, modern methods upon traditional methods of dairy farming.

The location matters during farming and later transporting the milk to the market. Ethnicity influences the cultural beliefs and practices related to dairy farming.

### Ethnicity Composition

The composition is because of the high level of intermarriage between Fijians from the Lau group of islands of eastern Fiji. Also, some neighboring countries such as Polynesians from the island of Tonga. They work together to support dairy farming, especially in Fiji.

**Fiji ethnic composition (2007)**

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**Figure 5.** The pie chart shows the composition of different Ethnic groups.**Source:** Fiji Ethnicity Composition.

Religious beliefs influence dairy farming practices by taking breaks on holy days and dietary restrictions (Gumpert, 2009). Access to finance is a challenge for dairy Fijian farmers as they lack knowledge regarding access to credit and finance. To improve the effectiveness of dairy farming in Fiji farmers must adopt the socio-demographic characteristics and make the dairy farm productive, profitable, and sustainable at the same time.

***Effects of Climate Change on Socio-Demographic Characteristics***

Climate change effects that significantly affect socio-demographic characteristics include population migration and displacement, and climatic conditions such as severe drought, floods, and heat stress can lead to population migration, mostly in vulnerable communities (Tabe, 2019). Urbanization increases because of climate change as people move out to cities in search of better job opportunities, economic opportunities, and safety. Climate change also affects people who face income inequality. Such as low-income earners or households.

However, climate change affects people's health badly, such as creating new health risks because of changing climate and respiratory diseases (Royford Bundi Magiri et al,2023). Social cohesion and community resilience are disturbed because of climate change creating anxiety, stress, and conflicts within the communities. Apart from the environment, climate change also affects education and employment opportunities by altering the labor markets and changing the skills required for different kinds of jobs available.

Moving on, gender inequalities and climate change affect gender inequalities by division of labor. More loads are given to women which changes their role in society (Bart Minten, 2022). Rural-urban migration is common in Fiji where people leave the affected rural areas because of climate-related disasters and move to urban areas searching for better living. Climate change also affects housing, infrastructure, and food security by increasing the costs of repair and maintenance and at the same time increasing the price of needs such as milk, rice, and flour.

Water scarcity is a severe problem in the dairy industry which affects dairy farmers during droughts. This is because of the change in precipitation patterns that affects the water availability. Climate change has made people migrate and seek asylum because of climate-related disasters and environmental degradation. Most people leave rural areas because of climatic conditions and are not able to manage in cities and they forcefully have to seek asylum.

***Climate Change Adaptation Methods for Dairy Farmers in Fiji***

Climate change is expected to impact the dairy industry in various ways; however, farmers can adopt these methods to fight climate change and work towards better production of milk and other dairy products.

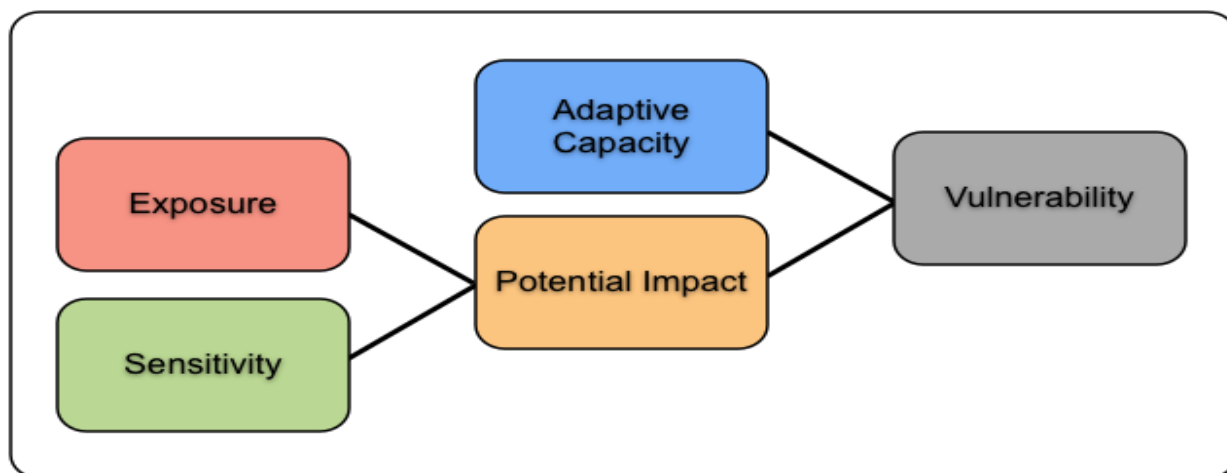
Weather forecasting and monitoring today in this technological world farmers have equipment and tools to anticipate and prepare for extreme weather conditions before they occur. During drought or before drought seasons occur farmers can adopt to drought tolerant dairy breeds such as Friesian or Brahman. These conditions are better suited to withstand the dry seasons. Water storage for farmers is very important to withstand dry weather conditions. Farmers can also use water wisely during dry seasons to fight against climate change till the weather changes.

Moreover, farmers can conserve soil by adopting and practicing contour farming and terracing to avoid reducing soil erosions which will help retain moisture. Dairy farmers can adopt climate-smart grazing practices to promote healthy soil in places such as rotational grazing. Disease management in cattle is very important as it will

help manage disease outbreaks in all livestock. Routine Checkups and injections when needed for cattle are important so that it does not affect milk production.

Farmers can easily adapt to the integrated pest management systems in reducing the use of pesticides which will minimize the impact of pests on milk production. Today's technology used by farmers such as mobile apps gives them prior and accurate information about climate-related weather conditions. Managing risks and insurance, to maintain their financial stability farmers can purchase insurance or implement risk management strategies. This will also not impact climate-related events in a time of need. Farmers ask for and receive subsidies and training from government NGOs and other private sectors to improve their knowledge and skills in dairy farming practices which are helpful to adopt in climate-resilient dairy farming (Naviticoko, 2023). Farmers must work closely with processors and buyers to ensure market access during climate-related disruptions such as market access and price stabilization. Community-based adaptation methods are easiest for farmers to adapt by working with the members of the communities to develop and implement new methods to adapt to climate change-related issues.

**Adaptation and Vulnerability Frameworks**



**Figure 6.** The diagram shows the adaptation and vulnerability frameworks.

**Source:** The components of climate change vulnerability, showing how each contributes to vulnerability.

**Factors that Influence Climate Change Adaptation Strategies**

Some factors that influence climate change adaptation strategies include topography and geography where location, elevation, and area of terrain matter so see the frequency of climate-related events such as severe droughts and floods. Social and economic factors influence the ability to adapt to climate change. For instance, communities with less financial resources struggle to invest in climate-related infrastructure. Traditional and cultural values/practices also influence the adoption of climate change. Such as some people in the community may want to change due to cultural beliefs.

The knowledge, skills, and thinking ability of the stakeholders which also includes government officials and community people may influence the adaptation to climate change. The quality and availability of technology and infrastructure used such as buildings and roads may affect the ability to adapt to climate change (Francis X. K. Mwinkom et al, 2021). Technology advancement plays a critical role. The risk in communication, and the way farmers, stakeholders, and communities communicate about climate change can influence the adoption strategies. The communications done between the government, stakeholders, farmers, and other community people must be effective in supporting adaptation methods.

**Effects of Climate Change on Dairy Farmers in Fiji**

Climate change has various effects on dairy farmers and farming practices. These effects include temperature increase, a rise in temperature affects the quality and quantity of the milk produced by cows. Severe drought season affects dairy farming a lot because dairy farming needs enough water. Severe drought season can lead to a reduction in milk production and an increase in the cost of feed which leads to a decrease in profits (Magiri, 2023). Fluctuations in temperatures increase the spread of diseases amongst the dairy cattle such as mastitis and brucellosis. These diseases lead to a reduction in milk production, costly veterinarians, and an increase in mortality rate.

However, little changes affect the availability and quality of feed for dairy cattle. For example, the nutritional content in the feed. Climate change has always led to severe flooding as well which has damaged the farms and other infrastructures of the dairy farmers. Farmers are affected by economic impacts as well where the market

price of the milk products increases, which increases the feed costs back in the farm and farmers end up making no to less profits than before. All effects directly or indirectly affect the health and well-being of dairy farmers. They come under stress by seeing the rate of milk production upon doing so much just because of climate change. Dairy farmers can go under depression and anxiety as well.

According to (Magiri, 2023) Those effects have mitigation measure that helps dairy farmers in Fiji to overcome health issues if any, adapt to weather patterns, and be prepared before the weather changes. Cattle can also go under depression because of changing weather patterns, therefore dairy farmers are responsible for cattle health management. For example, giving their vaccinations on time and looking for any disease started so that it is cured to the earliest. Ask for help from the government agencies or other NGOs involved in dairy farming when needed and community support is helpful as well. These practices can help mitigate the upcoming climate change issues and prevent farmers from managing the cattle and their health simultaneously.

### ***Brucellosis Disease in Cattle Affecting Dairy Farming***

Brucellosis is a disease common in cattle around the Pacific Island community. Hence, there have been no recent studies on brucellosis found in Fiji. Before Fiji declared freedom from the disease in 1996 but re-emergence of the disease in 2009. The suspect of brucella is the poor monitoring for the disease could have contributed to re-emergence in 2009 (Tukana, 2018). Once in 2009, the disease was re-established in Fiji, it was hard for the farmers and veterans to control it at some time.

On the other hand, at the time of disease was present in Fiji other Pacific islands such as Vanuatu, Solomon Islands, and PNG reported freedom from brucella disease. However, till today brucella is not present in other Pacific Island countries, as in Fiji there is brucella present but most people till today are unaware of the disease. Only dairy farmers and veterinarians are aware of the disease, and they cure it and inject cattle as needed. Looking at the good side of brucellosis disease is that it is important that if the surveillance system and disease reporting are poor, the disease could re-emerge, which would have negative impacts on human and animal health.

According to (Tukana, 2018) in Fiji, there is very little awareness of the brucellosis disease in the communities now with very little and poor surveillance capacities. Later in the future, there is a very high chance of brucella spreading over the Pacific Island countries. Lately, there has been a current outbreak of brucellosis in Fiji, which could have been a good opportunity to use that situation and study cattle on the farms that had the outbreak.

## **CONCLUSIONS**

In conclusion, dairy farmers face a lot of problems in the production of quality and quantity of milk on time for the dairy industry and exportation. They have to go through many climatic conditions and ways to adapt to those and then produce better for everyone's consumption. Studies have shown that the socio-demographic characteristics of Fiji dairy farmers have the most significant impact on their climate change adaptation practices. The other findings have shown that farmer's age, farm size, and education level are the main factors that most influence the ability to adapt to climate change.

According to the research, it is found that older farmers were less likely to adapt to new climate-resilient practices and technologies compared to today's generation farmers who accept the changes and accept the adaptation methods and new technologies and work towards it. Today farmers are educated and understand about changing climate and they adapt to all new changes. However, older farmers still stick to the traditional method of farming and do not want to accept the changes or adapt to new changes or new technologies.

On the other hand, the size of the farm was found to be an important factor where larger farms are more likely to adopt climate-resilient practices compared to small farms. The reason behind it was that larger farms had more resources and were more likely to have access to new technology and most experts such as climate-related officers and NGOs were there to help farmers to adapt to climate change. Social networks play an important role in dairy farming and climate change adaptation yet old farmers are not aware of social networks new educated farmers are using social networks and adapt to climate change such as viewing the weather forecast before and preparing in advance.

Additionally, the findings in this study have important implications for the policymakers, NGOs involved, and the government who work together to promote climate change adaptation in the Fiji dairy industry. The target from the government noted is to promote social networking systems and educate and train the old farmers, providing resources and support to the farmers with small farms and making effective plans and awareness for farmers to adapt to climate change. Lastly, all policymakers and stakeholders with the government and NGOs must work together on the factors that influence the adoption of climate-resilient practices by Fiji dairy farmers. Suggest the farmers with new ideas and inventions that can help promote climate change adaptation in the dairy sector.

## RECOMMENDATIONS

There have been many aspects of climatic changes that have affected the animal production sector in several ways and so Fiji citizens and its government created possible ways to overcome these scenarios not only in the present time but in the future as well.

**Solution for Livestock and Other Terrestrial Organisms**

Below are some of the methods carried out to revive the situations of climatic changes.

**Workshop—Carried Out in Nabua, Suva Based on Adaptation in the Livestock Sector by SPC (2011)**

In this workshop, group division was carried out between the participants who were assigned to obtain the adaptation methods for each climate change in sectors such as cattle, dairy, local pigs, broilers and layers, small ruminants, and lastly, local poultry. They were able to determine and map the risks and threats of climatic hazards, such as droughts, sea-level rise, rise in the temperature value, flooding, and cyclones. Through their mapping of research, they were able to indicate some of the adaptation ways for futuristic benefits in the livestock sector, which include.

**Cattle:** containing those crossbreeds that are tolerant to heat, lower exposure to disease infections, and tolerant to drought and heat stress as well. Secondly, maintaining maximum availability and quality through water management practices by establishing well gutters or tanks and new ways to obtain water resources.

**Swine:** obtaining good house locations and designs. Likewise, good water management practices as well such as water tanks, water pumps, and boreholes. Proper sanitation and hygiene with good husbandry practices like observing the rates of stock, managing the feeding process, and keeping appropriate records were also determined by the participants.

**Commercial poultry:** improving the feeding availability that is highly nutritional and can replace compound feeds. Secondly, designing shed areas associated with climate vulnerabilities so that poultry site areas could be improved for their production. Like cattle breeds, the participants also determined that resistant breeds should be more likely to survive climatic hazards.

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