

Assessing impacts of climate change on small businesses in the Madang Lagoon area

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Abstract

This paper provides an analysis of climate change's impact on small businesses in the Madang Lagoon area. The study used quantitative methodology. The quantitative data were collected using a self-administered questionnaire. The study used non-probability sampling which combined convenience and snowball sampling that are popular sampling techniques. The completed questionnaires were retrieved and coded on an ordinal scale of 1 to 5 manually on the questionnaire and entered the codes into a specially designed excel spreadsheet and raw data were transferred to the Scientific Package for Social Science (SPSS) software and generated the reports. The study found that majority of the small businesses were affected by climate change and some businesses have had to close operations and others diversify into other small businesses. About 78% of businesses were owned and operated by women who support their family to meet the daily needs. All the small businesses were classified as being in the informal sector. The study also found that the environmental impact of climate change is evident in the study areas but little or nothing is done to prevent further damage caused by coastal erosion. As per responses from respondents, there is a plan, but nothing has been done so far to mitigate and adapt to climate change challenges. The study provides a better understanding of climate change impacts on the natural environment and small businesses.

Keywords: Climate change, business, small business, mitigation, impacts

Introduction

The paper aims to identify and discuss the impacts of climate change on small businesses and how it affects small businesses in the Madang Lagoon area in Papua New Guinea (PNG). Climate change imposes new stresses on both the natural and socio-economic environment of businesses (Williams & Schaefer, 2013; Ambang, 2011; Berkhout et al., 2006). Some businesses tend to adjust and adapt to such challenges and others not. Thus, it is important to understand and interpret climate change signals to prepare for climate change impacts (Williams & Schaefer, 2013). This allows analysts and decision-makers to develop emergent strategies to adapt to a potential future crisis. Such plans give the business owner a better opportunity to counteract any climate change-related issues such as floods, drought, and other natural disasters (Williams & Schaefer, 2013; Berkhout et al., 2006). Similarly, it provides knowledge for better choices about how to achieve “efficient, effective and equitable adaptation” (Berkhout et al., 2006, p. 135).

This research also has a practical outcome, as key findings could help develop contingency and adaptation techniques for small businesses. The objectives of this study are, 1. to assess the impacts of climate change on small businesses and the natural environment; 2. to identify the types of mitigation techniques and benefits that could be used by SMEs in Madang Lagoon.

Background

Climate change

Climate change is a prolonged change in the weather patterns determined by continual changes in the temperature, rainfalls, wind, snow cover, drought, and other changes. These include both severe and average conditions (Kuange et al., 2017; Ambang, 2011; Jacka, 2009). Climate change can be caused in several ways. First, it is caused by the processes of greenhouse gases from the sun. Second, it can be caused by human activities such as logging, bush fire, and the burning of fossil fuels such as oil, coal,

petrol and diesel. Third, it can be caused by domesticated animals such as cattle releasing methane gas (Kuang et al., 2017; Ambang, 2011; Jacka, 2009). The challenges global climate change poses to people varies in different countries in the world. In PNG, the impacts of global climate change are seen and felt in many parts of the country (Connell, 2016; Burkett, 2015; Edwards, 2013). Some of the impacts include coastal erosion, sea-level rise and saltwater inundation, prolonged droughts, landslides, river flooding and crop damage from insect pests (Mc Kenna. et al., 2019; Kuang et al., 2017; Connell, 2016). These have affected the daily lives of PNG people in terms of gardening, business, education, hunting and other daily activities (Mc Kenna. et al., 2019; Kuang et al., 2017). For instance, some coral atolls in the Autonomous Region of Bougainville, Manus, and Madang are sinking due to sea-level rise, resulting in food gardens flooded by saltwater, fresh drinking water sources affected and reclaiming of the land. The first climate change refugees are from Carteret Island in the Autonomous Region of Bougainville (Connell, 2016; Burkett, 2015; Edwards, 2013).

Climate change impacts

Most atoll island communities in PNG are indeed exposed to flooding and sea-level rise during high tides and climate-related pressures that put a strain on their livelihood (Luetz, 2017; Connell, 2016; Edwards, 2013). This trend was identified during a workshop in Madang in 2018 where researchers presented findings that showed that changes had occurred in rainfall and temperatures had increased over the years. For instance, the people of Ohu and Bundi experienced continuous rainfall that damaged the Madang urban roads. Others experienced a long number of hot days that made women weak and too tired to work in their food gardens and resulted in bush fires, especially in forest protected areas (Mc Kenna. et al., 2019).

Riwo community has experienced land shortage due to population growth and sea-level rise that is eroding the community's land. The shortage of land has resulted in social/cultural and economic impacts. Riwo participants reported that they experience petty crimes, alcoholism and domestic violence and lack of bush materials for the building of houses (Mc Kenna. et al., 2019). Population increase in coastal areas can aggravate susceptibilities by damaging the ecosystems such as mangroves and coral reefs that island people manage and depend on for protection (Luetz, 2017; Connell, 2016).

Further, Carteret Island in the Autonomous Region of Bougainville is sinking and displacing its inhabitants (Luetz, 2017; Connell, 2016; Burkett, 2015; Edwards, 2013). These affected communities are yet to be relocated, which will be a challenge, as they need to start all over again by building a house, garden, schools and dealing with issues connected with the host communities (Luetz, 2017; Burkett, 2015). These communities are vulnerable to the effects of climate change, but the national government of PNG has so far done little to help them (Connell, 2016).

The literature reveals that there are several ways to adapt to climate change threats that can be facilitated by the government. First, vacant land could be identified by Provincial Government and purchase the land to resettle the affected communities. Second, mangroves can be planted near the beaches and third, build sea walls to prevent coastal erosion. These could help the vulnerable communities that might be affected by sea level rise caused by climate change (Luetz, 2017; Burkett, 2015). However, none of these adaptation techniques have been implemented so far in the affected communities (Luetz, 2017; Connell, 2016). Sea level rise is a serious issue that needs to be addressed with the support from affected communities, provincial government and the national government of PNG (Luetz, 2017, Burkett, 2015; Ambang, 2011).

Climate change impacts on small businesses

Many businesses can be affected by external factors and one of them is the greater frequency of natural disasters such as flood, drought, landslide and cyclones, which is caused by climate change (Williams & Schaefer, 2013). The businesses that survive such turbulences are the ones that have an achievable strategy that can adapt to external factors (Leonidou et al., 2015; Williams & Schaefer, 2013). These are successful businesses that gain a competitive advantage and outperform their competitors by mitigating external factors such as climate change and promote and develop climate-smart business

concepts and modules (Leonidou et al., 2015; Williams & Schaefer, 2013). For instance, business owners can design or sell environmentally friendly products that will cause less harm to the natural environment (Leonidou et al., 2015; Ambang, 2011).

However, according to Ambang, (2011), most businesses in PNG have a medium level of awareness of climate change impacts on their businesses and some businesses have no strategy to mitigate external factors, especially the effects of climate change. Ambang concluded that climate change awareness and adaptation policies are the responsibility of the government and not the private sector. It seems that there is a lack of knowledge and awareness on climate change in PNG. Luetz and Burkett argue that it is not only the responsibility of the government but includes both the private sector and the affected communities to address climate change impacts (Luetz, 2017; Burkett, 2015). However, McKenna and Tekopiri (2020) identified in their paper that people in PNG believe that climate change effects such as rising sea level, heavy rain, drought, and other factors are caused by God, and they have no influence on its effects. Besides reflecting how most respondents hold deeply religious views, this shows that people lack knowledge and understanding of climate change and its effects because those owners of SMEs have very modest means, they are unable to outlay funds to combat the effect of climate change or often do not have access to information to know what strategies to employ (Luetz, 2017; Burkett, 2015).

Theoretical framework

The theoretical framework for this paper is a link between cause-and-effect theory. This is an existing model but adjusted to the current study. The cause of unsuccessful small businesses in the Madang Lagoon area is mostly due to the effects of climate change. The literature reveals that several factors relating to climate change affect daily activities of local people, as discussed below.

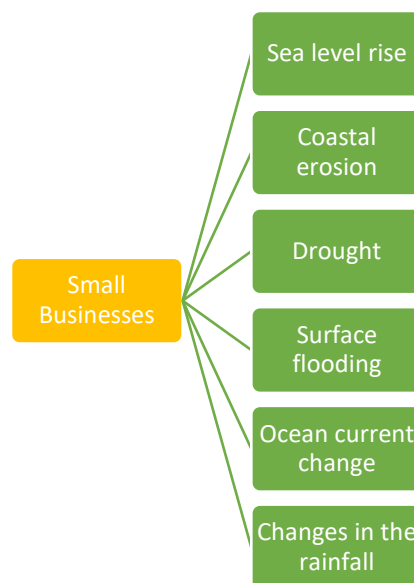


Figure 1 Theoretical Framework

First, sea-level rise is a big issue that is reclaiming the land and displacing the inhabitants. The worst affected are the small islands especially the atolls in PNG. The people who reside there depend on the land for gardening and hunting (Mc Kenna. et al., 2019; Kuange et al., 2017). It is now a threat to their livelihood because the majority of the people, who live in rural villages, survive on subsistence farming (Sumb, 2020). This is a major issue affecting coastal villages not only in Madang Province but also in other coastal provinces in PNG and Pacific Island countries (Connell, 2016).

The second factor is coastal erosion, which is caused by sea-level rise (Mc Kenna. et al., 2019). When the sea level rises during high tides, it erodes prime land for gardening and some family homes are submerged under the sea (Kuange et al., 2017; (Luetz, 2017; Edwards, 2013).

The third climate change factor is drought and temperature increase, which affect the growing of food crops and can cause bushfires. Bushfires might affect some protected sites that could result in habitat loss for wildlife (Mc Kenna. et al., 2019; Kuange et al., 2017).

The fourth factor is surface flooding resulting in food gardens being destroyed and freshwater sources being affected. The effect of compromised fresh water sources for communities in PNG is severe, as they already lack a clean and treated water supply for drinking and cooking (Kuange et al., 2017; Connell, 2016).

The fifth factor is ocean current change that makes it hard for fishermen to go out in the open sea to provide fish for consumption and to sell for extra money. Some people in Madang Lagoon engage in fish sales as a small business for an income (Sumb, 2015).

The final factor is the change in the rainfall, with heavy rain causing destructive flooding and also cash crops that do not grow due to changes in the rainfall (Kuange et al., 2017; Connell, 2016). All these factors, caused by climate change, affect small businesses.

Methodology

The research methodology for this study is quantitative and employs a positivist research paradigm. In positivism, the researcher works with the observable social reality to develop law-like generalizations. This is typically a deductive and objective approach that starts from general to specific conclusions. Also, it's highly structured with a large sample size (Bhattacharjee, 2012).

The quantitative data were collected using a self-administered questionnaire. The questionnaire consisted of two parts. The first part includes demographic characteristics of the respondents. The second part includes questions about issues and challenges faced by small business owners related to climate change. The self-administered questionnaires were given to the community leaders to distribute to small business owners in their respective communities.

The study used non-probability sampling which combined convenience and snowball sampling that are popular sampling techniques (Bhattacharjee, 2012; Bryman, 2012). These sampling techniques were appropriate for this study as the researcher recruited some participants for whom the researcher has contact (for example, community leaders) and others who were identified by the initially selected respondents. The research respondents were all from the Madang Lagoon area.

A total of 50 self-complete questionnaires were distributed to villages in the Madang Lagoon area. Of the 50 questionnaires, 33 were completed and returned to the researcher. The completed questionnaires were coded on an ordinal scale of 1 to 5 manually on the questionnaire and the data entered in an Excel Spreadsheet. Raw data were transferred to the Scientific Package for Social Science (SPSS) software for the data analysis. Descriptive statistics were used to analyse the data. Demographic characteristics of the respondents and the type of businesses owned by these respondents were provided. The type of climatic change impacts and their effect on the small business enterprises were described.

For this study ethics clearance acquired from the Faculty of Business and Informatics Research Committee. Participants who were selected participated voluntarily and were provided with a consent form and an information sheet about the research, including the reasons they had been chosen to participate. Also, COVID-19 protocols were observed during the data collection.

Results and discussions

The demographic characteristics revealed that the majority of the respondents were females (79%) and (21 %) were male (Table 1). The average age of the respondents was 45 years, and the majority (87%) were small business owners. The sample population represents the small business owners in the Madang

Lagoon area of Madang Province and does not necessarily reflect the whole of Madang Province. Also, the small businesses are classified under the informal sector as they have not been registered with Investment Promotion Authority (IPA).

		Frequency	Percentage
Gender	Male	7	21.2
	Female	26	78.8
	Total	33	100.0
Age	25-35	7	21.2
	35-45	11	33.3
	45-55	4	12.1
	55-65	10	30.3
	67 and above	1	3.0
	Total	33	100.0
Position	Owner	29	87.9
	Part Owner	1	3.0
	Village Association	3	9.1
	Total	33	100.0

Table 1 Demographic profile of respondents

What type of business you are engaged in?

Of the (33) respondents that were surveyed, almost half of the respondents (39%) were engaged in informal table marketing and (18%) traded as store owners and others (42%) were engaged in different informal small businesses (Table 2). The majority (78%) of these small businesses were owned and operated by women to support their families. All the small business owners were rurally based with no regular income. They depend on subsistence living and engage in small businesses to meet their daily needs such as medical, school fees, food and other necessary items. This is consistent with the literature as (85%) of people in PNG live in rural villages and survive on subsistence farming (Sumb, 2020).

The aim of starting a small business is to earn an income to sustain their livelihood. Some small businesses remain small, but others expand and diversify to big businesses by providing employment opportunities for others and alleviate poverty (Allen, 1999). Also, employment minimizes criminal activities in urban areas as it was identified by Sumb (2020/18/17) that most criminal's activities were caused by jobless youths. These small businesses need the support from government to help and fund them as they contribute positively to the development of the country (Sumb, 2015).

Types of Business	Frequency	Percentage
Trade store	6	18.2
Poultry	1	3.0
Mini Finance	5	15.2
Table Market	13	39.4
Betel-nut sales	3	9.1
Sawing	2	6.1
Cocoa/Copra sales	3	9.1
Total	33	100.0

Table 2 Type of small businesses

What kind of impacts you experienced in your small business?

Based on the survey, most of the businesses indicated that their businesses were affected by climate change. 79% of the respondents indicated that they receive less income and (21%) indicated that they experienced a lack of customers (Figure 2). This is related because a lack of customer's means business-owners had much lower incomes to spend, leading to the reduced income for other businesses. Another factor is that most people along the north coast of Madang rely on copra and cocoa business but, cocoa and copra were affected by a disease (Bogia coconut syndrome) and the production was less resulting in low incomes (Smith, 2016; The National, 2014). This affected table market people as there is less cash flow in the community to buy their products. Some communities experienced continuous rainfall, which affected food crops, while others experienced high tides which made it difficult for them to go fishing for their own consumption and for selling at the market (Mc Kenna. et al., 2019). These findings are similar to literature to change impacts that affect the local people not only small businesses but also contribute to social and cultural issues.

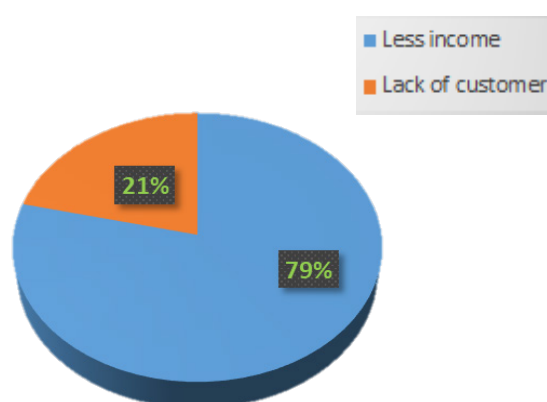


Figure 2 Impacts of climate change on small business

If climate change has affected your business, how much is the loss in revenue?

The majority (82%) of the small businesses made losses amounting to less than K1000 and only a few (18%) made losses over K1000 in revenue (Figure 3). For the majority of the small businesses, the revenue loss is less than K1000 which is relatively small, but significant because these are informal businesses, and their daily takings are low but are enough to sustain them in their daily needs. Some made a loss and close operations, and others diversified their small businesses. One major challenge for the local communities is school fees for their children. When they raise enough money, they can pay the school fees but with a loss of revenue it is a struggle for parents to pay school fees (*The National*, 2014).

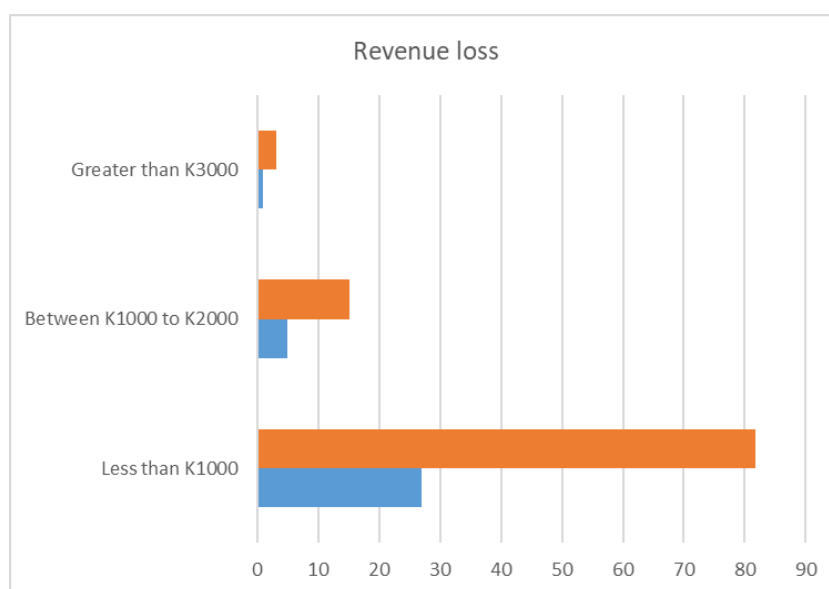


Figure 3 Loss of revenue because of climate change impacts

What climate change related pressures do you think will affect your small business?

When asked about the likely impact of climate change on their small businesses, 57% of the respondents indicated that coastal erosion might affect their business (Table 3). In some communities, they already have experienced coastal erosion that is reclaiming their prime land for gardening and building houses (Mc Kenna. et al., 2019; Sumb, 2015). A similar finding was experienced in the Carteret Island in the Autonomous Region of Bougainville and local people were displaced (Luetz, 2017; Burkett, 2015; Edwards, 2013). Some parts of Kranket, Bila, Riwo and Siar have experienced coastal erosion, but the local people and the local level government are doing little or nothing to prevent coastal erosion (Sumb, 2015).

Climate change impacts	Frequency	Percentage
Ocean current changes	4	12.1
Drought	2	6.1
Changes to rainfall patterns	8	24.2
Coastal erosion	19	57.6
Total	33	100.0

Table 3 Likely impacts of climate change

Within your area, are you aware of any plans aimed at adapting to the effects of climate change in your small business?

From the survey, 79% of the respondents indicated that there is a plan to build seawalls to protect the small businesses and community against climate change but not implemented and the coastal sea erosion is evident in most of the villages within the Madang Lagoon area (Table 4). This could be related to their Christian faith because people believe that climate change impacts are from God, and they cannot do much to protect the environment (McKenna & Tekopiri, 2020). This is the most likely reason as there is no urgency in building a seawall or planting trees such as mangroves. The second reason could be that people are simply ignorant about the effects of climate change, and therefore do not see the need to take any action to combat it. For instance, there was a project initiated by Worldwide Fund for Nature (WWF) to plant mangroves within the Madang Lagoon area but the project was regarded as a failure because local people did not complete planting the mangrove seeds that were distributed to them (Post Courier, 2018). The final reason is they expect the government to build seawall and as identified by Ambang (2011), they believe that climate change awareness and mitigation is the responsibility of the government.

Mitigation Strategies	Frequency	Percentage
Coastal Infrastructure e.g. seawalls, storm surge barriers, dune reinforcement	26	78.8
Disaster risk management	3	9.1
Coastal barriers	3	9.1
Increased forestation	1	3.0
Total	33	100.0

Table 4 Mitigation Strategies

Conclusion

Climate change is affecting both the natural and the business environment. This is a concern for business owners globally. The effects of climate change are also experienced in PNG. Thus, this study examines the impacts of climate change on small businesses in one part of Madang Province. This paper first offered a brief background of climate change and its effects in PNG then discussed the impacts of climate change as revealed by the empirical studies. It then reported the research findings of the study.

The survey findings indicated that the majority (79%) of small business owners were females, and their small businesses were affected by climate change due to a lack of demand for the products, resulting in low income. These are informal businesses that sustain families and with such effects of climate change, it affected them in meeting some of their family needs which poses a serious problem on the local people. The major challenge is parents unable to pay school fees for their kids and could result in social issues. Also, the study found that some businesses closed operations and others diversified their businesses. This was explained in the cause-and-effect theory in the theatrical framework. The cause is climate change factors and effect of this is the loss of business experienced by small businesses.

It was highlighted in the literature that coastal erosion is reclaiming prime land for cultivating food crops and building shelter for the family. It was found that there is a plan, but nothing has been done to prevent further damage. The literature also reveals some possible reasons for not taking any actions against climate change impacts. First, people believe in God and as such they believe that climate

change is caused by God (McKenna & Tekopiri, 2020). The second possible reason is local people expect the government to carry out climate change awareness and build seawalls (Ambang, 2011). The final reason is local people are simply ignorant and unwilling to take the initiative to do it themselves.

Business-owners in Madang Lagoon reveal that they have seen and experienced climate change, and it has affected their businesses and the natural environment, but little or no attention has been taken to mitigate climate change impacts. The limitation of this study is that it only captured the Madang Lagoon area, but future studies could expand to Madang Province and include a larger sample to provide comprehensive formation. The sample size for this study is small and the results may not be generalized.

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