

Impact of Tropical Cyclone Pam on Housing Characteristics in Vanuatu

VINAU SAHE

VANUATU NATIONAL STATISTIC OFFICE

Manager's statement

Housing Characteristics is a common subject that all official surveys and census conducted by the Vanuatu National Statistics Office do consider. However, the usage of this data for in-depth analysis is an area that VNSO has been lacking. Housing or building policies have been limited in Vanuatu and that is just an example of the lack of usage of housing characteristics data for informed decision making.

It is through researches such as these that pave the way for more emphasis on the use of housing data. Vinau's research is the first of its kind that VNSO will benefit from particularly the recommendations that will set improvements on housing data collection and analysis.

We wish to confirm that this work is Vinau's own and that it will be vital for VNSO.



KAP Calo Andy
Senior Statistician – Social Statistics Section
Vanuatu National Statistics Office

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Also extend my thanks to my supervisor for allowing me to participate in this course and allowing me to take time off in doing my normal duties and spend time on this course.

Last but not least, the government statistician for the opportunity to release staff for the period of this course and giving us the support for building up our knowledge and skills and also for letting us use the office resources to complete some of our courses.

Many thanks!

Concepts and Definitions

Traditional housing (43%) is constructed from local materials such as thatch, natangura (woven palm fronds), woven cane, or other naturally available material. Key features include a concrete or crushed coral gravel floor; lightweight timber frame with local material wall cladding; roof sheeting made from locally grown material, sometimes with chicken wire covering the thatch (predominantly outer island and peri-urban).

Semi-permanent housing (30%) is incrementally constructed from traditional materials that are replaced or supplemented over time with salvaged or second hand materials. Key features include concrete or crushed coral rock floor, inadequately designed timber-framed walls; natangura grass or corrugated galvanized iron (CGI) roof on non-engineered roof members (predominantly informal settlements or rural communities).

Permanent housing (27%) comprises single- and double-story structures that were likely designed to be comparatively durable. Key features include engineered concrete or timber framed floor; concrete block or timber-framed walls; and CGI on trussed roof structure or roof tiles.

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Acronyms

HIES	Household Income & Expenditure Survey
TC	Tropical Cyclone
VNPHC	Vanuatu National Population & Housing Censuses
VNSO	Vanuatu National Statistic Office

Background

Vanuatu is made up of 83 islands and these islands make up the six provinces of Vanuatu geographically Torba, Sanma, Penama, Malampa, Shefa and Tafea. The two urban areas of Vanuatu are located in Shefa province (Port Vila) and Sanma Province (Luganville).

In the 2016 Post Pam Mini Census Report, Volume 1 the population of Vanuatu was 272,459 - with a total of 55,285 private households.

Usually known as one of the Pacific island countries that is most vulnerable to natural disasters, it has a history of cyclones, tsunamis, earthquakes, drought, coastal and river flooding, storm surges, landslides and debris, sea level rise, climate change and volcanic eruptions. According to a 2011 World Bank report, “Vanuatu is expected to incur, on average, 48 million USD per year in losses due to earthquakes and tropical cyclones. In the next 50 years, Vanuatu has a 50% chance of experiencing a loss exceeding 330 million USD and casualties larger than 725 people, and a 10% chance of experiencing a loss exceeding 540 million USD and casualties larger than 2,150 people.” (WHO, 2011)

Early in March 2015, there was a category 5 tropical cyclone that hit some of the islands in Vanuatu and had a devastating impact on the livelihood of the people of Vanuatu. Although not all the islands were greatly affected except for two major provinces, Shefa and Tafea, services to other provinces were affected as a result and the most evident was the higher cost of living.

In the “Tropical Cyclone Pam Lessons Learned Workshop Report, June 2015” by the Vanuatu National Disaster Management Office there are findings that 81 per cent of homes sustained some damage from Cyclone Pam in Tafea and Shefa, 188,000 estimated people were directly affected and 65,000 people were displaced from their homes. The report from the 2016 census also stated that most of the households which incurred severe damage to dwellings were from Tafea province with 80 per cent reported completely damaged dwellings.

Usually the Vanuatu National Statistics Office (VNSO) carries out a census every 10 years and a survey once in every 5 years or so. The last census was carried out in 2009 prior to the 2016 Mini census in which information is being collected on health, education, population, housing characteristics, income sources, agricultural and

livestock activities, fishing activities, communication and income and expenditure. The next census was supposed to be till 2019 however due to the destruction left by cyclone Pam there was urgent need to update the household listing before the actual census thus the mini census in 2016.

Deciding on what information to collect during census and surveys is very challenging and depends on most stakeholders and policy makers as well as the government goals and plans which need to be addressed. Whether all the information was widely and frequently used is unknown therefore the interest in this topic is to explore the data collected in the 2016 Mini Census and to find out whether this information can be used to make some data analysis on housing characteristics otherwise where possible, make recommendations to improve the quality of data collected particularly on the housing questions for future censuses.

The issues discussed in this report are similar to the report “Housing in greater Christchurch after the earthquakes” by Rosemary Goodyear. Rosemary has outlined some common issues arising from disasters affecting housing characteristics such as overcrowding issues, increased housing problems for low income earners in particular.

And so as part of a statistics course provided by the New Zealand Statistics Office through the New Zealand Government, participants are expected to produce a research project based on any work related issues. Therefore this research will try to explore and answer the following questions:

1. What type of dwelling structures were mostly damaged by the cyclone? What materials were these houses made of? (Concrete, metal, etc)
2. Compare the changes in the dwelling tenure to see which dwelling tenure is common before and after and see if this will determine the rebuilding of homes after the TC Pam. Are there a lot of people not living in their own homes but in rent houses and rent free homes?
3. Ranking the aid received in their various forms to determine what was the most needed aid after the cyclone so that the government may need to put more focus on to help the people in Vanuatu for their recovery.
4. Is there any issue associated with the TC Pam such as overcrowding? If there is overcrowding, is there a relationship between household income and household size which may be the cause to overcrowding?

Research Plan/ Methods

The main objective of this research is to explore the impacts of TC Pam on housing characteristics using secondary information collected from published reports and determining whether people in Vanuatu have responded positively.

Information collected in this research is based on the Vanuatu National Censuses, specifically the 2009 National Population and Housing Census. These censuses occur every 10 years except for the mini census in 2016, the Post Pam Mini Census, which was purposely completed to update the household list and collect basic progression indicators on the effect of government policies and services (quoted from pg.i).

Most of the data in this report is secondary data reported from the census and survey reports which had been collected via face to face interviews using written questionnaires as well as tablets.

The target population in this research is 133,204 people living in private households in the two most-affected provinces, Shefa and Tafea. The sample frame in this report focuses on the affected provincial areas and further analysed by one urban and rural setting for comparison.

The sample size of this research is 55,285 private households recorded in 2016 census compared to previous census (see Table 1 below). This is then sub divided to the two main provinces in which one represents the urban areas and the other the rural areas.

Information collected in this report includes the number of private households in each province in Vanuatu between 2009 and 2016, the building materials type, and the type of aid support received by the provinces, and the household income source and the household size.

The statistical summaries are in the form of table of counts, graphs, time line and bar charts.

Key results are the changes in the building materials from recent census compared to previous censuses and the effects of TC Pam on housing characteristics identifying the causes linking to these issues.

Legal and ethical issues

The Vanuatu Building Act 31 of 2013 does not specifically outline whether damaged buildings from any cyclone or natural disasters are prone to the building act but from verbal conversation with the Municipality officers, it is vital that any person who is affected by a natural disaster write a letter to the Municipal to state that they should be exempted from the Building Act given the situation. It should also be noted that the Vanuatu Building Act only applies to the urban areas within a Municipality station and does not apply to rural areas. Therefore this act does not affect or delay the rebuilding of homes.

All of the data contained in this report is from published reports from the Vanuatu National Statistics Office which is mandated by the Statistics Act Cap 83 and revised in 2013 to collect and disseminate census information on population and housing characteristics. The information represented in this report is aggregated by total private households in urban and rural areas and is not specifically by individuals. Therefore it tries to cater for the confidentiality and privacy rules to make sure that individuals are not exposed and legal issues are not overlooked.

Data and data issues

Collecting data is very time consuming and expensive and so is not possible to collect additional data for this research. Instead, most of the housing information is already available in census and survey reports. However, the data from these reports are very limited and some of this data is not consistent. Instead, it has been a challenging task to use secondary data from census and survey reports as well as reports in the internet to obtain results which can answer the proposed objectives of this research.

The key variables in this research are:

- Number of private households – this is the number of private households compared over the census years to see the growth (or decline).
- Percentage of damaged dwellings - the mini census report did include a question on reported damaged dwelling for current households so this will determine how many households experienced a damaged house from the TC Pam but then it is limited to current dwelling and not what kind of dwelling was

being damaged to determine the dwelling structures that are most vulnerable to cyclones (the materials that they are being constructed from).

- The most distributed aid support – this question is to support the findings on what was the most needed supported provided and whether this aid support was a long term or short term that would assist with the rebuilding of homes after the cyclone.
- The relationship between household income and household size - this question is focused on identifying issues with household size and whether it has a relationship with household income that could lead to overcrowding issues. However, overcrowding is linked to information about number of rooms and household size but this is not possible with limited data in the 2016 mini census report. This problem is further discussed below (see recommendations).

Analysis

For this research, most data are derived from the census reports as they are the most detailed reports containing information in regards to housing characteristics.

Question D1B_Completely damaged dwellings by H3_Household Tenure is a question asked in the 2016 Post Pam Mini Census relating to how many households had a house damaged by the TC Pam. This question has been used to answer one of the research questions on how many households had a damaged house by the cyclone and can be compared to the findings by the report on Vanuatu TC Pam Lessons learned report.

The type of analysis in this report covers:

1. Percentage of damaged dwellings - the mini census report did include a question where households were asked whether they had a dwelling that was completely damaged by the cyclone. Analysis is being done using a column graph to find out how many dwellings were completely damaged from the TC Pam by provinces to find out what provinces experienced more damage (see figure 2). Unfortunately, the TC Pam mini census did not collect further information on the damaged dwelling but rather the current dwelling and is not able to identify the materials used in the damaged dwelling in order to determine the dwelling structures that are most vulnerable to cyclones (the materials that they are being constructed from).
2. Number of private households – comparing the increase in the number of private households using a column graph (see figure 1). Usually households increase over time due to the population increase so this will be compared to see the growth and how great this has changed or whether the TC Pam or any other major disaster had a toll on the number of households to cause a major change.
3. The most distributed aid support – this question is being analysed using bar chart as it ranks them in the order of most distributed to the least by the two most affected provinces, Shefa and Tafea (see figure 4 and 5).
4. The relationship between household income and household size – a scatter plot is used for this question (see graph 6 to 8) and the result of neither positive nor negative relationship will determine whether it has a relationship with household income that could lead to overcrowding issues.

Results

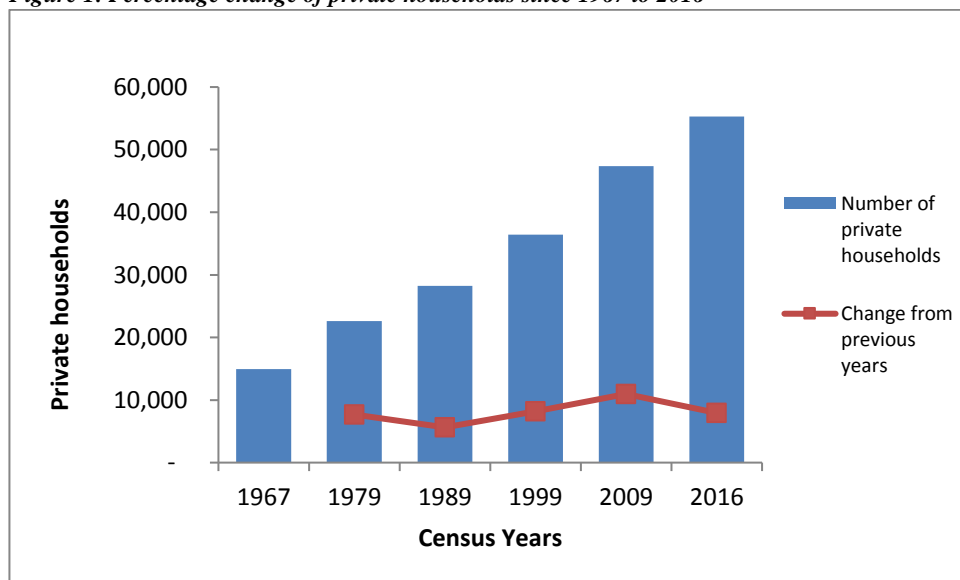
Presumably the number of private households increases with population growth. The table below is the summary of the recorded number of private households since 1967 to the last census. Major changes in the growth of private households can be seen during a major incident or disaster therefore this will be further investigated below.

Table 1: Number of private households since 1967 to 2016

Census Years	Number of private households	Change from previous years	Percentage change
1967	14,937		0
1979	22,621	7,684	51.4
1989	28,252	5,631	24.9
1999	36,415	8,163	28.9
2009	47,373	10,958	30.1
2016	55,285	7,912	16.7

Source: VNSO, VNPHC

Figure 1: Percentage change of private households since 1967 to 2016



Source: VNSO, VNPHC

Figure 1 shows that even though there is a continual increase in the number of private households from 1967 to 2016 the change is not steady and there is a decrease in the change from 1979 to 1989 which could have been by the effect of TC Uma in 1987. There continues to be an increase to 2009 but then the change in the growth of private household in 2016 increased only by 7,912 private households compared to 2009 which showed a great increase of 10,958 private households. This could link to the damage caused by TC Pam on individuals living in private households. This can be clearer in the next censuses for evidence of the steady growth of private

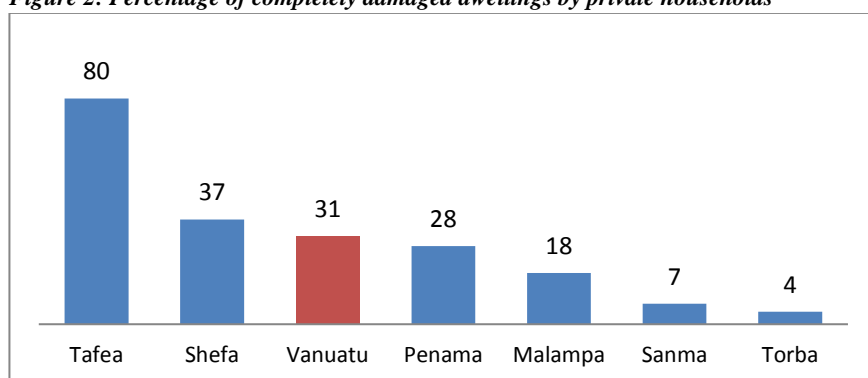
households compared to the previous censuses. The change shows that a major disaster does have a lot of impact on housing characteristics. Hence in the next analysis there will more investigation on the different changes occurring around housing characteristics.

Research Questions:

1. *What type of dwelling structures were mostly damaged by the cyclone? What materials were these houses made of? (Concrete, metal, etc)*

In the 2016 Post Pam Mini Census report, 31 percent of households in Vanuatu, interviewed in the 2016 Post Pam Mini Census, reported that they had a dwelling that was completely damaged by the Tropical Cyclone Pam in 2015 (see figure 2). About 37 percent of the households have household members seeking shelter elsewhere during the cyclone. Tafea province experienced the greatest damage of dwellings as reported by 80% of the private households and despite TC Pam wind forces being very destructive in Shefa Province, 7,395 (less than half, 37%) of the private households reported a completely damaged dwelling during the ordeal of TC Pam (see table 1 - Appendix).

Figure 2: Percentage of completely damaged dwellings by private households



Source: 2016 Post Pam Mini Census Vol1 report, VNSO

Figure 2 above indicates that of all the provinces more than half of the households in Tafea experienced a completely damaged dwelling by the category 5 TC Pam compared to other provinces. This is followed by Shefa province which has almost 40% of households that reported a damaged dwelling. These two provinces had the higher number of reported damaged dwelling experienced by TC Pam.

To further investigate the types of houses or dwellings that were damaged by the cyclone in each province would be difficult as the 2016 Mini census report has very limited data relating to the dwellings damaged by the cyclone. However, table 2 below outlines the types of dwellings damaged by cyclone Pam according to the Vanuatu Post-disaster needs assessment report. Out of the 8,101 totally damaged houses, 27% were permanent houses, 30% semi-permanent and 43% traditional houses. On the other hand, the partially damaged houses comprised more permanent houses than traditional houses suggesting that permanent houses are more resilient to the cyclone than the traditional houses.

Table 2: Totally and partially damaged houses by type

Typology	Total damage		Partial damage	
	Number	Value	Number	Value
Permanent House	2,205	3,968,773	3,489	2,512,306
Semi permanent house	2,445	733,523	3,131	375,723
Traditional house	3,451	1,035,366	1,535	184,151
TOTAL	8,101	5,737,662	8,155	3,072,180

Source: Vanuatu Post-disaster needs assesment, Tropical Cyclone Pam, March 2015

Based on the information above, the majority of dwellings damaged by cyclone Pam were constructed with traditional materials. Therefore table 3 below shows percentage changes in the traditional materials used in the most affected provinces in Vanuatu. In Shefa province there is a decrease in the use of traditional materials for roofing as shown by -0.18% compared to Tafea which is constant with 0.0% change. As for the walling materials, the use of traditional materials has decreased by -0.52% for Shefa and likewise by -0.10% for Tafea. This negative change from traditional materials used as building materials seem likely to result from the lessons learned in the damage by cyclone Pam.

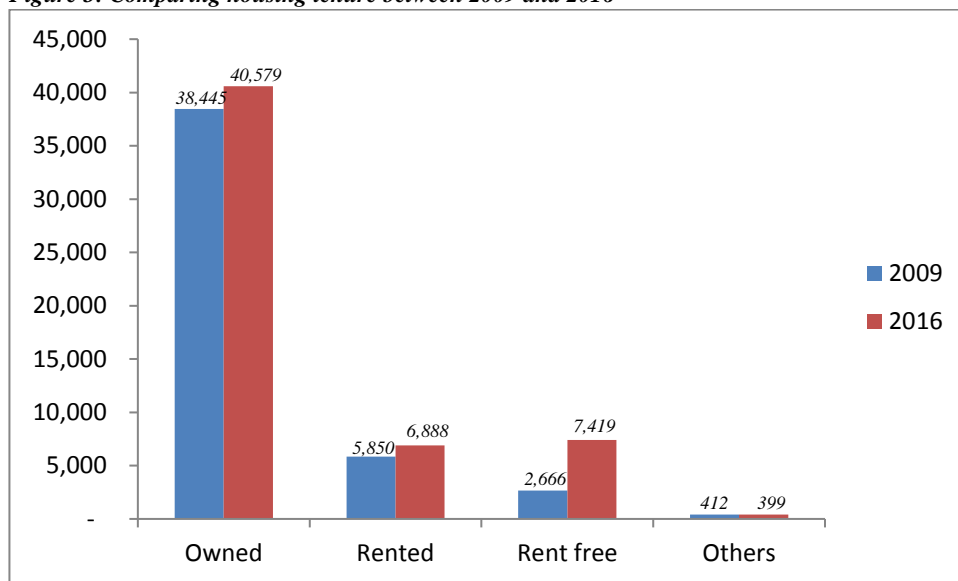
Table 3: Comparing changes in building materials for Vanuatu, Shefa and Tafea

Building Materials		Vanuatu			Shefa			Tafea		
		2009	2016	% Change	2009	2016	% Change	2009	2016	% Change
Roof Materials	Metal (kapa)	48.14	54.66	0.14	84.71	89.93	0.06	27.70	33.68	0.22
	Palm(Natagura) straw	45.20	44.12	-0.02	9.91	8.09	-0.18	65.15	65.04	0.00
	Concrete	2.93	0.46	-0.84	2.47	0.80	-0.67	2.37	0.10	-0.96
	Plastic sheeting / tent / tarpaulin	2.01	0.45	-0.78	1.78	0.71	-0.60	1.40	0.53	-0.63
	Other materials	1.73	0.12	-0.93	1.13	0.10	-0.92	3.38	0.63	-0.81
Wall Materials	Makeshift or improvised materials	2.95	2.24	-0.24	4.72	1.43	-0.70	1.32	0.92	-0.30
	Traditional materials	42.83	38.52	-0.10	8.23	3.95	-0.52	67.06	60.34	-0.10
	Wood	9.52	6.86	-0.28	7.58	4.82	-0.36	5.06	5.30	0.05
	Concrete, cement brick	24.92	27.87	0.12	38.98	43.76	0.12	11.60	10.48	-0.10
	Metal	18.88	23.11	0.22	39.59	45.26	0.14	12.16	22.21	0.83
	Other	0.91	0.99	0.09	0.90	0.17	-0.81	2.80	0.54	-0.81
Floor Materials	Concrete	59.72	61.92	0.04	78.10	70.67	-0.10	23.59	23.11	-0.02
	Wood bamboo palm	5.65	16.80	1.97	3.82	5.48	0.44	10.80	45.40	3.20
	Coral Sand soil	22.47	16.34	-0.27	9.39	10.58	0.13	45.52	31.04	-0.32
	Metal	1.12	4.82	3.31	1.79	13.11	6.33	0.87	0.34	-0.61
	Improvised materials	1.47	-	-1.00	1.39	-	-1.00	1.42	-	-1.00
	Other materials	9.58	0.13	-0.99	5.52	0.16	-0.97	17.80	0.12	-0.99

Source: 2016 Post Pam Mini Census Vol1 report, VNSO

2. Compare the changes in the dwelling tenure to see which dwelling tenure is common before and after and see if this affected the rebuilding of homes after the TC Pam. Are there a lot of people not living in their own homes but in rent houses and rent free homes?

Figure 3: Comparing housing tenure between 2009 and 2016

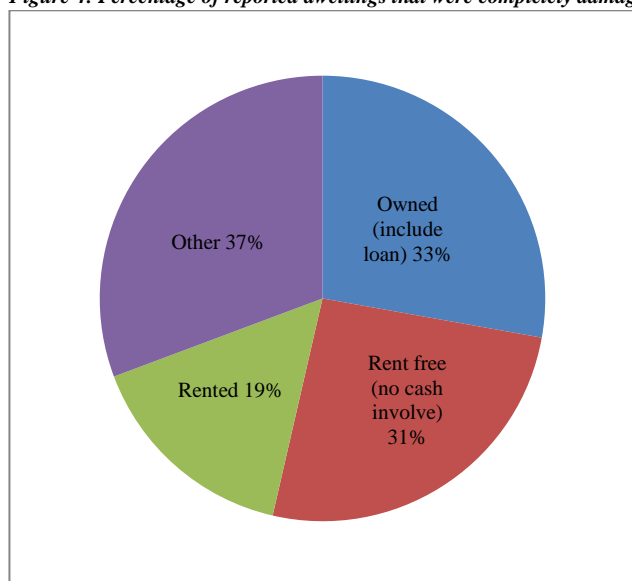


Source: VNSO, VNPFC

In the 2016 Mini Census report, there was a category of housing tenures referred to as ‘Rent free’ comprising of households living in a house free of rent yet not being the owners. The tenants in these ‘Rent free’ households are either looking after the houses while the owners are living elsewhere, are living with relatives rent free, or are government employees living in government houses .

Figure 3 shows that in 2009 about 40,000 households lived in owned houses and this number was almost constant in 2016. Similarly about 6,000 households lived in rented housing in 2009 and still in 2016. Significantly the housing tenure in 2016 has an increase of more than 5,000 households in the rent free tenures compared to 2009 which is a very high increase compared to other tenure types with a constant increase. The rent free tenures could be that most of the people who were affected by the cyclone had moved to live in other places.

Figure 4: Percentage of reported dwellings that were completely damaged by housing tenure



Source: 2016 Post Pam Mini Census Vol1 report, VNSO

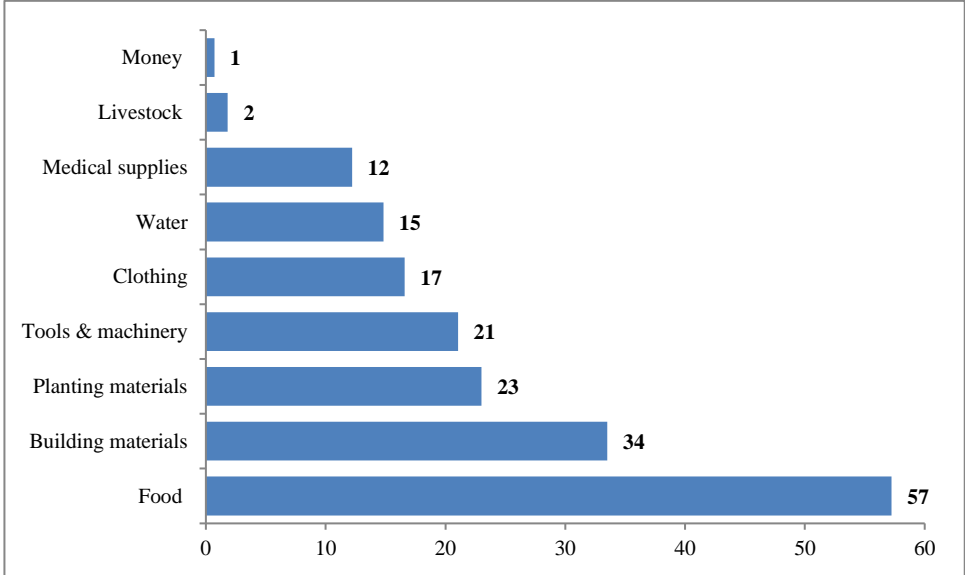
In figure 4 above, 33% of households living in owned houses reported that their dwellings had been completely damaged by TC Pam which is relatively similar to rent free households of 31%. It is very low though in the households of rented houses indicating that the majority of the reported damaged dwellings had been rebuilt as they have a high share in the owned houses.

3. Ranking the aid received in their various forms to determine what was the most needed aid after the cyclone so that the government may need to put more focus on to help the people in Vanuatu for their recovery.

After the cyclone, aid was received in various forms to assist people in the recovery process. Prior to the aid distribution, assessment had to be carried out to determine what was needed in what parts of the country to determine fair and relevant distribution amongst the people.

According to the Mini Census report, food was the most distributed aid comprised almost 60% of the total aid support delivered, followed by 34% of building materials through to cash, which as the least distributed and comprised only 1% of money. (See figure 5 below)

Figure 5: Percentage of aid support received in the order of the most distributed to the least in Vanuatu



Source: 2016 Post Pam Mini Census Vol1 report, VNSO

When compared to the Vanuatu Post disaster needs assessment report (see extracted table 4 below), private housing (32%) was the most affected sector although, because of people’s immediate survival needs, building materials appear to be second in demand to food (see figure 5 above).

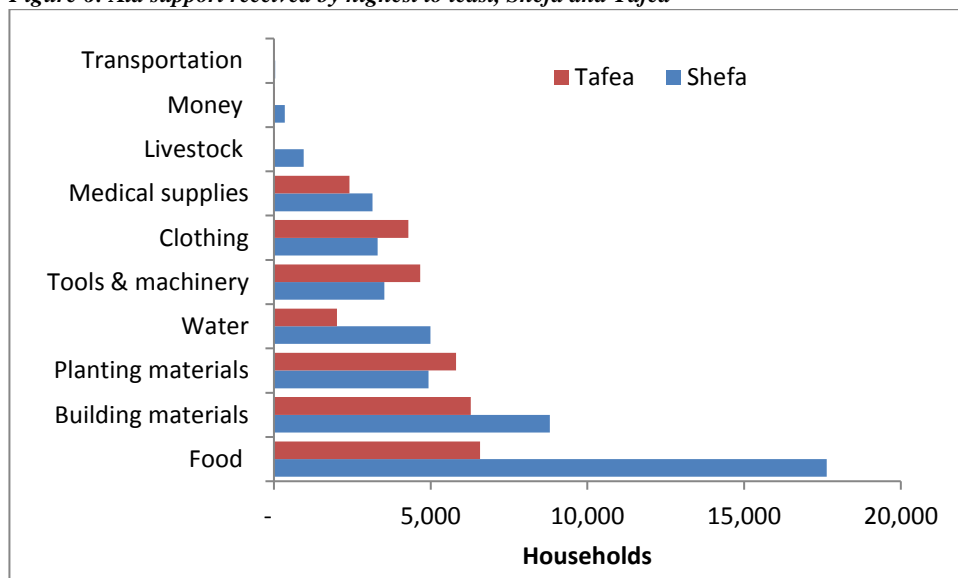
Table 4: Summary of Damage and loss by sector

	Damage		Losses		Total Effects	
	VT (millions)	Percentage of total	VT (millions)	Percentage of total	VT (millions)	Percentage of total
Productive Sectors	8,526	29	10,403	54	18,928	39
Agriculture	1,421	5	4,641	24	6,062	12
Commerce and Industry	1,196	4	2,152	11	3,348	7
Tourism	5,908	20	3,610	19	9,518	20
Social Sectors	14,339	49	630	3	14,969	31
Housing (Private)	9,452	32	440	2	9,893	20
Health	869.793	3	106.91	1	977	2
Education	3,908	13	79	0	3,987	8
Culture	108.651	0	3.428	0	112	0
Infrastructure Sectors	6,403	22	2,926	15	9,329	19
Transport	3,017	10	2,137	11	5,155	11
Public Buildings	532.359	2	12	0	544	1
Water	414	1	284	1	697	1
Energy	179.4	1	105.5	1	285	1
Communication	2,261	8	387	2	2,648	5
Cross-Cutting Sector	0	0	5328	28	5328	11
Environment	0	0	5,328	28	5,328	11
Grand Total	29,268	100	19,286	100	48,554	100

Source: Vanuatu Post Disaster Needs Assessment report, 2015

Looking at the two most affected provinces in Vanuatu (Shefa and Tafea), food was the most distributed aid supply reaching more than 15,000 households in Shefa. In Tafea the dominating aid supplies, building materials and food, were supplied to over 5,000 households. This high demand for food supplies and building materials in both Shefa and Tafea province compared to the other aid support being supplied indicate the immediate need for food and shelter in any substantial disaster response. (See figure 6 below)

Figure 6: Aid support received by highest to least, Shefa and Tafea



Source: 2016 Post Pam Mini Census Vol1 report, VNSO

Question D1b of the 2016 Mini Census questionnaire asked, ‘Does this household have any dwelling that was completely damaged during cyclones since TC Pam?’ Comparing the results provided in figure 1 with those below in table 4, Shefa reported 37% of households with damaged dwellings (see figure 2) compared to 44% of

households reported receiving aid support in terms of building materials (table 5). Likewise, in Tafea, 80% of households reported damaged dwellings compared to 92% of households receiving building materials supply.

Table 5: Percentage of households receiving aid support by support type for Shefa and Tafea

Aid support type	Shefa	Tafea
Food	89	96
Building materials/tarpauline	44	92
Planting materials/medicine	25	85
Water	25	29
Tools/machinery/equipment	18	68
Clothing	17	63
Medical supplies/medicine	16	35
Livestock (chickens cattle etc)	5	0
Money	2	0
Transportation	0	0

Thus the 7% difference in aid between completely and partially damaged suggests that most partially damaged building were still habitable and required only minor or temporary aid to make them liveable .

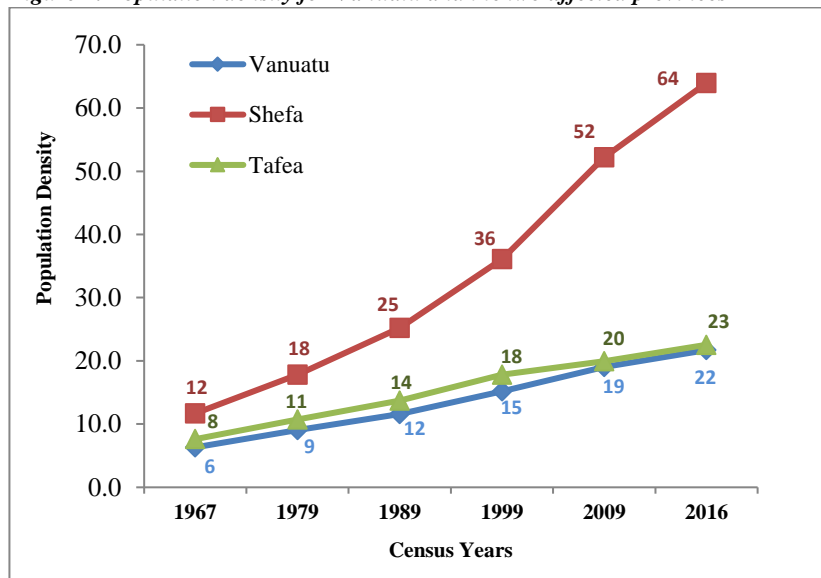
4. Is there any issue associated with the TC Pam such as overcrowding? If there is overcrowding, is there a relationship between household income and household size which may be the cause to overcrowding?

Usually there are a lot of issues after a major disaster and expectations are that there will be overcrowding issues after TC Pam. Therefore this last question will look into the issue of overcrowding and see whether it is associated with TC Pam recovery.

In her report ‘Housing in greater Christchurch after the earthquake’ Dr Rosemary Goodyear measures crowding in accordance to the Canadian National Occupancy Standard (CNOS) which best fits the New Zealand social context. There are a few criteria under the CNOS which describes the context of crowding and one of these criteria is “There should be no more than two people per bedroom; parents or couples share a bedroom” (pg 60). Crowding issues can lead to other issues such as poor health conditions, financial issues, and food problems. In the Vanuatu context, according to a 2009 Annual development report, overcrowding is when there are 3 or more persons per room, page 62 of the report states.

Unfortunately the 2016 Mini Census report does not have detailed information on housing thus there are challenges in producing analysis on overcrowding based on the number of rooms and household size. Therefore from the information collected, figure 7 below shows the population density instead, to see the changes in the number of person per square kilometre.

Figure 7: Population density for Vanuatu and the two affected provinces

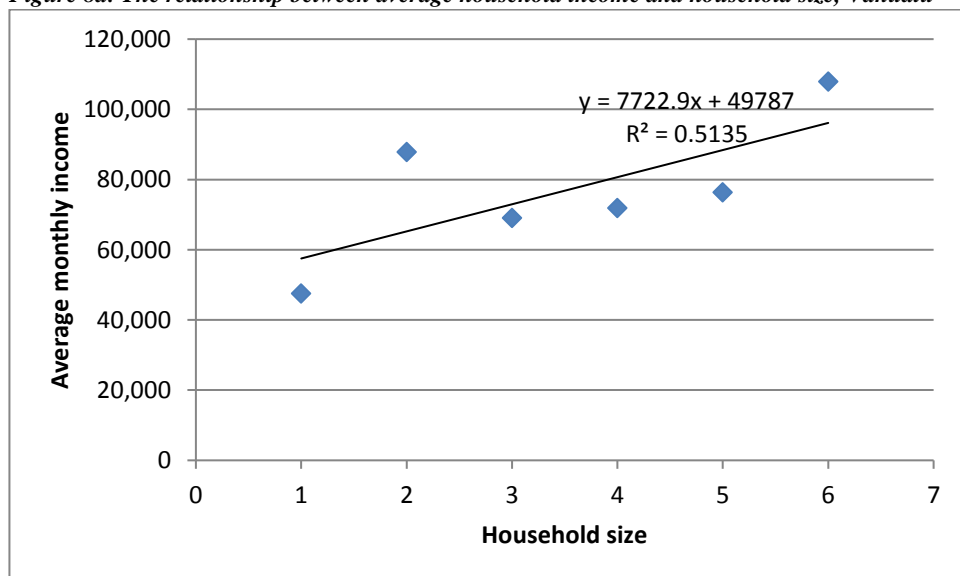


Source: 2016 Mini Census and 2009 Population and Housing Census

Figure 7 above indicates that in Shefa province the population density is really high compared to Tafea and Vanuatu. The growth of 52 people per km² in 2009 was a great increase from 36 people per km² in 1999 and this increased by another 12 people per km² in 2016 for Shefa. Typically between the census years the population density in Tafea and Vanuatu was constant except for Shefa. One reason could be of the job and education opportunities offered in Shefa but the change was not significant in 2016 compared to 2009. Therefore this could suggest that Shefa is becoming crowded and the rate is rapidly increasing compared to other provinces.

The overcrowding issue after TC Pam however cannot be determined in reference to the term used by the 2009 Annual Development report to define overcrowding. Yet it is shown by population density and in due course over the next census, this may change and become evident. Figure 8a, 8b and 8c shows the relationship between the latest household income and household size for comparison between Shefa, Tafea and Vanuatu.

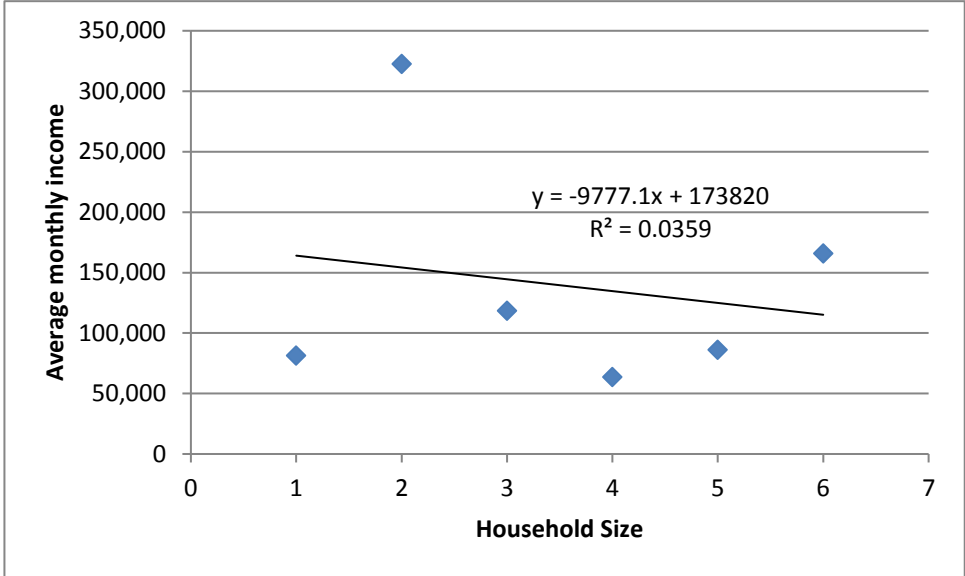
Figure 8a: The relationship between average household income and household size, Vanuatu



Source: 2010 HIES, VNSO

Figure 8a shows that in 2010, there is a moderate relationship between the average household monthly income and the household size. This means that the higher the household size, the higher the average household monthly income. So the average monthly income for a household is vt 49,787 plus 7,722.9 as the household size increases by one person.

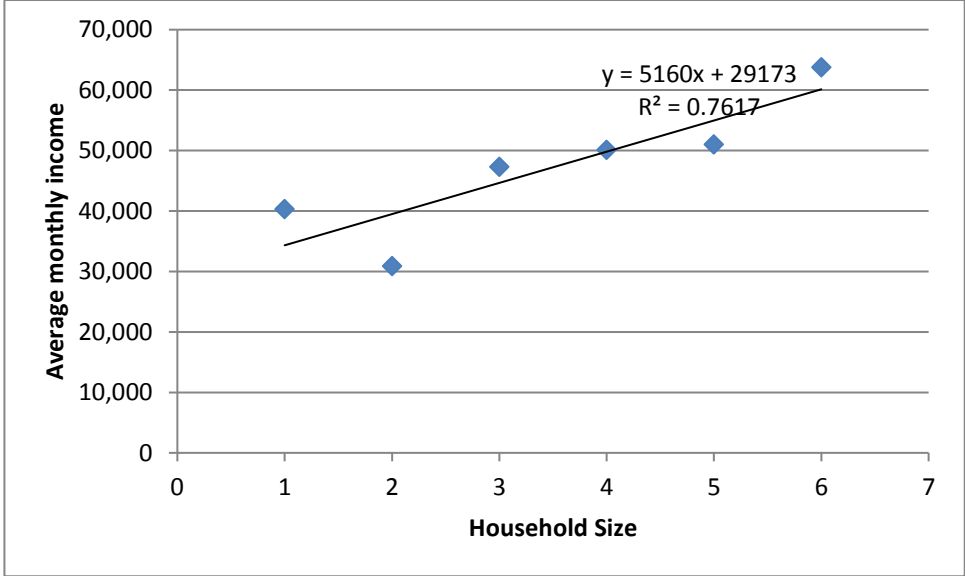
Figure 8b: The relationship between average household income and household size, Shefa



Source: 2010 HIES, VNSO

On the other hand, figure 8b shows that in 2010, there is no relationship between the average household monthly income and the household size for Shefa. This means that the average monthly income for Shefa is 173,820vt and for every person added to the household size the average monthly income decreases by -9,777vt.

Figure 8c: The relationship between average household income and household size, Tafea



Source: 2010 HIES, VNSO

Unlike Shefa, there is a strong relationship between the average household monthly income and the household size for Tafea. The average monthly income is lower by 29,173vt compared to Shefa and for every person added to the household size the average monthly income increases by 5,160vt.

Conclusions

The 2016 Post Pam Mini Census report has very limited data thus the analysis being done in this research is only limited.

It was reported that there were a total of 31% of damaged households in Vanuatu with the most being in Tafea province where an 80% of dwellings were completely destroyed by TC Pam. The mini-census data does not show, however, what types of building materials these houses were made of but the Vanuatu Post assessment needs reported that most of the houses that were destroyed were traditional houses composing of 43%. Current household figures show that in 2016, most houses use metal for wall and roof constructions and there has been a decline in using wood for constructing walls. There was a 0.06% increase in metal especially for Shefa and despite the greatest damage of over 80% houses in Tafea, there is still constant use of traditional material for roofing with a small increase of 0.22% use of metal. Compared to walling materials, the use of traditional materials has decreased for both affected provinces as shown by a -0.52% for Shefa and -0.10% for Tafea.

The key results show that the TC Pam did affect the change in the number of private households and so the change in the number of households decreased by almost 30% to 7,912 after Cyclone Pam compared to 10,958 in the previous census year.

The 2016 housing tenure data indicates that a significant 5,000 more households now live in rent free houses compared to 2009 which was only 2,700 households. This could be the result of dwellings being damaged which has forced people to move into other houses and still living in those houses. In spite of this high increase, the other housing tenures have been constant over the census years with very little changes.

The most distributed aid was reported to be food which was about 60% of the total aid supply distributed followed by 30% of building materials which shows the urgent need for attention in preparation for a natural disaster.

And lastly the 2010 HIES report (which is the latest updated report) on household income shows that with increasing household size, as could be expected, that the average monthly income has also increased. However, this does not necessarily suggest that there is a positive relationship between average income and average household size. Crowding produced by moving people from destroyed housing into shared accommodation could be distorting these figures. Again, it needs to be stressed that the data is limited and further research is needed to find the link to overcrowding issues with household size and the number of rooms.

Recommendations

In the book, "Traditional architecture in Vanuatu" Christian Coiffier describes traditional housing variation from province to province. Housing structures differ in the provinces of Vanuatu and the lack of available data, particularly following TC Pam, strongly suggests that further research should be undertaken to find out whether the building structures from the early ages were more cyclone resistant compared to modern building structures even though there is indication that the most damaged households were made of traditional materials.

Finally, in order to do more useful analysis to identify overcrowding issues, there need to be questions included in future census questionnaire on the number of rooms in a dwelling as well as an average monthly income. Additional questions need to be included on what housing materials were used in dwellings that were completely damaged. This might give us some ideas of what dwelling structures are prone to cyclones, or are mostly damaged by cyclones and whether the municipal government might change some building codes to increase the number of cyclone proof homes.

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Appendix

Table 1: Number of households with damaged dwelling

	Total Private households	Dwellings completely damaged by cyclone	Household with members seeking shelter elsewhere
Vanuatu	55,285	17,286	20,202
<i>Rural</i>	<i>41,296</i>	<i>3,161</i>	<i>4,765</i>
<i>Urban</i>	<i>13,989</i>	<i>14,125</i>	<i>15,437</i>
Torba	1,960	86	221
Sanma	10,704	781	526
Penama	6,959	1,926	1,968
Malampa	8,896	1,614	1,993
Shefa	19,913	7,395	9,940
Tafea	6,853	5,484	5,554

Source: 2016 Post-TC Pam Mini Census report vol 1

Table 2: Percentage of reported damaged dwelling per provinces

Region	Yes	No
Vanuatu	31	69
Torba	4	96
Sanma	7	93
Penama	28	72
Malampa	18	82
Shefa	37	63
Tafea	80	20

Source: 2016 Post Pam Mini Census Vol 1

Table 3: Order of aid support received from most supplied to least by Vanuatu, Shefa and Tafea province – 2016 TC Pam

Aid received	Yes			No		
	Vanuatu	Shefa	Tafea	Vanuatu	Shefa	Tafea
Food	31,643	17,641	6,579	993	253	162
Building materials/tarpauline	18,528	8,807	6,277	14,108	9,087	464
Planting materials/medicine	12,713	4,933	5,808	19,923	12,961	933
Tools/machinery/equipment	11,633	3,520	4,665	21,003	14,374	2,076
Clothing	9,177	3,304	4,284	23,459	14,590	2,457
Water	8,191	4,993	2,007	24,445	12,901	4,734
Medical supplies/medicine	6,742	3,141	2,414	25,894	14,753	4,327
Livestock (chickens cattle etc)	1,010	950	22	31,626	16,944	6,719
Money	391	346	28	32,245	17,548	6,713
Transportation	75	41	20	32,561	17,853	6,721

Source: 2016 Post Pam Mini Census Vol 1

Table 4: Population by region for the census years and the population density, 1967-2016

Region	Population in census year						Land Area (km ²)	Population Density (number of persons per km ²)					
	1967	1979	1989	1999	2009	2016		1967	1979	1989	1999	2009	2016
Vanuatu	77,710	111,251	142,419	186,678	234,023	266,555	12281.25	6.3	9.1	11.6	15.2	19.1	21.7
Torba	3,481	4,958	5,985	7,757	9,359	9,875	867.33	4.0	5.7	6.9	8.9	10.8	11.4
Sanma	12,785	19,423	25,542	36,084	45,855	52,145	4262.06	3.0	4.6	6.0	8.5	10.8	12.2
Penama	13,968	18,937	22,281	26,646	30,819	31,334	1203.92	11.6	15.7	18.5	22.1	25.6	26.0
Malampa	17,407	23,567	28,174	32,705	36,727	39,997	2808.41	6.2	8.4	10.0	11.6	13.1	14.2
Shefa	17,633	26,860	38,023	54,439	78,723	96,405	1507.36	11.7	17.8	25.2	36.1	52.2	64.0
Tafea	12,436	17,506	22,414	29,047	32,540	36,799	1632.17	7.6	10.7	13.7	17.8	19.9	22.5

Source: 2009 and 2016 Population and housing census report, VNSO