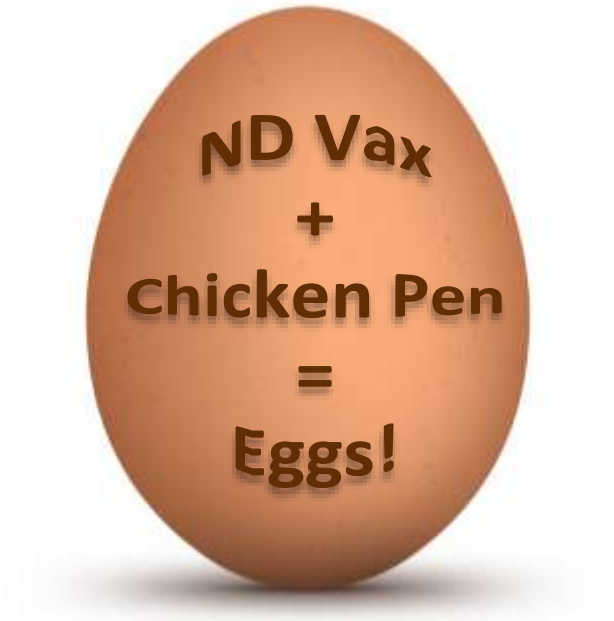
Raising Chickens in Timor-Leste

A Practical Consideration of Current Practices

KADI
KAPASIDADE



This report is dedicated to Nino Xavier who learnt to love the chickens at Kadi Kapasidade. He worked hard in setting up and monitoring the chicken pilot project and looking for solutions to many of the challenges we faced in raising chickens in Timor-Leste.

Cover photo: Some of the chickens outside the pen in Kadi Kapasidade with Nino.

All photos from Kadi Kapasidade unless otherwise indicated.

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Introduction

Chickens are an important part of the life and cultural fabric of Timor-Leste. They are exchanged as gifts during cultural ceremonies, used in social gatherings for cock-fighting and are often represented in art and business. It is commonly postulated that the domesticated chicken had its origins in the red jungle fowl (*Gallus gallus*) from South East Asia. Charles Darwin even mentions Timor in his discussions in 1868 about the origin of chickens. (Darwin, 1868) This species can still be found roaming the jungles of Timor-Leste as an un-tamed bird.

According to the 2015 National Census, Timorese families were raising over 900,000 chickens across the country. The domesticated chicken raised by families appears to vary little from the red jungle fowl in many cases. However, there are a variety of different colours, shapes and sizes that suggest other genes have been introduced into the general chicken population of Timor at various stages in the past.

Red Jungle Fowl (Ericsson, 2017)

Despite the long history of chicken keeping in Timor-Leste, production rates are very low compared to those globally. This practical report sets out to briefly describe the current situation in Timor-Leste, the challenges in chicken keeping and the opportunities to make significant improvements especially in the area of protection from predation. It is not intended to replicate the numerous excellent resources available on raising chickens in developing countries. For a more complete and technical understanding of chicken raising we recommend the following resources:

- *Improving Village Chicken Production: A manual for field workers and trainers*. (Ahlers, et al., 2009) An excellent manual from ACIAR for nutrition, health and disease, including Newcastle Disease (ND).
- *Decision Tools for Family Poultry Development.* (FAO, 2014) Particularly useful for NGOs hoping to engage in a chicken project.
- *Constraints to production of village chickens in Timor-Leste.* (Serrão, 2012) This is a detailed research paper on constraints to chicken production which forms the baseline assumptions around chicken survival in this report and also has an extensive overview of feed types and their nutritional value.
- *Kuidadu ba rai, kuidadu ba ema, ho futuru Timor Leste: A permaculture guidebook for East Timor.* (McKenzie & Lemos, 2008) Published by Permatil, the permaculture organisation of Timor-Leste. This book is produced in Tetun and English and has a short but useful guide to chicken production with different ideas for chicken pens.

The Importance of Chickens for Timorese Families

Improvements in household food security and agricultural production do not neccessarily result in improved nutrition. Recent successes in improved staple food production have been demonstrated by programs such as Seeds of Life (Nesbitt & Spyckerelle, 2016) and the various food storage programs such as the IFAD drum project. (Thapa & Hessel, 2016) This has resulted in more Timorese families having a higher production in staple food sources such as corn and rice which is vital for basic survival as well as improved storage capacity. However, malnutrition is still a major challenge across Timor-Leste with half of Timorese children being stunted (low height for age) and almost 1 in 5 categorised as wasted (low weight for height). (Health Survey, 2010)

Chickens are an important source of nutrition and potential income for farmers across Timor-Leste. Over 80% of households outside of the city of Dili raise chickens and chicken numbers have increased nationally by 32% from 2010 to 2015. (General Directorate of Statistics, 2015) At this rate the total chicken population is likely to have surpassed 1,000,000 in 2019. Chicken prices generally range from USD5 (young pullets) to USD25 (roosters). At an average value of USD8 per bird this industry can potentially rival the coffee industry in Timor-Leste with minimal inputs.

Chickens are also a small asset unit compared to other livestock such as cows, pigs and goats which means that a family can have a number chickens and still afford to sell, exchange or eat one as required. They provide one of very few opprtunities to derive daily protein benefit from egg production without reducing livestock numbers (the milking of cows and goats is still yet to be developed).

Chicken eggs are well recognised as an excellent source of nutrition contained in a convenient package. Some benefits include:

- An excellent source of good quality protein for body growth and repair
- A natural source of vitamin D essential for strong bone and muscle development as well as overall health
- Rich in vitamin A for healthy skin and teeth as well as promoting good vision
- Rich in vitamin E – an anti-oxidant that aids in protecting body tissue from disease
- A good source of vitamin B12 which is essential for brain and nervous system function and aiding proper blood formation (particularly difficult to source from vegetables)
- Omega-3 Fatty acids which, among other benefits, are important for infant development
- Anti-oxidants such as selenium which protects the immune system
- Choline which supports healthy metabolic function of the liver, brain, nervous system and muscles. It's important for supporting foetal brain development during pregnancy.
- Iron which is important for the production and function of haemaglobin in blood, the main protein for carrying oxygen. (Australian Eggs, 2018)

Nutrition Facts

12 servings per container

Serving Size 1 egg (50g)

Amount per Serving	
Calories	**70**
	% Daily Value
Total Fat 5g	**6%**
Saturated Fat 1.5g	**8%**
Trans Fat 0g	
Cholesterol 185mg	**62%**
Sodium 70mg	**3%**
Total Carbohydrate 0g	**0%**
Dietary Fibers 0g	
Total Sugars 0g	
Includes 0g Added Sugars	**0%**
Protein 6g	**12%**
Vitamin D 1mcg	6%
Calcium 28mg	2%
Iron 1mg	6%
Potassium 69mg	2%
Riboflavin 0.2mg	15%
Vitamin B_{12} 0.4mcg	15%
Biotin 10mcg	35%
Panthothenic Acid 1mg	20%
Iodine 27mcg	20%
Zinc 1mg	10%
Selenium 15mcg	25%
Molybdenum 8mcg	20%
Choline 147mg	25%

*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrion advice.

Calories per gram

Fat 9 Carbohydrates 4 Protein 4

A full list of nutrients can be found in the appendix.

Research has shown that the Body Mass Index (BMI) of children in Timor-Leste declines during the wet season when food is scarce compared with the dry sesaon. (Spencer, 2016) This is the period of the year when the staple crops have not yet been harvested. However, there is ample green vegetation, grubs and insects for chickens allowing for improved chicken production of meat and eggs. This suggests that there may be significant opportunity for improved child nutrition at a time of the year when they need it most. Chicken raising for egg and meat production also provides opportunities to improve women's livelihoods who are often the main carers for household chickens.

Take a walk in any village in Timor-Leste and you will soon see how chickens are a natural part of community life.

Section 1: An Overview of Current Practices and Constraints

In Timor-Leste, chickens are allowed to roam freely day and night and are not usually caged. This allows chickens to scavenge by scratching in the yard and through leaf litter in nearby gardens and under trees. This provides them with the bulk of their food source and nutrition. Occassionally food scraps are provided and sometimes cracked corn or rice which assists in keeping the chickens tame and around the house. Laying baskets are usually woven from a single palm leaf and hung high in a sheltered place such as under the thatched eaves of the outdoor kitchen. This provides protection from wind, rain, sun and some predators such as dogs and potentially cats. Eggs are not routinely collected as chickens are generally left to lay a clutch to hatch live chicks. A chicken can have 3 clutches per year, with around 12 eggs per clutch and of those around with 1-2 chicks survive to full productive maturity. (Serrão, 2012)

A traditional hut in Atekru, Atauro, with suspended woven baskets for chickens to lay eggs.

Roosters are highly valued as they can be sold for USD25 or more depending on the size and nature of the rooster. A rooster being raised for sale or fighting will often be kept with a cord around 1m long near the house and hand fed. This reduces the risk of it being lost or stolen. Laying hens may fetch a price of around USD12-15 but are not usually sold as they are kept for laying. A few farmers may sell pullets at USD4-8 at local markets to supplement their income.

The Huge Losses in Chicken Mortality

Successful chicken production is very challenging in Timor-Leste if farmers are considering increasing their income from this commodity. Farmers must manage risks related to predation, disease, theft, nutrition and climate challenges. The cost of inputs to manage these risks may not be seen as worthwhile given the average national survival rate of around 11%.

Serrão's research into the constraints to village chicken production in Timor-Leste provides a useful starting point for understanding the huge loss in chicken numbers. (Serrão, 2012) He surveyed 308 households in Aileu, Lautem, Liquica and Manatuto, at three different times of the year. His survey results provide a startling insight to the constraints to chicken production. In the table below, the observed results from his research are listed and then a calculation is made on the number of chickens remaining at the end of each stage in chicken growth and the main cause of death (by category) is estimated based on the survey results.

Table of chicken losses after hatching in Timor-Leste

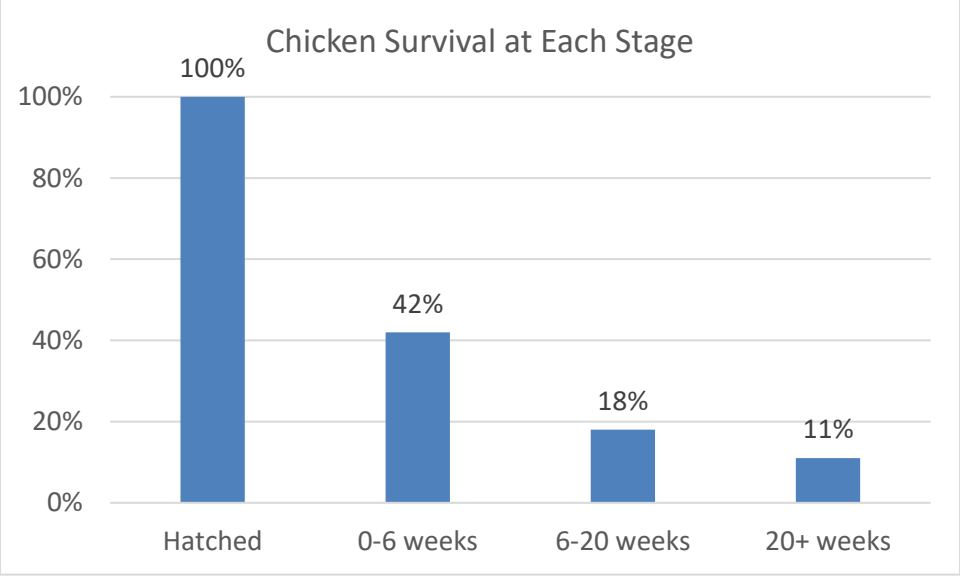
Stage	Description	Observed result	Amount remaining (% of hatched)	Death by predation	Death by climate	Death by disease	Death by other	Note
Laid	Eggs laid per year: 3 clutches x 12 eggs	36	36					1
Incubation	Eggs eaten by households: 3 clutches x 2 eggs	6	30					
Hatching	Average hatching rate	82%	100%					2
Chick (0-6 wks)	Deaths predominately from predation and climate	58%	42%	40%	13%	2%	4%	3
Grower (6-12 wks)	Deaths predominately from predation and disease	56%	18%	14%	0%	5%	4%	4
Adult	Deaths predominately from disease	39%	11%	2%	0%	2%	3%	5
	Totals		**11%**	**56%**	**13%**	**9%**	**12%**	

"Only 11% of all chickens hatched reach full productivity as adults."

Notes on data in the previous table:

1. Anecdotal evidence suggest clutch sizes from 8 up to 14.
2. Hatching rate may be affected by climate such as storms and also predation. For example, dogs are known to eat whole clutches at one time. Rats and snakes are also common predators of eggs. These losses may not have been reported. A hatching rate of 82% falls within a normal range globally and, for these calculations, the number of chickens hatched is set at 100%.
3. 58% of all chicks hatch are reported to die. Chicks are very susceptible to predation as they are not able to run away. Death rates are based on Serrao's report as estimated by households (p.112).
4. 56% of remaining chicks die at this stage which only leaves 18% of those chicks that originally hatched . Predation is still reported as a major cause of death based on perceived main causes of death across 3 survey periods in Serrao's study. Note that disease was considered a higher killer than predation in December.
5. Only 11% of all chickens hatched reach full productivity as adults. Longevity increases risk to ND. A significant cause of loss is categorised as 'unknown' which may simply be due to adults wandering away to some unknown fate.

As can be seen from the data in the table, only 18% of chickens that hatch survive to maturity and only 11% of chickens reach full productivity. These devastating results are attributable to predation (approx. 56%), climate (approx. 13%) and disease (approx. 9%) This division in the causes of death is an estimate only based on the research, trials and practical experience in Timor-Leste. Further detailed study would be beneficial in this area to ascertain detailed causes of chicken losses. In any case, successful chicken keeping in Timor-Leste must give serious attention to predation, climate and disease in order to be successful.



Graph of chicken survival showing nearly 90% of chickens die prematurely.

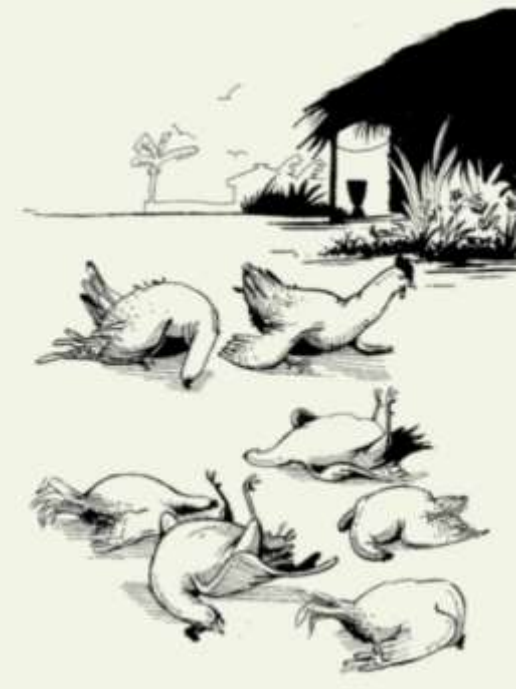
This report does not set out to outline in detail all the contraints to chicken production in Timor-Leste but rather to report on the 'journey so far' especially in relation to various efforts to address chicken predation through protection in chicken pens. However, some comments are provided below on the major killers.

Predation

Predation is the biggest killer of chickens in Timor-Leste. Most predation occurs between 0-6 weeks when chicks cannot run fast, jump or fly. Those that survive are the fittest – they are elite, acrobatic or very lucky birds. Predators include cats, dogs, rats, snakes and kites (hawks). Human thieves might also be included in this category. A simple observation can be done on any new clutch of chickens – sometimes they are observed to decrease by a bird or two each day as the local cat or dog takes their daily breakfast. Cats can hunt at any time but mainly in the evening (after dark) and early morning. Dogs are often looking for a meal around dawn. Rats and snakes are more active during the night. Kites such as the *makikit* (like Brahminy Kite) will hunt during the day and are reported as a major killer in rural areas. Different villages will have problems with different kinds of predators. Pens must be well-built to reduce access to the main predators found in a particular area. Any serious attempt at improving chicken production must work on the reduction of predation. This paper will look closer at the challenge of keeping out predators through the use of well designed chicken pens.

Newcastle Disease

A major constraint to chicken production in Timor-Leste is Newcastle Disease (ND) which can wipe out 50% - 100% of the flock within a few days. (Ahlers, et al., 2009) This disease is devastating to farmers in Timor-Leste and many empty chicken pens indicating failed attempts can be attributed to ND wiping out the whole flock and subsequently farmer interest in improving production. ND is caused by a virus and is spread easily from one chicken to the next by a variety of vectors including vehicles, dogs and other chickens. The main method of control is by vaccination which is being promoted and expanded by the Ministry of Agriculture and Forestry (MAF). It requires trained vaccinators who are normally the Government veterinary staff at Administration Post level. The farmer should have a reasonable way of catching the chicken (which is easier said than done). If the chicken cannot be caught then it cannot be vaccinated. Normally, farmers are notified in advance and they catch and restrain their chickens the night before vaccination day. The application of the vaccination is quick and simple – just a drop in the chicken's eye. Each farmer is recorded along with the number of chickens vaccinated and this data can give a very



Impact of Newcaslte Disease. Picture taken from the ACIAR guide, Improving village chicken production.

good indication of those farmers in the community who have the greatest interest and ability in raising chickens. Vaccination in Timor-Leste occurs 3 times a year and only in the months of March, July and November. All chickens in an ND vaccination program are vaccinated each time throughout their whole life. Farmers and organisations working in the area of chicken production must be active in planning for this vaccination and developing a solid connection to the MAF staff to ensure vaccination takes place. Without ND vaccination any attempts at improving chicken production are at great risk of failure.

MAF staff providing simple ND vax to rooster at Kadi.

Other Diseases

Timorese chickens appear fairly resistant to many diseases when allowed to roam freely and scavenge for their own food. A good list of potential diseases can be found in the ACIAR guide. Young chickens are more susceptible to a range of diseases if kept in pens for protection. In Timor-Leste, we have found that fowl pox appears to be more common. This viral disease spreads easily through the chickens in a pen resulting in ugly lesions and swelling particularly around the mouth and eyes. It is a debilitating disease that may result in a slow death as the bird is unable to eat and loses strength to compete within the flock.

Chickens suffering from fowl pox and unable to compete for food at pens in Kadi Kapasidade.

Keeping a pen clean and ensuring a well-balanced diet and clean water will help build a chicken's general health to be able to withstand such diseases. For fowl pox, a natural remedy that has proven successful is local Timorese tobacco soaked in water and drops of this water placed on the lesions morning and night for 7-10 days. In any case, pens should be regularly cleaned out, removing litter and droppings which can be used in the garden.

Climate Risk

Chickens, like all animals, do not cope well with extremes in weather. This is mainly exposure to rain and heat from the sun. In Timor, chickens are usually allowed to roam freely and adult chickens are skilled at finding protected places. However, most deaths occur from 0-6 weeks when small chicks can not cope as well with exposure to sun and rain. Care should be taken to ensure that chickens can find a place that is dry, cool and out of the wind. This is especially important for young chicks. Deaths can occur during heavy storms if young chickens become wet in the night and cannot get dry. Chickens kept in pens are at far more risk of climate exposure if the pen is poorly designed. In pens, attention needs to be paid to shading from sun from morning through to evening at all times of the year (the sun passes over the north in July and over the south in December). This affects the placement of nesting boxes to ensure that incubating hens are well protected at all times of the day and night and at no time should they receive direct sunlight. Two or three walls in a chicken pen should be lined to prevent wind and rain from entering.

Nutrition

Chickens get the best nutrition from free range scavenging that covers a wide area around the farmhouse. Farmers can supplement this with grains and scrap food. If chickens are kept in pens, they should be allowed to roam freely during the day in order to scavenge for food. If chickens are kept for longer periods in the pen then more attention needs to be given to their food supply. Food should include fresh greens, flowers and seeds from various grasses and plants. Consider their protein sources as well such as various beans and other pulses. This can be probitively expensive for a Timorese family but consider the issue of food storage so that a family can purchase grains and beans at harvest time when the price is lower and then feed to the chickens throughout the year and sell the chickens at a premium. Consider setting up insect and worm 'traps' such as a hole filled with organic matter, covered with roof sheeting for 3 weeks then allow chickens to scratch through it.

We have found the use of locally available had cranked food grinders helpful in reducing the burden of food preparation for chickens. Corn, beans and maringa leaves can be mixed in the hopper to turn out a nutritious feed source. (Cost USD22 from Nazareth Foundation, Comoro, Dili)

Hand cranked food grinder is great for reducing the labour burden of women in preparing food for both the family and the chickens.

Students at Kadi Kapasidade learn how to use a simple hand cranked food grinder to mix a variety of foods. Here they have picked maringa leaves and are grinding it with corn to make chicken food.

Kadi stored corn bought at the end of the corn harvest in air-tight 200L fuel drums. They cost around USD40 and can store about 185kg of corn costing USD90. Often this excess corn is lost to weavils so the cost of the drum is covered in the first year of purchase. We have added a screw cap lid at the bottom to aid in removing the corn. It is mounted on with a metal insert (from a down-water pipe flange) and rivets and the PVC screw cap is siliconed on. This addition costs around USD10.

A metal stormwater fitting is rivetted to the base of a drum and a PVC threaded cap fitting is siliconed onto this. This makes it much easier to remove a bucket of corn from the drum and the corn remains dry and weevil free.

Water Supply

It should not be assumed that a Timorese farmer automatically understands the importance of a fresh, clean supply of water for the chickens at all times. This is particularly important if chickens are kept in pens for any length of time. In our experience, farmers just do not make the link between health and water availability. Indeed, farmers themselves work long hours without drinking enough water until they suffer from headaches and painful kidneys. A cracked length of bamboo as a 'water trough' is generally not suitable. Any container left on the ground in a pen gets either tipped over or very dirty very quickly. Use uspended water supplies or another method to ensure the water is not tipped and does not get dirty. We have found Timorese chickens are very flighty (unlike calm, fat, egg laying breeds of other countries). This means they often knock over suspended water supplies. After many years of testing different ideas, our best solution has been the simple water nipple fixed into the lid of a used aqua bottle. The water stays sealed and clean and is only delivered to the chicken as the chicken needs it.

Breeding

Breeding is a long term consideration. Timorese chickens have very low rates of egg production. They are also very flighty. This gives them greater ability to get away from predators but makes them very difficult for the farmer to raise. Egg laying breeds from other countries are imported for large commercial enterprises such as in Railaco but are not generally available to smaller chicken farmers. These laying breeds may also be more suseptible to tropical diseases. Kadi is exploring a cross between the imported laying breeds (possibly related to the Isa Brown variety) and the local chicken. The aim is to increase egg production while maintaining some disease resistance.

Nino Xavier, Manager of Kadi Kapasidade, with a cross-bred rooster.

The ‘Care-Factor’

Not every farmer wants to get more serious about raising chickens. Each family has its own interests and life circumstances that are important to them. A farming family needs to *want* to raise chickens more successfully before considering investing energy in vaccination and a chicken pen. They also need to care for the chickens well-being. We have had some participants in our training centre lose more than 10 chicks to cats before noticing the loss and even then they didn’t take action to protect the chicks. Others will leave the chickens locked in a pen all day with no food or water. Those farmers that care will know how many chickens they have and will know when a chicken dies. They will want to know when the next vaccination round is coming and will prepare for it. When the chickens get sick they will take action to provide medicine. They will take pride in their chickens and value the benefit of increased production. An excellent way to find the farmers who are really interested in raising chickens is to ask the MAF staff who do the vaccinations. They keep data on farmers in villages and how many chickens they had vaccinated. Target the farmers with the most chickens who can lead the way in adopting improved chicken raising practices. The ‘care-factor’ is a vital component to the success of a chicken raising endeavour. We have found that the ‘care-factor’ is often not an automatic social attribute but it can be learned and developed over time.

“The ‘care-factor’ is a vital component to the success of a chicken raising endeavour.”

Ratu getting to know the growers at Kadi Kapasidade.

Section 2: Kadi Kapasidade Chicken Production Pilot

Kadi Kapasidade ran a 12 month chicken production pilot from July, 2016, until June, 2017. The main aim was improve chicken survival rates from a national rate of 11% up to a survival rate of 30%. We defined survival rate as the number of all chickens that died compared with the number of chickens that were born during a 3 month period. Only 8 pens were established and farmers displayed a range of commitment to the program. We were specifically focussing on the impact of using chicken pens on survival rates.

Pilot Design

This pilot had three components:

- Chickens had to receive ND vaccinations
- Chickens were kept during the night in secure pens
- Simple guidance and advice was provided each month with monitoring

Inputs

- Kadi supplied a chicken pen, guidance and monitoring – some of these pens are described in section 3. Some of these were installed by Kadi staff together with the farmer
- MAf supplied Newcastle Disease vaccination – all chickens were to be vaccinated every 4 months with a simple eye-drop vaccination by MAF staff.
- The farmer supplied the chickens and chicken feed

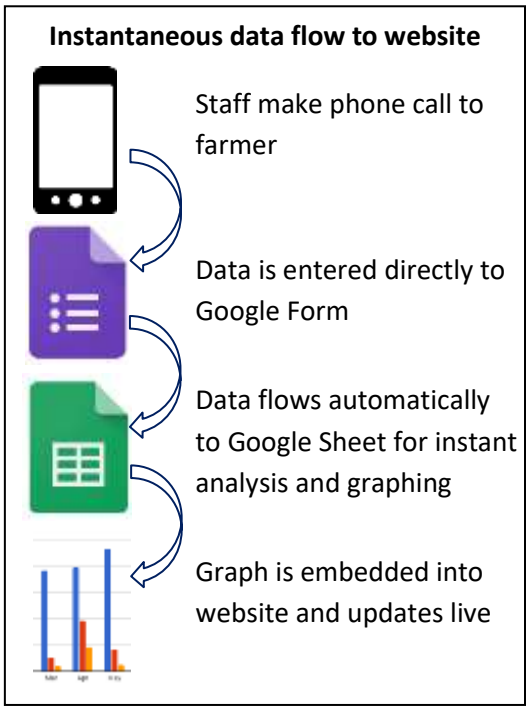
Kadi did not provide any money, food or chickens. We presumed that every household tends to have a few chickens and if these were looked after well then the number of chickens would naturally increase.

Monitoring

Farmers were called each month by telephone and asked basic questions about how the chickens were going. Farmers were also occassionally visited. Key questions that were asked included:

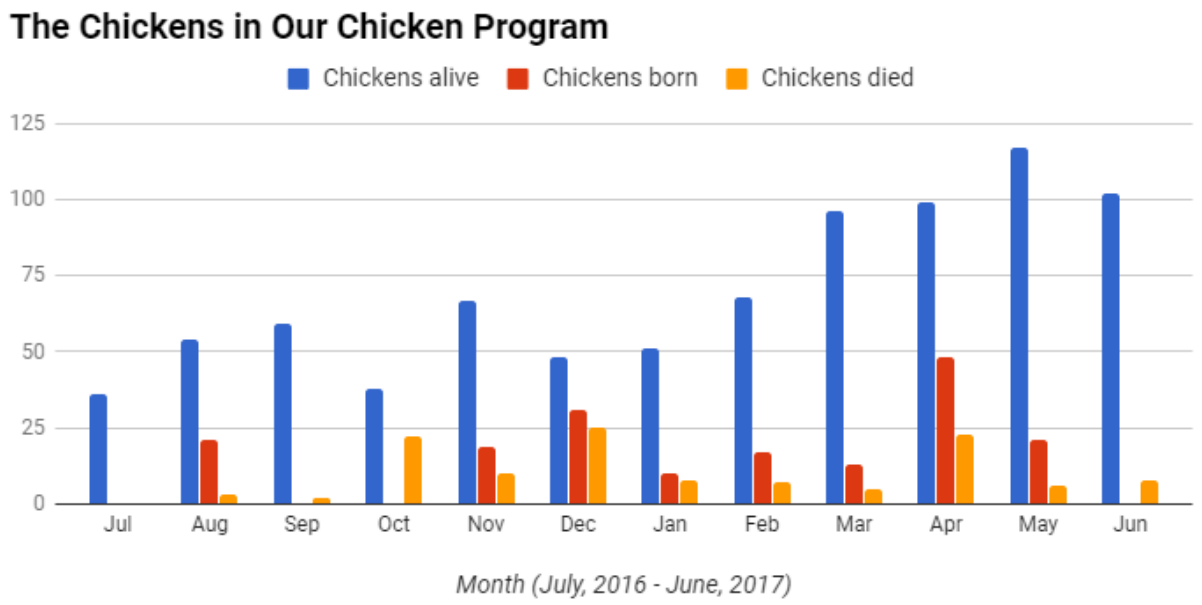
- How many chickens were in the pen?
- How many chickens were born?
- How many chickens died?
- What were the causes of death?
- About how many eggs were collected daily?

We did not attempt to record other input costs such as additional food supplied or labour time as this trial was focussed on trying to understand survival rates and causes of death. Data flowed instantaeneously from farmer response, through our prepared Google Sheet to our website at no cost to the program.



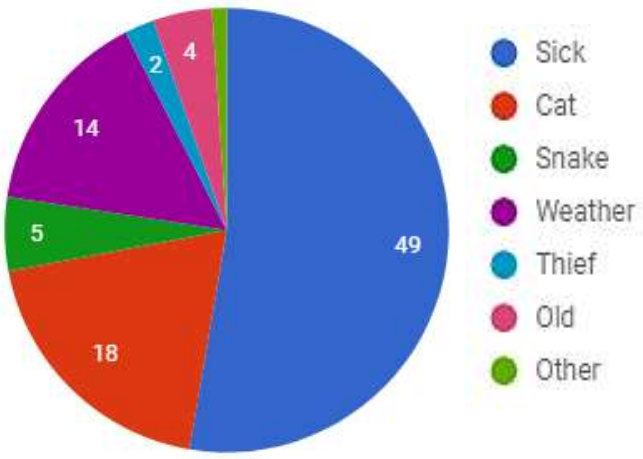
Results: Survival Rate Tripled!

Chicken numbers increased from 36 chickens at the start to 102 chickens at the end. 180 chicks were born and 119 chickens died resulting in an overall average survival rate of 34%. Only a third of farmers collected eggs and only half of these eggs were eaten. The rest were 'incubated' (sometimes eggs are collected from several nests and placed under a brooding chicken). Vaccination was not routinely accessed by all farmers and in at least one case all chickens were presumed lost to Newcastle Disease (these were adult chickens all dying suddenly within a few days). Farmers improved in their management of the chickens during the last 6 months where the average survival rate was 48%. This data shows that while the program was a significant improvement on the national average, we are still experiencing more than half of all birds dying before delivering full productivity.



So why were the chickens dying? A quarter of deaths were caused by predation. This is where significant gains were made by housing the chickens in pens. The main predator reported was cats but also some chickens were lost to snakes. But pens increase the likelihood of disease as birds are confined in a space that can harbour diseases more readily. More than half of the deaths were caused by sickness including a portion that died due to Newcastle Disease. Climate issues were also a significant factor in causing deaths.

Cause of Chicken Death



Lessons Learned and Moving Forward

This trial provides a very general indication for a few chicken farmers over 12 months. A better understanding would be gained by similar monitoring of a much larger number of farmers. Doing this over several years would indicate trends at different times of the year. For example, in September and October no chickens were born but 24 died. Accurate monitoring of chicken births and deaths as well as causes of deaths is a critical first step to truly understanding chicken production in Timor-Leste.

A significant contributing factor was farmers' understanding of the use of a chicken pen for protection. This required getting chickens familiar with using the pen, getting them in each night and releasing them during the morning. It took some time for farmers to get acquainted with this process.

A critical factor was reducing mesh hole size in the pen from 50mm to 15mm. We started with mesh with 50mm hole size. In the second 6 months we introduced 12mm hole size in some pens and more of the smaller chicks were protected. Now we make all new pens with 15mm hexagonal, hot-dipped galvanised chicken wire which we buy at Vinod Patel in Dili. It is the most durable and affordable mesh available.

"A critical factor was reducing mesh hole size in the pen from 50mm to 15mm."

This trial was simply about exploring chicken survival rates and how they could be improved particularly with ND vaccination and night-time pen protection. As chicken survival improves, the focus can move more toward chicken health, monitoring egg and meat production and economic analysis to see how profitable chicken keeping can be.

Conclusion

Chicken survival can be significantly improved with a combination of ND vaccination and chicken pens especially those built with no hole bigger than 15mm. We were able to raise survival rates from 11% to 48% during a period of 12 months of improved chicken keeping. Further gains could be made with improved pen design, more consistent vaccination and better farmer education.

Post Trial Developments

In 2018, Kadi focussed its efforts on improving its own survival rates in Kadi pens. We worked on protecting small chicks, including the use of brooding boxes, and reducing disease. We were able to raise the population in our pens to over 100 chickens. We then shifted our focus to improved egg and meat production. Kadi pens now have around 50-60 chickens which deliver about 30 eggs per month to the training centre. In 2019, we hope to more carefully monitor egg production, input costs and survival rates.

This is what its all about – lots of local eggs from the Kadi pen.

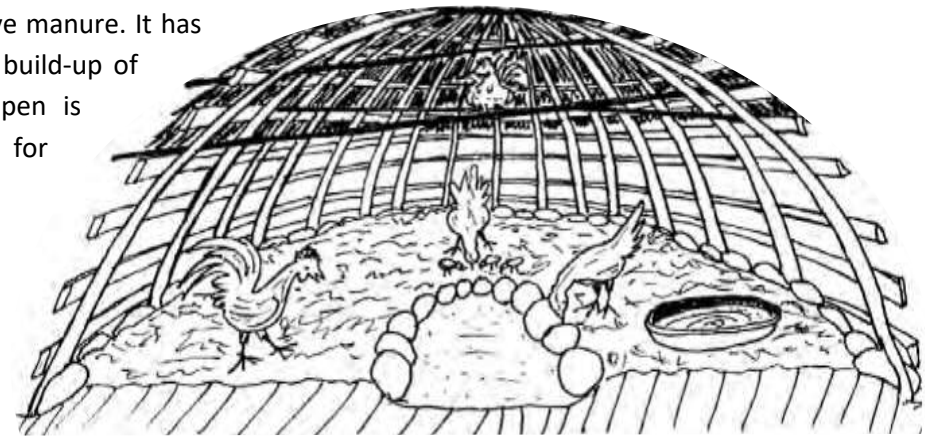
Section 3: Description of Some Chicken Pens in Timor-Leste

Kadi Kapasidade is working to improve chicken production systems that work in Timor-Leste through actual testing. A number of small trials were conducted from 2008 to 2016. Experimental work started on the premise of using local materials that were accessible and affordable for rural farmers in order to construct chicken pens. After 8 years, this thinking had evolved to explore how chicken production can be improved using durable steel mesh construction in a manner that makes financial sense for the farmer. The pens below start with construction using only traditional materials through to pens using imported construction materials.

Bamboo Move-able Chicken Pen

Description:

We started with Permatil's chicken tractor design using bamboo slats. (McKenzie & Lemos, 2008) This is a relatively light construction that allows farmers to move the pen from one garden bed to another. Chickens weed the soil and leave manure. It has the advantage of reducing the build-up of disease bearing litter as the pen is moved. We trialled this pen for about 6 months.



Move-able bamboo chicken pen design by Permatil. (McKenzie & Lemos, 2008)

Observations:

- It was actually difficult to source local materials – there are not many farmers with an abundance of accessible bamboo.
- The construction was heavy and required 4 people to lift.
- Adult chickens readily escaped even from small holes.
- Offered no protection for the most vulnerable small chicks.
- Tali roof thatching added a lot of extra weight.
- Chickens scratched at the perimeter rocks until they escaped.

Conclusion:

This pen failed for us although it may still be worth pursuing if a farmer is keen and has suitable natural resources and time to build it. This pen may be successful if incorporated into a larger system where a few relatively tame chickens from a larger flock are locked in for a few weeks to clear and fertilise a garden bed. Consider a design like this but wrapping the frame in small-hole size mesh. We recommend that organisations avoid the term 'chicken tractor' (tratór manu) for this pen as it raises expectations of getting a standard mechanised tractor.

Fixed Bamboo slat pen

Description:

We were still keen to continue with using local materials and built a fixed pen with a smaller raised enclosure for night time protection. This pen had 1.8m high walls with dimensions 4m x 6m but no covering or mesh over the top. The small inner pen was raised 1m from the ground with dimensions of 1m long x 70cm wide x 70cm high. The small pen used some 12mm mesh to help contain small chicks. Chickens were released to scratch around the yard and attracted back to the pen in the evening with feed.

Observations:

- Most chickens readily 'flapped' over the 1.8m wall regardless of whether one or both wings were clipped.
- Cats got in over the wall
- Hungry dogs ripped open the bamboo slats to get at the chicken food, the chickens or the eggs that may have been laid outside of the inner pen.
- The raised inner pen was too small for 3-4 chickens and young chicks were trampled
- Young chicks fell from the raised, inner pen and died
- Young chicks escaped through the slats and were killed
- Poles and bamboo lasted about 2 years before needing an upgrade

Conclusion:

This pen failed for us although we have seen high-walled pens with no roof work in some other locations. It worked better than the dome bamboo pen for containing the chickens to some degree. It was surprising to observe how agile the Timor chicken can be which reflects their survival capabilities. This contrasts with other breeds around the world such as layer breeds with a heavier body and calmer nature.

Bamboo is an excellent building product and useful for a variety of construction applications. Care must be taken to cut bamboo when borers are not active (generally dry season) and treat it either soaking in sea water or with borax. Bamboo lasts about 1-2 years fully exposed to sun and rain or indefinitely if treated well and kept dry and covered. Bamboo poles rot quickly if placed directly into the soil.

Photo: Klaus Tan, chuttersnap, Unsplash

Enclosed Bamboo Chicken House – Red Cross

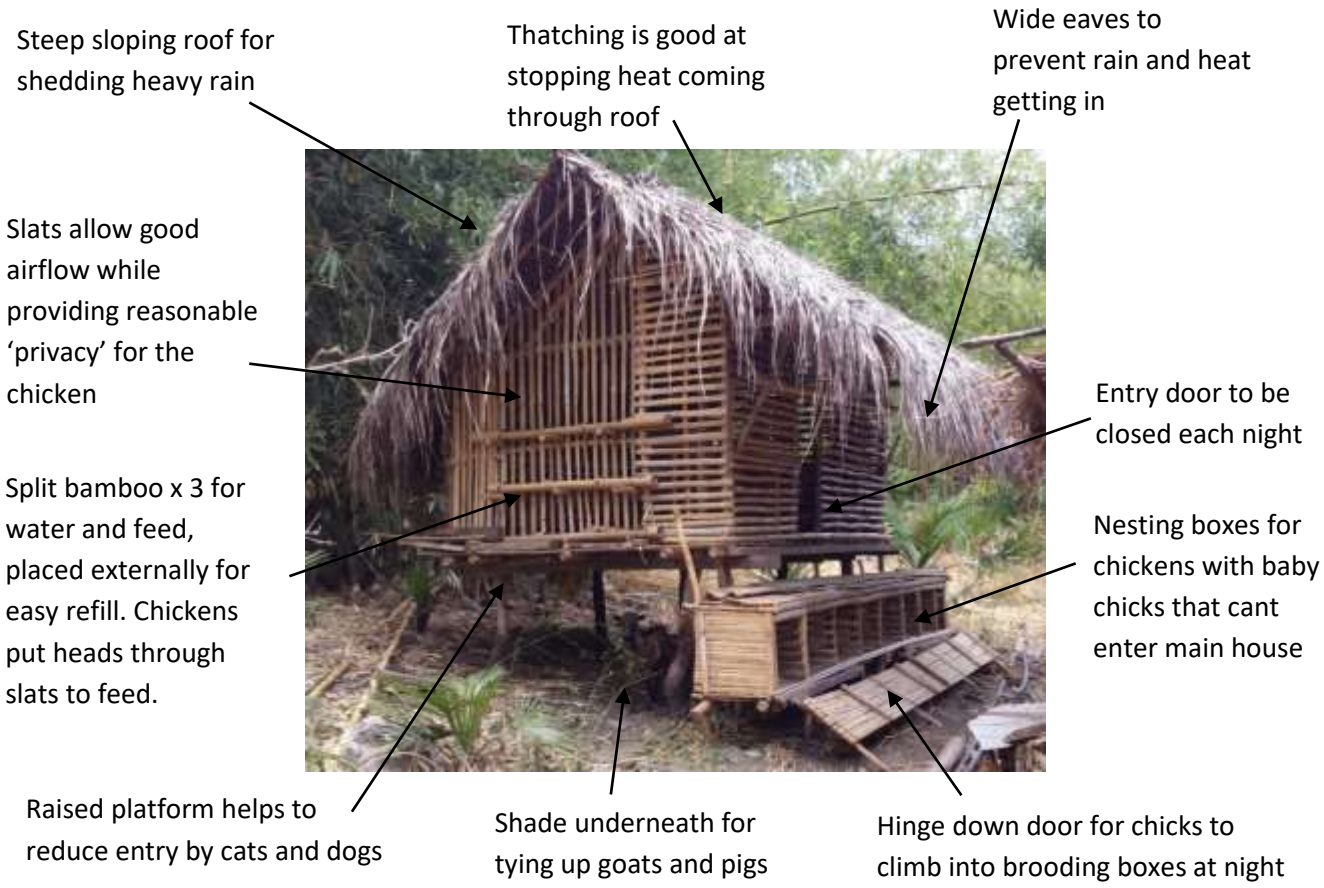
Description:

Red Cross has been conducting an exciting chicken pen project in 2017 and 2018 on the island of Atauro. The following description is based on a random visit to one pen when there was opportunity to inspect a pen in Maker and ask questions about how it was constructed and operated from the farmer's perspective. This is perhaps one of the most 'feature-packed' advanced pens that we have seen. It was reported that the program would buy 2 roosters and 8 hens to put into a farmer's pen. An amount of $50 was paid to the farmer for the chickens being in the pen. This particular farmer did not attend the training but was keen to make a pen and improve chicken production. He bought his own nails and prepared all bamboo slats, coconut leaf thatching and other timbers and spent about one month constructing the pen. He put 10 chickens in and was given $50.

Materials used:

- 12 lengths of bamboo
- 1kg of nails – 75mm and 50mm
- Leaves from 15 coconut palms
- Other timbers for posts and sub floor support (bearers & joists)

Pen dimensions are about 2.2m wide x 2.7m long x 2.4m high (at apex).



Some construction detail showing how bamboo is split and nailed – often an ‘X’ was cut at the end and the nail driven into the centre of the X to stop the bamboo from splitting.

The chicken feeders – bamboo is a great idea, but we’ve never seen them working (not sure why). They tend to split so they are usually not suitable for water. These feeders had no evidence of being used and had some small bird faeces which may indicate a design issue – if the feed is placed outside then everything else can get to the food.

Inside the pen are 3 tiers, with the bottom level comprised of small holding pens about 70cm long x 60cm wide x 60cm high. There were 8 of these smaller holding pens. They are useful for protecting smaller chickens or restraining aggressive chickens. These particular 'rooms' had no doors and were not in use.

The second and third levels provided 12 nesting boxes big enough to hold a traditional Timorese woven chicken nest. Some of these had been used although the farmer's one sitting chicken was actually just outside the kitchen. Its possible the farmer may move the nest in at hatching time.

Note the hand made metal feed tray – this simple tray is a more common way to provide food for chickens in pens in Timor and is large enough to not tip.

The ingenious chick raising boxes have a door hinged with strips of motorbike tyres. Great concept but this was never used and may need some modifications to make it attractive to mother hens. It appears too exposed and at a convenient height for a dog's evening meal if the farmer neglects to close the door.

Remains of an unfortunate 'land crocodile' (*lafaek rai maran)* of the *Varanus sp.* As of 2013 it was not yet scientifically identified. (Kaiser, et al., 2013) It grows to about 1.5m in length and is commonly reported by villagers as it eats both eggs and younger chickens.

The monitor of Atauro, photograph from the paper published by Kaiser et al. (Kaiser, et al., 2013)

Adequate roosts were provided at same height

Detail of coconut leaf thatching inside

Main door from inside and outside with simple hanging bar mechanism for shutting. Note the tyre hinges. The construction of a secure door can be challenging. It should be dog proof and thief proof but allow easy access for all family members who may take part in caring for the chickens.

Actual Operation of the Pen

A lot of thought and work went into the construction of this pen however at the time of the visit it was not being used consistently. The farmer stated that after the pen was built that the numbers of chickens increased to over 50. He was able to sell ten chickens at 6 months of age in Beloi about 4 hours walk away for USD9 to the Timorese tourists from Dili. This is a high price and would reflect a unique opportunity for the farmer to sell directly to the more affluent consumers coming each week from Dili. The pen was mainly used to catch the chickens. This was only done at certain times such as selling (once in 6 months) or vaccination (3 times per year). It also appeared that mothers with hatching chicks may have been locked in the pen for a period of time. The normal daily routine however was that all the chickens would scratch around as normal and then fly up into the trees to sleep at night.

The farmer stated that of the chickens that were born, about half would die. When asked how many chicks made it to maturity he answered that any number from no chicks dying to all chicks dying. He currently had around 30 chickens in the yard and one chicken sitting on a clutch. Simple calculations approximately validated his estimations. Given that in the 8 months since construction 8 hens would have about 2 clutches of 9 hatching chicks and 10 being sold and maybe 8 being eaten or given away. This would result in 154 potential chickens (10 + 8 x 9 x 2). If around 18 were sold or eaten then there should be around 136 chickens. Therefore, it is presumed that around 100 chickens died over the 8 month period likely due to predation, theft or other loss as large losses from sickness were not reported. This would indicate a survival rate of around 30%, about 3 times the national average.

> "We estimated about 100 chickens died in this chicken pen system during 8 months of operation."

Observations

- The pen was made of excellent construction with lots of good features
- The spacing between the slats are too wide which would result in the smallest (most vulnerable) chicks being able to fall through or escape
- The spacing also allows snakes and rats to enter in
- The front brooding boxes were not 'private' enough for chickens to use
- The daily habit of locking away all chickens at night with food and water did not appear to be considered worth doing by the farmer
- The farmer appeared reasonably happy with the pen and his use of it
- Thatching over the whole chicken pen with sturdy posts should result in this pen lasting 6-8 years.

Conclusions

More work needs to be done on encouraging or demonstrating to the farmer the value of securing the chickens at night. This could be matched with accessing chicken food either from increased food production or purchasing in Beloi when selling chickens. The pen has a few critical flaws such as gaps between the bamboo and reliable water supply. However, if the whole pen could be lined with chicken mesh (cost around USD40) then this could substantially reduce losses from predation and easily offset the cost of the mesh. This sort of investment would need to be coupled with a commitment to use the pen daily which may develop over time.

Hybrid Pens – mixing local and manufactured materials

A practical compromise between the affordability of local materials and the effectiveness of manufactured materials is to combine both into the one design. Critical weak points in the pen such as the first 90cm of the wall can be improved with mesh. Poles and roof can be made from timber and thatch providing effective shade and protection from rain. The size of the pen depends on the number of chickens and the intention for chicken production. Three very different examples are shown below demonstrating how farmers are trialling different solutions to improving chicken production.

This pen in Atabae built in 2016 uses just one roll of chicken wire (50m long x 90cm wide) combined with various poles of milled timber and bamboo together with palm stems (bebak) and some shade cloth. Note the attention to the base with rock and concrete which appears to be 'over-engineered' for a chicken pen. This pen also demonstrates the 'bare-earth' policy of some farmers where chickens have very little perch points or dust holes or other structures in the pen. It is successful in containing chickens above about 8 weeks of age. Younger chicks will escape from the 50mm hole size. This farmer had some success and was able to get his chickens vaccinated. An early issue was hens not laying eggs and having clutches – possibly due to lack of nesting boxes.

A pen in Same under construction in 2017 using bamboo and 50mm chicken wire. Note the use of split bamboo around the bottom which will aid in preventing access by dogs. The horizontal slats above the wire will prevent the chickens from flying out. This pen will be improved with thatching such as coconut palm leaves. Finishing detail will be important such as mounting a door that is easy for children to use for daily management, closing the top section, preventing wind and rain coming through walls and putting in perches and nesting boxes.

This pen built in Besusu, Manufahi, in 2017 demonstrates a more technical design. It appears to be built with a government grant as a community project but exact details are not known. There are two rows of divided compartments built above ponds. This pen combines solid local poles with sawn timber, palm stem slats, sheet metal roof and two or three different types of mesh. Note the access down the middle potentially to aid with cleaning the pens. The ponds under the pens did not have a clear explanation from the people using the pens with suggestions offered such as 'reducing the smell'. They may be part of a fish raising plan or for keeping ducks. Chicken manure and feed scraps can provide excellent nutrients for fish in ponds underneath. Note the larger cage built on the side. And the finer 2cm square mesh on the raised pens that can keep in young chicks. The exact purpose of many features of this design and its effectiveness in a Timorese setting is not yet known.

Photos: Lucinda Windeatt

Pens from Manufactured materials

Pens made predominately from manufactured materials are usually more durable than pens made from local materials but may be more expensive. However, we found that we could not assume that steel and mesh was more expensive than bamboo and thatch. 30mm square tubing and roof sheeting sold in major market places around the country are potentially cheaper than the labour cost of sourcing and installing local materials. Through assisting a number of farmers in chicken pen construction we found that many farmers lacked the knowledge, time and resources to build out of local materials. We also found that if they did make the effort to use bamboo and thatch that these pens lasted only about 2 years and were vulnerable to failure due to predators and escaping chickens. This led to the transition to pens made predominately from manufactured materials. A major constraint was sourcing durable wire netting at an affordable price. 1cm wire mesh common in Chinese shops is relatively expensive and rusts quickly. Chicken wire with 50mm holes has been available since 2014 but small chicks were found to escape and die. In early 2018, Vinod Patel hardware store in Dili began stocking suitable galvanized chicken wire with 15mm hole size at a more affordable price of around $45 for 30m at 90cm high.

A pen built in Beto Tasi, Dili, using 40mm (1 ¼") steel posts, sawn timber, 100mm C-channel and 50mm chicken wire. This was actually an upgrade of the earlier bamboo slat pen – note the old slat wall in the background. This pen is completely covered over with mesh to prevent chickens escaping and is left open for some light to come through overhead trees. The door is well fitted with hinges and lockable latch – note the correctly installed bracing to stop the door slumping down. The perimeter along the ground is lined with blocks set into a small trench with minimal concrete. This pen also included an inner 'snake-proof' night pen as below.

The night pen was built inside the larger pen to prevent snakes and rats from taking small chickens. It is approximately 1.6m x 1.6m wide and 1.8m high to suit the size of the roof sheeting. It provides a sheltered area for roosting as well as laying eggs. The yellow feeder on the left allows grain to be provided for chickens to eat when they need it. The grain feeder did not work well in this pen – flighty birds tended to knock it over (despite being hung from above). The white container on the right provides water and also was not successful over the long term in this example due to chickens knocking it around as they chased each other. Two level perches are provided. This door is hinged on the left so the door bracing is mounted incorrectly as the sagging door will tend to pull off the diagonal brace. Traditional nesting baskets were originally mounted up high in this pen but we found that the incubating hen was often severely attacked by other birds – possibly due to having the highest position. Subsequently, an improved nesting box was built in the bottom right which is shown below.

This shows an economical nesting box design using a sheet of 9mm plywood. 5 sections provide room for chickens and the section below provides a very secure cage for young chicks in their first 1-2 weeks. The flat top is not helpful in that it accumulates chicken manure above the nesting chickens – most designs show a steeply sloping roof. The section below was very useful for protecting a new batch of chikens however the long dimensions with the door at one end prevented the farmer from being able to catch the chickens inside as he couldn't reach the whole way in. Note the hinged door – very young chicks were unable to jump the 100mm to get out which kept them contained while allowing the mother out. After a week young chicks could jump out and enter in up the ramp. Its important to provide adequate nesting materials in the boxes to encourage laying and protect the eggs. Another improvement would be to reduce the opening to the nesting boxes by attaching a strip along the top that comes down about 8cm to prevent other chickens attacking the laying hen from above.

The Kadi Pen

After experiencing the difficulties outlined above, Kadi Kapasidade set about designing a suitable pen that could be used to secure chickens especially during the night and have space for mother hens with chicks to stay enclosed throughout the day. The pen was designed with the following considerations:

- Transportable in a ute or small truck as a 'flat-pack'
- Easy to install on-site
- Cost effective – the farmer who invests should get a return from sales of chickens
- Predator proof
- Have a weather protected area and an open area
- Include nesting boxes that were secure for the chicken but moveable
- Include horizontal roosts at the same height with around 4cm diameter poles
- Include suitable water dispenser that would provide reliable clean water
- Include an improved feeding system to minimise waste
- Have a secure but easy to use door
- Make maximum use of bought materials with minimal wastage
- House approximately 20 adult chickens
- Last more than 10 years

With these considerations in mind we designed our 'Kadi Flat-Pack Chicken Pen' with dimensions of 3.6m wide x 5.4m long x 1.8m high with a sheltered section at one end that included roosting and nesting boxes.

The original Kadi flat pack prototype pen just installed in Beto, Dili, built in November, *2016*.

Construction detail showing corners and bracing, joins were made using self-tapping metal screws. Square metal tubing was used – 30mm x 30mm, light guage gal steel.

Construction detail showing bottom corner. A small trench was dug, filled with firm concrete and then pen set on top. Thick wire can be placed in the concrete to tie down the pen. Note the 1cm square mesh which is quite expensive but neccesary to protect young chicks. Since this pen was constructed, Vinod Patel have begun selling a more affordable and durable mesh which Kadi currently promotes to farmers.

The covered area was 1.8m wide using the length of one standard sheet of corrugated roof sheeting. The flat sheet metal on the walls provides protection from wind and rain. We chose to use flat sheet to detract predators from entering through holes created by corrugations near the ground. A small slab was included as a dry area to place nesting boxes.

The flat-pack pen was installed in three other locations in Lautem with farmers. Funds were raised for the construction which cost around $500 including materials, transport and installation. Complete installation

can be done in one day with simple tools. Training was provided in pen management and farmers are actively encouraged to have their chickens vaccinated.

Observations

- The mesh at 1.8m needed better support to prevent it sagging
- The uncovered area proved to be too hot – this pen was later completely covered and plenty of sunlight still gets in from the sides
- Small wild birds (manu liin) entered every day and consumed a substantial portion of feed (30-50 small birds). Now we cover the whole pen with small hole mesh from Vinod.
- After 12 months, rats began entering by digging holes underneath and eating chickens
- A nearby neighbour's roof meant that the whole pen would be flooded in big storms.
- One large open area is not suitable – subsequently we've developed an extensive system of segregated pens.
- Finding long straight roosting timber is not easy and we settled for 4cm x 6cm milled timber
- The pen was too large and looked too expensive which resulted in some difficulties with the community when these pens were installed in other locations.

Conclusions

The flat-pack system was great in being able to control critical features such as having a completely secure pen. It was relatively easy to install and the farmer could get right into the business of raising chickens without time costs in building a pen. However, the pen was too large. A smaller pen with different sections would be an improvement. Another disadvantage is that other farmers may consider that they cannot replicate this pen because of the materials and skills required to build it. Pens should have a roof over the whole pen to protect from sun and rain. Given these considerations, the pen formed a good basis from which the farmer could make further modifications over time.

The Kadi Chicken pen was modified the following year. Note the full roof covering raised up (a bit too high!), the lower 90cm was changed for 12mm hole mesh, the upper section was changed for 25mm size mesh. Small cages were added in along the left wall to care for chicks, sick birds and roosters. In this photo, UNTL students have come for a field trip.

The World Vision Pen

World Vision piloted a chicken keeping project in 2017 in Aileu. Training was provided which included information about chicken feeds, sicknesses and treatments. As with most chicken projects, Newcastle Disease vaccination was a vital component. The main components of this project included:

1. Good housing design including nesting & brooding
2. Good breeds (prolific layers and mothering ability)
3. Good feeding management for required chicken nutrition
4. Good sanitation & medication (prevention mgt.)
5. PTFs education in all aspect of WV funded the construction of the chicken pens and about

World Vision initially built 10 pens which were supplied to the farmer along with 8 chickens and a rooster and food for the first few months. World Vision intentionally liaised with Kadi Kapasidade to observe the Kadi pens and chicken keeping methods and then made modifications to the design. A significant improvement was providing separate compartments or cages to be able to manage chickens better. This allowed adult chickens to be separated from chicks. They also increased the shaded roof area and lifted the height of the cage which provided a cooler environment. The project has since been substantially expanded in different municipalities in Timor-Leste. The pictures and comments below relate to an early design which may since have been improved.

The pen designed by World Vision with three sections to help in separating chickens. Note the addition of shade cloth for extra cooling. The lack of walls will result in storm weather impacting chickens.

Security is a major issue for chicken farmers and many chickens are lost simply because they fly away (and get caught by someone else) or stolen by someone to eat (its often claimed that young people or children steal chickens). This World Vision pen ws locked with a padlock and small chain.

Two examples of nesting boxes made from 12mm plywood and cardboard boxes. Note the bamboo roost and steel rod to assist in chicken entry. The front strips at both the top and bottom of the entry area help to give the mother a sense of security and protection. These boxes were set at 1.7m high. Advantages include that they are more secure from attack by other birds or animals that may enter, and they are more protected from rain storms and direct sun given lack of other walls. Disadvantages include radiant heat from the metal roof just above and young chicks may die from falling out.

Typical water and feed dispensers that can be bought in Dili. One water dispenser was knocked apart during the visit by a flighty chicken – these birds are not as docile as typical layer breeds.

Often any container is used for water such as this small tuna tin. In practice, a tin like this is soon knocked over leaving the chickens very thirsty and impacting on their condition. Bamboo can make a great water and feed trough if set up so it doesn't tip, and if it is maintained daily and replaced when it cracks.

The small chicks can easily escape through the 5cm mesh and eaten by animals – this is the main cause of death for chickens in Timor-Leste.

Observations:

- Pens were solidly constructed and durable
- Doors were well built allowing easy access with padlocks for security against thieves
- 'Bare earth' pens may be improved with organic matter and branches to provide interest for chickens
- Attention needs to be paid to sealing the bottom where the pen meets the ground
- Ongoing supply of food may be challenging if not seen as a commercially viable business
- Reliable water supply in all pens can be challenging
- Large hole size mesh is a critical factor that may result in increased chick losses

Conclusion

World Vision improved on the Kadi design by lifting the roof height, decreasing the pen size and segregating the structure into three separate pens. Farmers were experiencing improved success rates by using these pens. However, the design needs to consider how to protect the young chicks by decreasing mesh hole size and some lining on some of the walls in order to improve success rates.

One Year On

World Vision have powered ahead helping farmers build over 200 chicken pens in Aileu, Baucau, Bobonaro and Covalima. In mid-2018, pens in Aileu had 1300 chickens producing over 4000 eggs. (Salamat, 2018) They have also produced a brief report about their work in chicken production, *Producing Eggs in East Timor.* (Salamat, Hilton, & Dowling, 2018)

The Atekru pen

Occasionally Kadi Kapasidade provides a roll of chicken wire to a farmer and encourages them to come up with their own design. One of the best is this simple pen observed in Atekru, south of Adara on Atauro island. We like it because it is small, straight forward, durable and actually being used effectively for night time protection. Kadi had no involvement in this except to supply some mesh and encouragement. Night time visits are a good way of seeing if a farmer is actually using a chicken pen. This pen is about 3m long by 2m wide and 2m high at the apex sloping down to 1.3m high at the back. 20 chickens were found in the pen and about another 22 adult chickens observed roosting in surrounding trees.

Alfonso's pen in Atekru – note the combination of standard length roof sheets with some thatching underneath. A drum is shown to the left which was not readily adopted by this farmer for food storage and only used if abundant corn was produced in a good season. Other supplies are stored in the pen. There is a shelf about 1.2m from the ground in the closest end of the pen. Note the strong base – very small chicks would be contained by this for the first 2 weeks of their life.

> "This simple pen in Atekru is the best pen we have seen so far."

From inside, showing shelf with roosting bars holding about 8 growers (8-10 weeks). Note also the thatching which would help to keep chickens cool and provide wide eaves. The farmer wanted to remove these in time – he had a theory that increased heat might help to kill bugs or mites in the floor of the pen thus improving chicken health. He was encouraged to keep the thatching.

Mother hens sleeping on the ground protecting their chicks – they would benefit from some sort of box, even if only cardboard. These mothers are protecting 3, 4 and 5 chicks respectively so its assumed half or more of the chicks have already died. Strange to see the rooster opting for being on the floor instead up on the roost with the others.

The farmer had acquired an assortment of mesh to make this pen. The farmer had used only 10m of hexagonal mesh supplied by Kadi, the rest of the materials were supplied by the farmer. The square mesh to the left is very strong but also very expensive.

Conclusion

An excellent design and deceptively simple. Its functionality is demonstrated by the fact that the farmer actively uses the pen. The main thing to improve would be decreasing mesh hole size and incoporating better layer boxes.

Of all the pens we have seen and tested in Timor-Leste, we actually consider that Afonso's simple pen in Atekru is the best pen we have seen so far. It is simple in design and easy for other farmers to replicate. More affordable mesh with a smaller hole size could be used. The small size of this pen emphasizes to the farmer the need to let the chickens out during the day. This pen was also the most used pen that we observed – with the farmer actually using it on his own initiative. We have used this pen to inspire a new design shown in the recommendations below.

Final Recommendations

In this section we outline our 10 best recommendations for successful chicken keeping for farmers and projects engaged in improving chicken production in Timor-Leste. There are many other factors to consider but these are what we would call 'the next step for Timor' and its mainly around making and using a good, simple chicken pen.

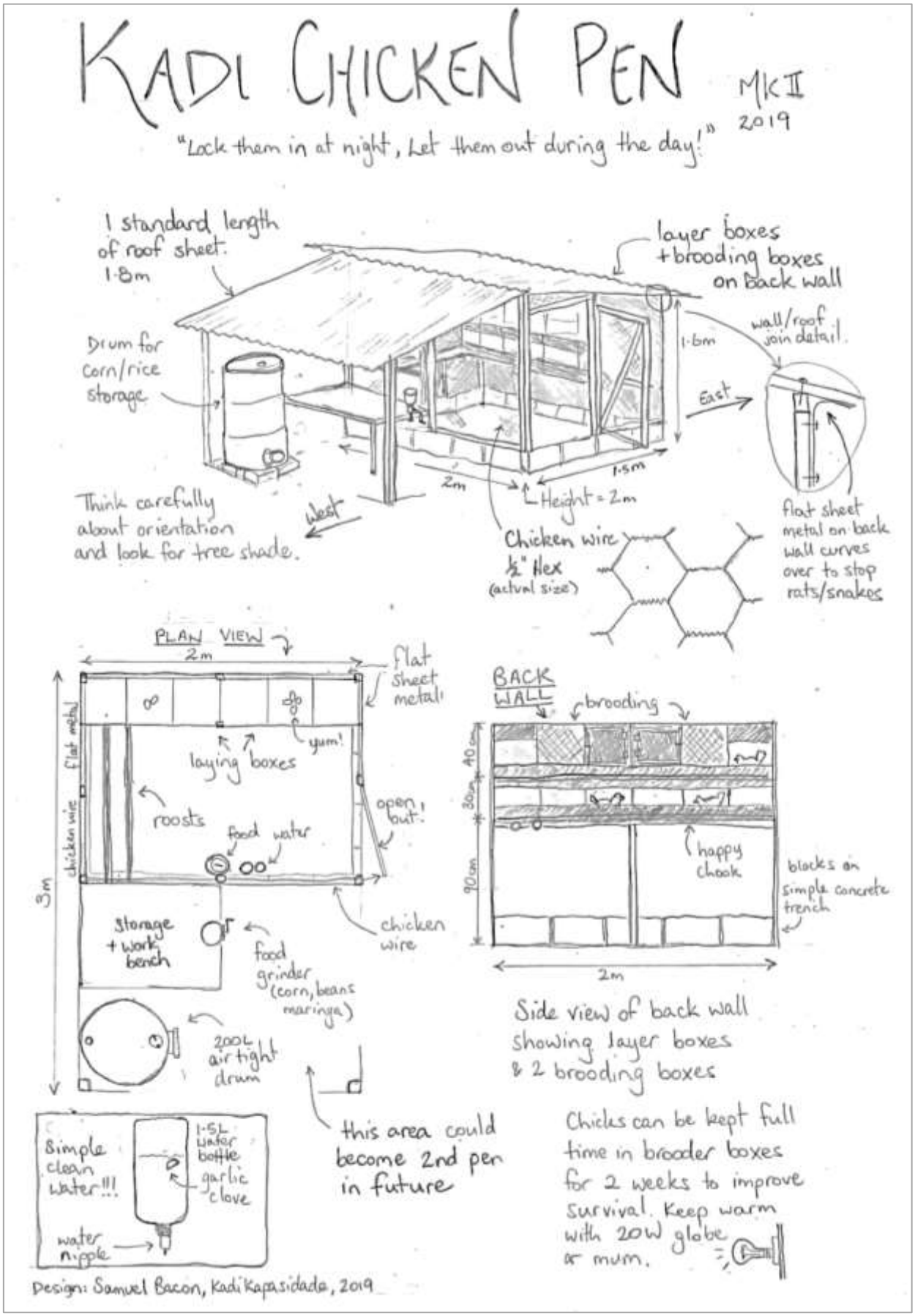
10 Tips for Chicken Keeping

1. Newcastle Disease Vaccination – any attempt at improving chicken production is at great risk of failure without regular access to ND vaccination. Local farmers should make contact with their Administration Post MAF staff. Larger organsiations could liaise with the National Department of Veterinary Services in the MAF compound in Comoro, Dili.
2. A well designed and simple chicken pen is necessary to protect against the many predators in Timor-Leste.
3. Small-hole mesh size for the chicken pen – a chicken pen should not have any hole anywhere greater than 15mm (including the roof) This small size is necessary to stop entry of snakes and stop small chicks putting out their heads and being taken off by a cat's claw (this really happens!) Pens built with bamboo could be lined with this mesh at low cost. (Supplied by Vinod Patel in Timor-Leste).
4. Protect chickens from around 5pm until 9am the next morning in a pen. Chickens can be housed in the pen full time for about 2 weeks initially to get familiar with it.
5. Release chickens from around 9am until 5pm to freely scratch and feed around the house.
6. Attract chickens into the pen using feed such as rice or cracked corn. Often chickens will naturally roost in the pen if they are familiar with it and if they feel well protected.
7. Adequate protection from sun, rain and wind – a pen should have a full roof cover, and 2 or three walls protected with local thatch, weaving or 'piku/bebak'. Thin flat sheet metal can also be used.
8. Clean water supply – consider the very affordable chicken nipple mounted in the aqua bottle. Add in a garlic clove each week to help fight disease burden. (Supplied by Kadi Kapasidade)
9. Provide supplementary food such as cracked corn, rice, mung bean and maringa leaf. The cost of this should be offset by profits in production.
10. Air tight food storage drum – a 200L fuel drum makes an excellent storage system and will decrease the cost of supplementary food supply.

> "Combine vaccination with protection to achieve great improvements in production."

If a farmer incorporated these key recommendations into their chicken raising activity then they should be able to triple the survival rate of their chickens. Once this survival rate improves they can then consider other factors such as decreasing disease and balance chicken numbers with egg and meat production requirements. Further investigation is required in measuring inputs compared with production. However, for now, Timor-Leste needs to focus on helping their chickens survive long enough just to start laying eggs. A simple design for a small scale chicken farmer is provided to help achieve this outcome. Happy chicken keeping!

A New Kadi Chicken Pen Design



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Appendix: Table of nutrients in eggs

Nutrients	RDI*	Per 100g	Per Serve (2x60g eggs)	%RDI
Energy (kJ)	8,700	559	581	7%
Protein (g)	50	12.2	12.7	25%
Fat (g)	70	9.9	10.3	15%
Sat fat (g)	24	3.3	3.4	14%
Mono fat (g)	n/a	5.1	5.3	n/a
Poly fat (g)	n/a	1.6	1.7	n/a
Cholesterol (mg)	n/a	383	398	n/a
Carbohydrate (g)	310	1.3	1.4	0%
Sugars (g)	90	0.3	0.3	0%
Sodium (mg)	2300	136	141	6%
Potassium (mg)	2800 (f), 3800 (m)	133	138	4-5%
Magnesium (mg)	320	12	13	4%
Calcium (mg)	800	47	49	6%
Phosphorus (mg)	1,000	200	208	21%
Iron (mg)	12	1.6	1.7	14%
Selenium (µg)	70	39	41	59%
Zinc (mg)	12	0.5	0.5	4%
Iodine (µg)	150	41	43	29%
Thiamin (Vitamin B1) (mg)	1.1	0.12	0.12	11%
Riboflavin (Vitamin B2) (mg)	1.7	0.5	0.5	29%
Niacin (mg)	10	<0.01~	<0.01~	n/a
Vitamin B6 (mg)	1.6	0.05	0.05	3%
Vitamin B12 (µg)	2	0.8	0.8	40%
Pantothenic acid (vitamin B5) (mg)	5	2	2.1	42%
Folate (µg)	200	93	97	49%
Vitamin A (Retinol) (µg)	750	230	239	32%
Vitamin D (Cholecalciferol) (µg)	10	0.8	0.8	8%
Vitamin E (Alpha-tocopherol) (mg)	10	2.3	2.4	24%
Omega - 3 fatty acids (total) (g)	0.89 (f), 1.46 (m)	0.17	0.18	12-20%
Short chain Omega-3s (ALA) (g)	0.8 (f), 1.3 (m)	0.06	0.06	5-8%
Long chain Omega-3s (DHA/DPA) (mg)	90 (f), 160 (m)	110	114	71-127%
Omega-6 fatty acids (g)	8 (f), 13 (m)	1.37	1.42	11-18%
Lutein (mg)	n/a	0.38	0.4	n/a
Zeaxanthin (mg)	n/a	0.13	0.14	n/a
Lutein + zeaxanthin (mg)	n/a	0.51	0.53	n/a
Biotin (µg)	30	<8~	<8~	n/a
Fluoride (mg)	3 (f), 4 (m)	<1~	<1~	n/a
Chromium (mg)	0.2	<0.01~	<0.01~	n/a
Copper (mg)	3	<0.02~	<0.02~	n/a
Manganese (mg)	5	0.023	0.024	0%
Molybdenum (mg)	0.25	0.012	0.012	5%
Vitamin K (µg)	80	<2~	<2~	n/a

(Egg Nutrition Centre, 2018)

Thank you to all who have worked toward

improving chicken keeping in Timor-Leste!

Staff from National Directorate of Veterinary Services (MAF), Australian Biosecurity (DFAT) and Kadi Kapasidade after taking blood samples to monitor chicken diseases, 2018.