Appendix 3

Economic analysis, business training and marketing

The detailed reports included within this Appendix refer to the research activities undertaken within Objective 3 of the project. The specific reports contained within this Appendix include,

Appendix 3.1. Training manual for farm budgeting and planning for cattle farmers in Vanuatu

Prepared by: Scott Waldron

Farm budgeting and planning for cattle farmers in Vanuatu

Training manual

February 2020

To be cited as: Waldron, S., Antfalo, K., Quigley, S., Kalo, N., Rantes, J., Steve Boe., Bong, L., Mangau Navian, Joseph Sul, Jerine Napatu and Antoinette Naise (2020) “Farm budgeting and planning for cattle farmers in Vanuatu”. To be available at UQeSpace.

Acknowledgements. This manual was developed as part of ACIAR project LPS2014-037 “Increasing the productivity and market options of smallholder beef cattle farmers in Vanuatu”. We would like to thank ACIAR and project partners from the Vanuatu Department of Industry, Department of Livestock, the Vanuatu Agricultural Research and Technical Centre and the Vanuatu Agricultural College. We would especially like to thank the many farmers and staff members of the DoI and DoL that contributed to the material through interviews and pilot training sessions in Santos in 2018-19.

About the training program[1]

In brief

This training program is designed to provide a simple step-by-step way to understand and improve farm management for small-holder cattle producers in Vanuatu.

The program is aimed at several actors in the Vanuatu cattle industry

- Staff that support development of the Vanuatu cattle industry, including government officials, extension agents, project staff and trainers. This program can help them assess and provide advice to their agencies and farmers
- To students in schools and colleges.
- And to progressive farmers. Most farmers are happy with the way their farm is operating and can't or won't change it. Others might want to understand and improve the farm to meet plans for the future. This program is aimed at those farmers.

At the end of the training, the trainees will:

- Be able to record (write down) what is happening on the farm production and finance
- Develop a plan for the farm
- And develop steps to implement the plan

How to do the program

Facilitators and group members will work together as a team to follow the steps in the training guide. All group members should take a turn reading the information out loud and participate in discussions to share ideas, skills, knowledge and experience.

The program is split up into 3 parts and many modules and sub-modules. Trainees will work through each module in turn. The number of modules done depends on the group. On some days, the group will do just one difficult module and on others it might do 5 easy ones. The amount of time required depends on the group. The modules can be done quickly (e.g. in a 2-day workshop) or they can be done slowly, for example every month over a year.

The program has been developed mainly for participants and farmers in ACIAR project LPS-2014-037 "Increasing the productivity and market options of smallholder beef cattle farmers in Vanuatu". Farmers that have had their cattle monitored will have some information on their farm (cattle and land) that will be useful for this training program. Farmers should bring their project folders. If trainees do not have access this information, they can use (informed) estimates. Facilitators can help with other information and calculations.

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[1] This training program has been adapted from the "Small Farm Enterprise Productivity and Cash Flow Record Keeping" of ILO. It has been extensively adapted for specific use by small-holder cattle farmers in Vanuatu. Use of the program is encouraged but must be acknowledged to the ACIAR project LPS-2014-037 "Increasing the productivity and market options of smallholder beef cattle farmers in Vanuatu".

A case study example is used to guide training. Trainees are asked to fill out the budgets for another farm that they are familiar with, or who they are helping / assessing. Farmers should use their own farm.

The training manual also has an attached Excel workbook that includes tables and formulas to help with calculations. Trainees without computers will use pen, paper and calculators.

The training manual has been written for many types of people in the industry. Some modules are advanced but can be completed by staff and students. If the calculations are too difficult for some trainees, alternative methods are suggested in the manual in blue.

The instructions in the training guide for each step is provided. Look out for these signs:

	When you see this sign, read aloud
	When you see this sign, you are reading instructions and doing activities
	When you see this sign, share with the group

Part 1. The principles of farm management

Session overview:

This session will talk about the principles of farm management and record keeping and begins with an example farm used throughout the training.

Module 1. Joseph's household

Session overview:

This session will introduce Joseph's family, farm and cattle business. His case will be raised throughout the training and used to compare and guide the analysis of your farm.

Joseph's father was born in Port Olry and his mother from Khole. Joseph inherited land from his father in Olry, where he lives with his wife, son and daughter. He has 3ha of copra, and shares copra production with one for his brothers. Copra an important activity on the farm, followed by cattle. His wife grows vegetables and they don't grow kava. To earn bigger amounts of income Joseph has worked overseas twice (seasonal work) and sometimes does off-farm work.

Joseph owns and makes the management decisions about the cattle. The copra block has old coconuts with native carpet and buffalo grass and is fully fenced. In addition, he uses the copra land of the neighbour (2 ha). Joseph has 10 cows, 6 calves, 1 bull and 7 heifers for herd replacement on the copra block. Connected to the coconut block in Olry is a bush block of 9 ha. It is unfenced, except one newly fenced section near the road. So, Joseph tethers 4 steers and one of the bigger heifers he plans to sell on the block as well as on neighbour's land.

Joseph does most of the cattle work, especially checking fences and cattle, weeding and tethering. This takes up about half of his time but varies a lot. His wife and children help with tethering, especially when he is away. When intensive yard work is required – castration, sales – he gets help from neighbour's relatives. For bigger clearing and fencing work, he employs labour.

Joseph is quite happy with his cattle. There are very few mortalities, and the steers grow well enough especially tethered in the bush block. They provide big chunks of cash income every few months, although sometimes he is disappointed in the prices he receives. He uses money for living expenses and to pay school contributions for his children (3 times a year). He must fill custom obligations by giving cattle to relatives' wedding or funerals – about one per year but can more for a big event. He has limited time and money to put into cattle production, so the low input style suits him.

But Joseph also knows that his cattle aren't as good as they used to be. When he went overseas on seasonal work, some of the fences and pastures / weeds became run down. He stopped weaning, and the calves wean naturally now. He knows that he has too many cattle on the copra block, that the bull and some cows are too old, so some cows don't calve every year.

15mins

Have a think about Joseph's situation. Is it common? Can you relate to it? Do you ever have questions like this?

Have think about your situation and write down some of the main parts of your story. It can be useful to write things down.

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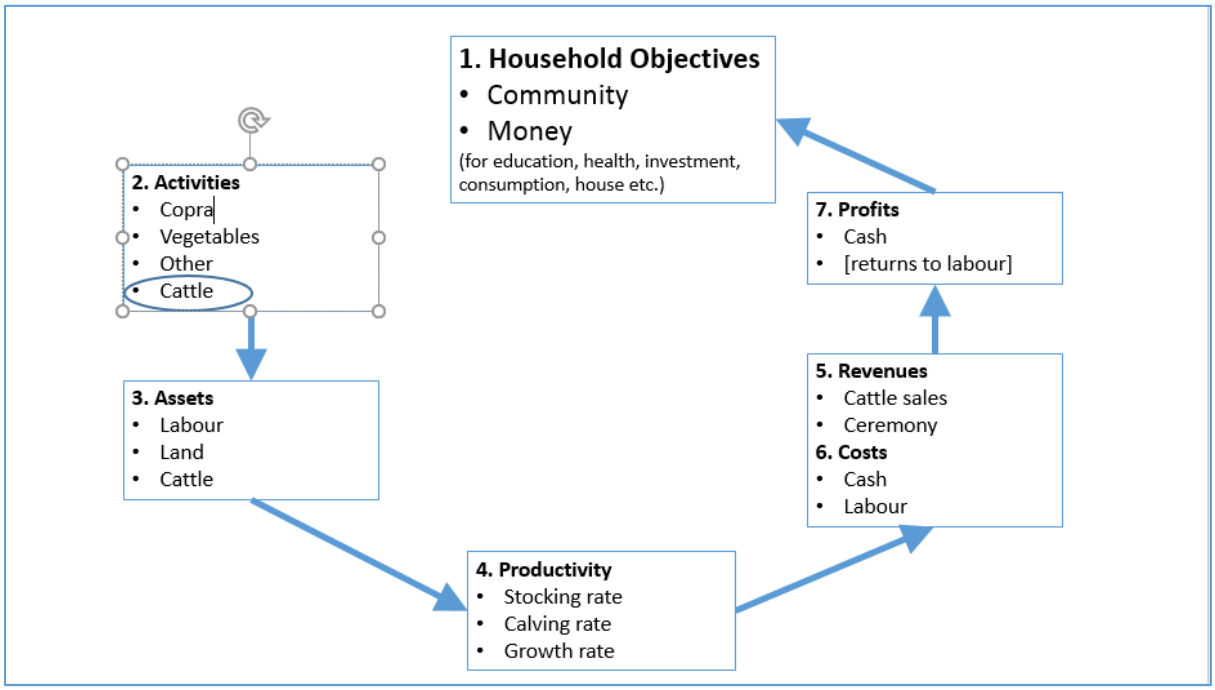
Module 2. Picturing farm management

Session overview:

This session will paint of picture of a farming business [and the parts of it].

The figure below shows the parts of a farm business. This will be used a framework through the training.



Box 1. Household objectives is the most important. These are usually broad household / family objectives, and farming supports these objectives. Good farmers should decide the priorities / objectives of their household. This will differ by households but can be:

- To meet community obligations (e.g. to help friends and family, to participate in organisations, to contribute to ceremonies)
- To have time (for other activities)
- Or to have money for different uses, e.g.
    - For household welfare (food, education, health, clothing, transport)
    - For re-investment (in farm or business)
    - For consumption
- To grow and provide security for the future

Box 2. Households support themselves through economic **activities, t**hat can be farm or non-farm activities. All households are different but most households in E Santos are involved in:

- Copra
- Vegetables
- Kava
- Other off-farm. Off-farm labour, seasonal work, transport
- Cattle. Which are the focus of this training.

Households often run activities together (as a diversified farm) and share resources (land, labour, capital). However, if there are constraints in resources, then expansion of one activity can mean cutting down on another. The best mix of activities of is a very important decision for households to make.

Box 3. Household assets. Most families have inherited or built assets including

- *Land* of the husband, wife, or relatives
- *Labour* within the household including husband, wife, children and relatives
- *Livestock* are a major asset in E Santos

The assets of the household provide security for the family (can be sold if required), and can be passed to other generations. Assets are of course used to produce farm products. Most households think it is good to have a lot of assets by, for example, expanding land area and stock numbers. But it can be easier and more realistic for small-holders to use existing assets – or even fewer assets – more productively.

Box 4. Productivity is the relationship between inputs (e.g. land, labour, money) and outputs (e.g. cattle weight sold).

- Some farmers are happy with "low-input, low-output" systems. E.g. low labour inputs for pastures and weaning, to raise cows that only calf every 2 years, which grow slowly.
- Other farmers have "high-input, high-output" systems. E.g. put a lot more work into pastures and cattle, get a lot more calves, which are sold at a younger age or heavier weights.
- Farmers have to decide on what is the best mix of inputs and outputs for them. This analysis will help with the analysis.

Box 5. **Revenue** is the money coming in come from production and prices. Larger or more productive farms have higher revenues. More calves are born, which grow faster and can be sold sooner or at a higher weight. In Santo, cattle with higher weights also get higher prices.

Costs. Increased productivity and revenues usually come at a cost. There are several types of costs. Costs can be in the form of money spent / invested, or in labour input.

Box 6. Profits are the difference between revenues and costs. If revenues increase more than costs, then profits increase. But the opposite is true too. It may be possible for a farmer to produce the best cattle in Vanuatu, but if it costs too much (in infrastructure, feed and labour) then it is unprofitable and not worth doing. Much of the skill in farming is in deciding what type of farm will bring the best combination of costs and revenues to maximise profits.

Money is obviously important to meet household objectives. However, if too much money or time is [devoted] to an activity, then this may leave less money and time for other things (e.g. community or spending time with family).

A farm can seem like a simple place, especially of the farmer has been there a long time. However, there is a lot happening and it is important to work it out carefully and properly.

Module 3. Record keeping

Session overview:

This session will talk about the relevance and importance of keep in records

Record keeping is the first and most important way to improve your farming business. A record is a written note of what has happened, what is happening, or might happen.

Most farmers have close knowledge of their farms, but few measure or write down the [knowledge / information]. For example:

- Most farmers just guess what their **assets** are, for example how much land (in hectares) they have or how many cattle they have (of different types).
- Most farmers don't know the **productivity** of their assets, for example how many calves they have per cow every year (calving rate), what the weights of their cattle are (in kilograms), or how fast steers grow (in kilograms per day).
- Most farmers don't plan ahead to try to sell at a particular weight or price to maximise **revenue**.
- Few households keep a record of the money and labour (**costs**) they use for different activities.
- If farmers don't know – with reasonable accuracy – the production, revenues and costs of their cattle, then they don't know how **profitable** they are. This makes it very hard to make good decisions or plans

As can be seen, most farmers make a lot of guesses about their farm and can't possibly manage all the information in their heads. These farmers will probably keep doing the same things year after year, and don't change or improve.

This is different to farmers that measure and record information. These farmers:

- Know what their **assets** (land and livestock) are so they can be protected and used productively
- Know how the **productivity of** their assets so they can decide, for example, whether (or not) they should try to improve land, or what livestock to keep or sell.
- Can increase **revenues** by targeting a market (type, weight, price) and by negotiating with different buyers.
- Know their (money and labour) **costs**, so they know how much is being spent, on what activities, and if it is a good use of the resources.
- If farmers know the revenues and costs of their cattle, then they can work out **profitability**. This allows them to know which work is the most profitable, what activities to do or not do, or what to invest (money and time) in so they can meet their objective.

It is important to note that record keeping is not easy. It takes time, thought and commitment. However, this can be interesting and fun, and is necessary if you want to really understand and improve your farm.

15mins

As a group, discuss the two greatest problems that can arise from not keeping records. Discuss the two advantages of keeping records. Record the results in Table 1A.

Table 1. The benefits of recordkeeping	
List two good things about keeping records	
1.	
2.	
List two bad things about not keeping records	
1.	
2.	

Part 2. Current cattle production systems

Session overview:

In Part 2 of the training you will record what is happened on your farm last year. Trainees / farmers will be asked to record household objectives, activities and assets. It will then look more deeply at cattle productivity, revenues, costs and profits. The results will be discussed, compared and used for planning in Part 3.

Module 4. Household activities

Session overview. In this module, you will list the activities the farm is engaged in, and the importance. This will help you to put cattle in context with other activities.

Look at the example of Joseph and then fill out the table for your activities, rank them in importance, and describe who they are important to

Table 2. Joseph's household activities

Activity	Yes / No	Rank (importance, source of income)	Reason. Important for what / who?
Copra	✓	1	For family cash expenses
Cattle	✓	2	For family expenses and ceremonies. Managed by men
Other livestock	✓	5	A few pigs and chickens, own consumption
Kava	X		
Vegetables	✓	4	Family food and sales by women
Transport	X		
Off-farm labour	X		
Overseas work	✓	3	Only occasionally, allows aggregation of big amounts
Other			

3. Your household activities

Activity	Yes / No	Rank (source of income)	Important for what / who
Copra			
Cattle			
Other livestock			
Kava			
Vegetables			
Transport			
Off-farm labour			
Overseas work			
Other			

As a group, review the table, discuss why you do your activities, and compare results. Do households in the group do different activities, why? Do you think these activities and importance will change into the future? Discuss the family roles in the activities. Will this change in the future?

You can write notes below.

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Module 5. Household land

Session overview. In this module, you will learn how to calculate land areas. Farmers know where their land is by experience and markers (fences, trees), but do not necessarily know the distances or areas. For farm management, it is important to know these numbers.

There are various ways to know the area (hectares) of your land.

Some farmers involved in projects (e.g. BBB) will have maps and land areas stated in their folders. If these are known, use these values.

However, many famers won't know these areas and will have to calculate themselves. There are several steps in doing this.

- You will have to measure the perimeter of the land. It is most accurate to do this by tape measure, or by car (odometer), but is most practical to be done by stepping out on foot. It can be assumed that one **big** step is one metre.
- When you just have one big block, you can just measure the perimeter. However, if you have several paddocks or blocks, especially for different uses, then these can be done paddock-by-paddock.
- In this case, draw a rough map of your paddocks and farm. Then walk around each of the **sides** of your paddocks and write down the number of steps on each side. If there are differences in the type of land (e.g. copra, bush, pasture) then write these down too.
- It will not always be easy to do this because the boundaries will not always be straight, land use may be mixed or there may be unclear ownership.
- A simplified example of given for Joseph below.

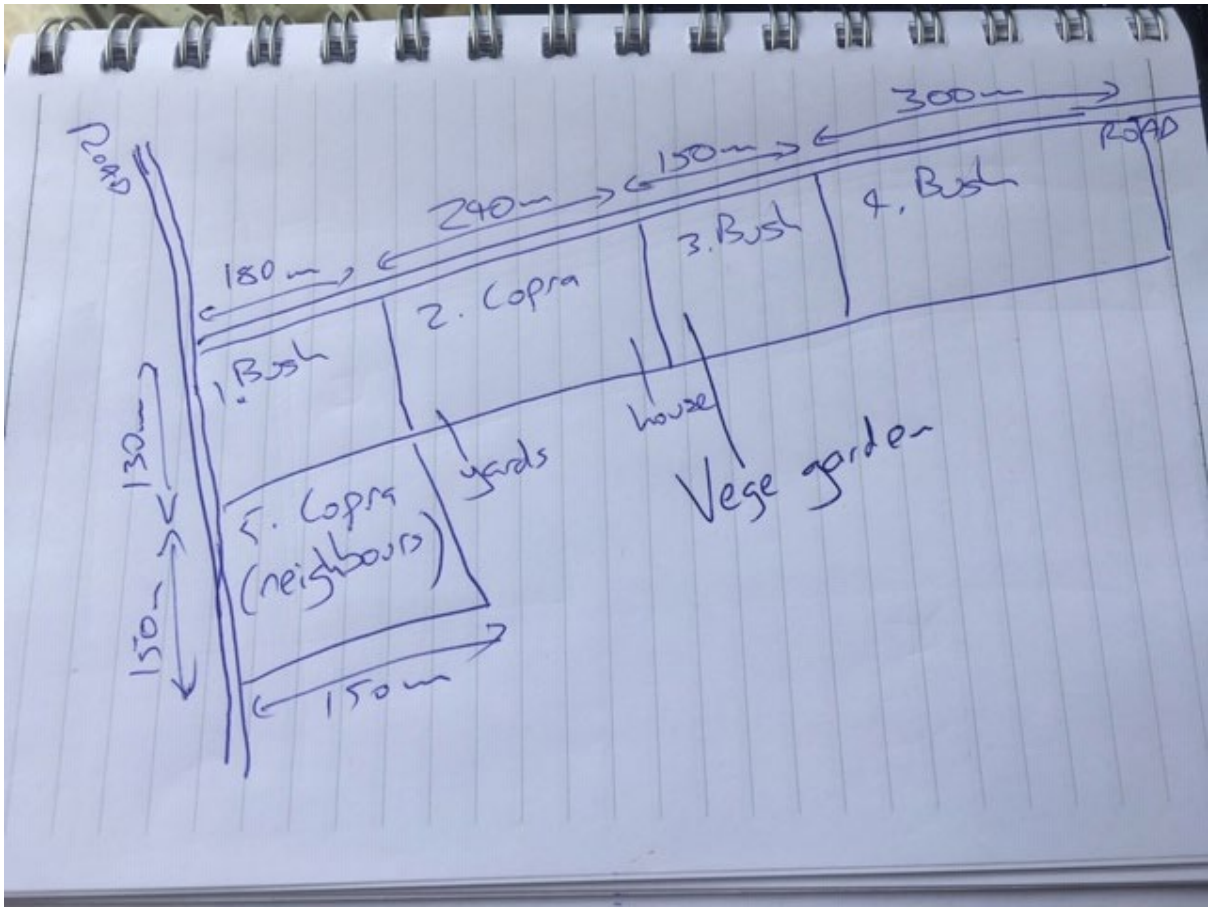


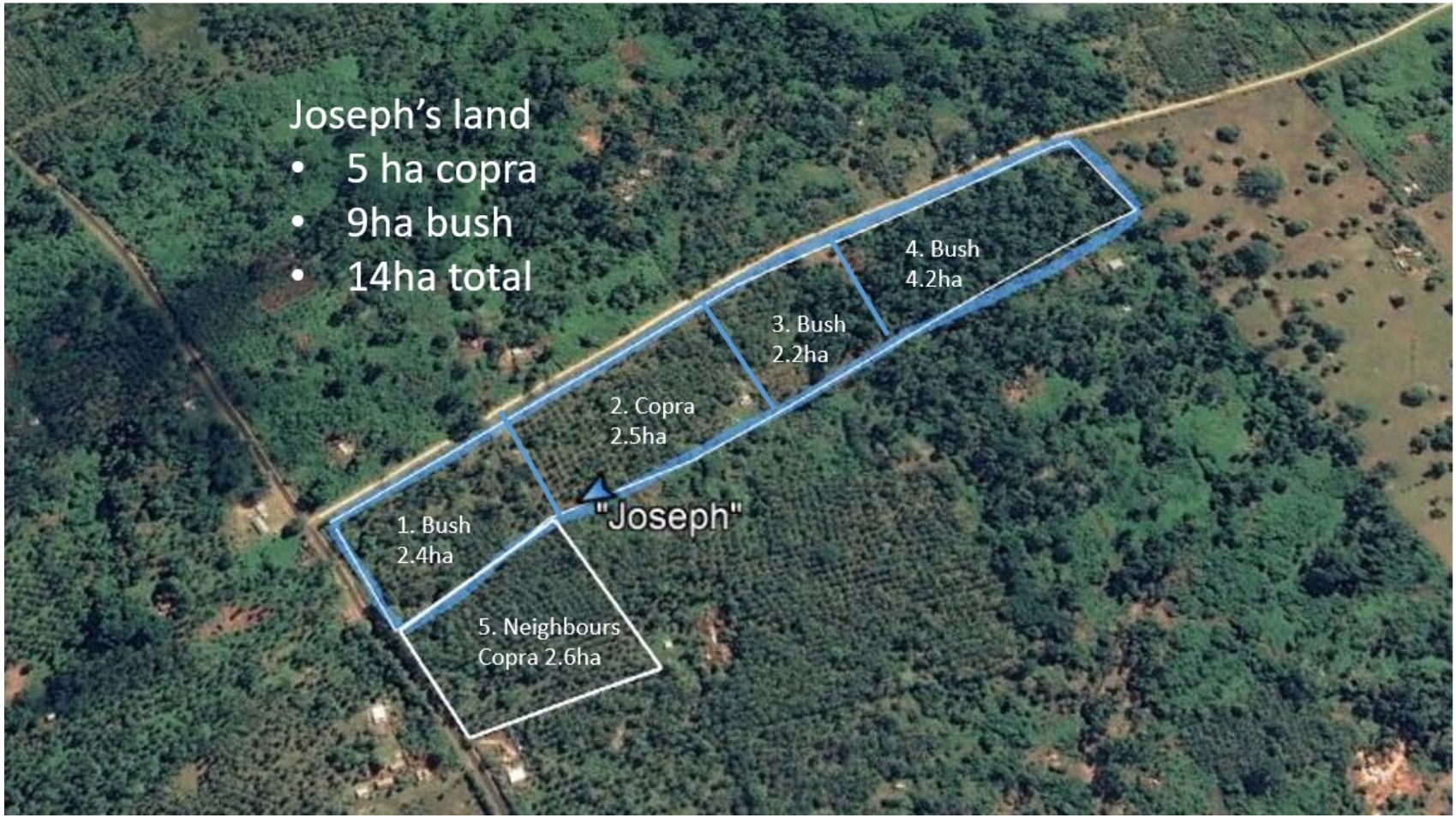
Figure 1. Paddock perimeters on Joseph's farm

Once these measurements have been made, then they must be converted to hectares. This is done by:

- Multiplying the distance on one side of a paddock with the distance on the other side to calculate the square metres of the paddock
- And then dividing the square metres of the paddock by 10,000 to calculate the hectares of the paddock.
- This is done for each paddock, and then added to give totals. The totals should be split by type of land.
- The calculations for Joseph are shown here

Land area on Joseph's farm					
	Land use	**Length (m)**	**Width (m)**	**Square metres**	**Ha**
Paddock number					
1	Copra	180	130	23,400	2.34
2	Bush	240	130	31,200	3.12
3	Bush	150	130	19,500	1.95
4	Bush	300	130	39,000	3.9
5	Copra - ne	180	150	27,000	2.7
Totals					
	Copra				5.04
	Bush				8.97
	All land				14.01

These calculations are put into a map:


Joseph's land
• 5 ha copra
• 9ha bush
• 14ha total
4. Bush
4.2ha
3. Bush
2.2ha
2. Copra
2.5ha
"Joseph"
1. Bush
2.4ha
5. Neighbours
Copra 2.6ha

Now that you have seen the way to calculate land area on Joseph's farm, calculate your farm area. In the area below (and other pages if required) draw a map of your farm, including blocks and paddocks you use for cattle, and the perimeter measurements.

Now that you have a map with perimeters, convert this into land areas. Divide the areas by paddock and land use (copra, bush, open grazing).

Land area on your farm					
	Land use	**Length (m)**	**Width (m)**	**Square metres**	**Ha**
Paddock number					
1					
2					
3					
4					
5					
6					
7					
Totals					
	Copra				
	Bush				
	Open grazing				
	Tether				
	All land				

Module 6. Household assets

Session overview. In this module, you will list household assets. The family may have many assets, but we are interested in those used for cattle. We also need to be as precise as possible [so may require some thinking].

Look at the example of Joseph and then fill out the table for your assets. If available, use the maps and printouts from your project folders

Table 4. Joseph's household assets										
Labour			**Land**			**Cattle**			**Other**	
Type	**% use for cattle**		**Type**	**Area and description**		**Type**	**Number**		**Infrastructure**	**Description**
Husband	Spends 30% of his time on cattle (fences, weeds, cattle, tethering)		Copra	2.3ha. Old trees, native pasture. Good fence.		Breeding cows	10. getting old		Yards	Basic / bush
Wife and children	Help with tethering and mustering		Bush block – in village	9 ha in Khole. Partly cleared, new fence on road. Need to tether		Calves > 1 year old	6.		Water	No
Other relatives	Help with tethering and yard work		Bush block – in another village, on wife's side	11ha nr Khole. Brothers also have a block in Sara and may be able to use some time in the future		Breeding bulls	1 . Getting old		Pasture improvement	No, but have planted forage plot
Hired labour	For big jobs – clearing, fencing		Neighbours or village land	2.7ha copra block, graze sometimes when required		Heifers > 1 year old	7 .		Fences	Good on copra, new one on bush block, others on bush block broken
						Steers > 1 year old	4 .		Ropes for tethering	5
						Uncastrated males (not for breeding)	1 . Haven't castrated, too big now		Chainsaw	No
						Total cattle	**28**		Pickup	No

Table 5. Your household assets										
Labour			**Land**			**Cattle**			**Other**	
Type	**% use for cattle**		**Type**	**Area and description**		**Type**	**Number**		**Infrastructure**	**Description**
Husband			Copra			Breeding cows			Yards	
Wife and children			Bush block – in village			Calves > 1 year old			Water	
Other relatives			Bush block – in another village, on wife's side			Breeding bulls			Pasture improvement	
Hired labour			Neighbours or village land			Heifers > 1 year old			Fences	
						Steers > 1 year old			Ropes for tethering	
						Uncastrated males (not for breeding)			Chainsaw	
						Total cattle			Pickup	

 As a group, review the table. In what areas (labour, land, livestock, other) do you have a lot of resources. Does the balance seem right or is there an imbalance? Do you have spare resources that are not being used? Are some resources over-stretched?

You can write notes below.

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Module 7. Cattle productivity

Session overview. In this module, you will use information from the earlier work to calculate the productivity of household assets. Only basic productivity indicators are used (stocking rate, calving rate, growth rate). These are compared to a benchmark.

Note: Most staff, students and trainers will be able to learn how to do these calculations. If it is too difficult for some any trainees or farmers to calculate percentages, then just use whole numbers (e.g. numbers of cows and calves).

Module 7.1 Stocking rate

In this module you will learn to calculate your stocking rates. This is an important and useful indicator.

A stocking rate is the number of "animal units" that you have on a hectare of land. It is important to know this because if you have too many cattle on the land, there won't be enough feed for each animal, and they won't be productive. Alternatively, you might not have many cattle on the land, so you can increase stock numbers there.

Carrying capacity of land

The first step in calculating stocking rate is to calculate the carrying capacity of your land. These types of land will have different types grasses and legumes, so be able to "carry" different numbers of cattle. These table can be used as a guide:

Table 1. Carrying capacity on main pasture types.

		Carrying capcity (animal units per ha)	ADWG	Kg/head/year
Open carpet, native legumes		1.5	0.3	117
Buffalo-carpet under old coconuts		1.5	0.3	117
Improved grass, sown legumes		2.5	0.6	210
Tethered in bush (estimate)		~1.5	~0.3	~117
Heavily shaded coconuts & bush		Low		

Source: Macfarlane, David and Shelton, Max (1986) Pastures in Vanuatu, ACIAR Technical Reports Series No 2. Table 1. Note that in dry season, these carrying capacities should be reduced by about 0.5 AU/ha.

Pasture type	*Suggested optimum stocking rates (AU/ha)*	
	Wet season	*Dry season*
Open native pastures	1.6–1.8	1.2–1.4
Buffalo grass & native pasture in moderate shade	1.3–1.5	1.0–1.2
Improved grass/legume pastures	2.5	1.8–2.0
Degraded improved pastures	2.2.–2.5	1.5–1.7

Mullen, B. F.; MacFarlane, D. C., 1998. The effect of band-seeding legumes into para grass (*Brachiaria mutica*) on pasture production, sustainability and animal productivity in Vanuatu. Trop. Grassl., 32 (1): 34-40.

The areas of land, paddocks and land use for Joseph was calculated in Module 5. If these are combined with carry capacities in Figure 2, then the suggested carrying capacity for Joseph is:

Carrying capcity of Joseph's land				
		Copra (bufflo & carpet grass under old coconuts)	**Bush**	**Total**
Hectares		5	9	14
Carrying capacity (animal units per ha)		1.5	1.5	
Total carrying capacity (AU/ha)		**7.5**	**13.5**	**21**

Based on the information above, fill out the same table for your farm

Carrying capacity of your land						
		Copra (bufflo & carpet grass under old coconuts)	**Bush**	**Other land 1**	**Other land 2**	**Total**
Hectares						
Carrying capacity (animal		1.5	1.5			
Total carrying capacity						

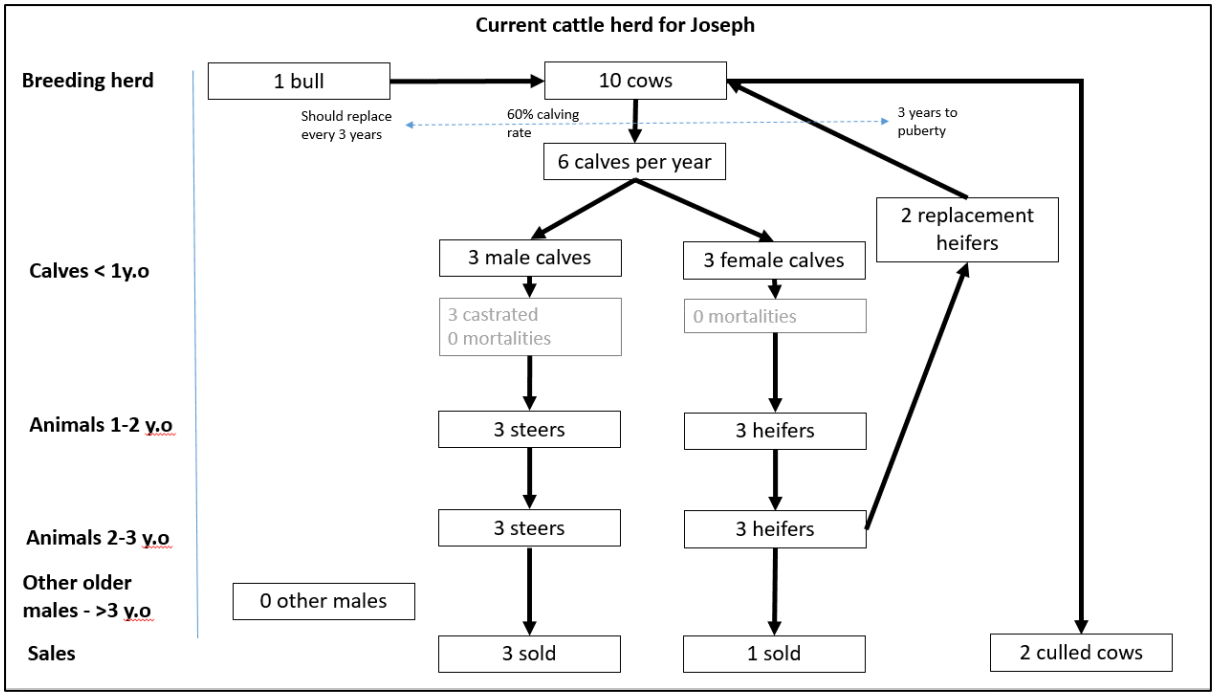
Cattle numbers and types

Counting the number of different types of cattle can be difficult when they are not nearby, the herd is changing, and you don't know the exact age of animals. However, it is very fundamental and important for households to keep these records. This should be done by: getting cattle in the yards, counting them and keeping a record of birth, sales, ceremonies, deaths and replacements.

Joseph's herd is shown below.

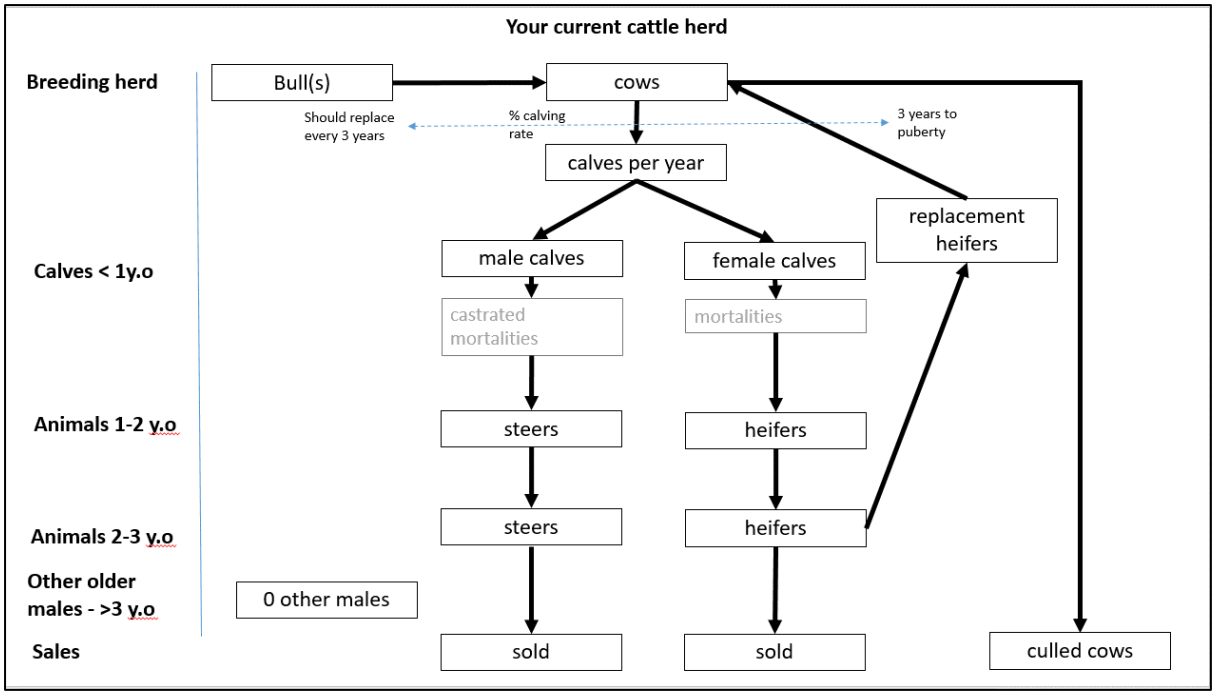
Cattle carried by Joseph (head)			
Lactating cows		10	
Calves <1yo		6	
	Female		3
	Male		3
Heifers >1yo		6	
	1-2 yo		3
	2-3yo		3
	3-4yo		0
Steers >1yo		6	
	1-2 yo		3
	2-3yo		3
	3-4yo		0
Breeding bulls (mature)		1	
Uncastrated males >1yo (450		0	
Total cattle		**29**	

Another way of showing this herd is in picture form, which shows the herd structure, and is used to calculate sales in Module 8.1.



Based on the example of Joseph, estimate the number of cattle in your herd in the following tables and figures

Cattle carried on your farm (head)			
Lactating cows			
Calves <1yo			
	Female		
	Male		
Heifers >1yo			
	1-2 yo		
	2-3yo		
	3-4yo		
Steers >1yo			
	1-2 yo		
	2-3yo		
	3-4yo		
Breeding bulls (mature)			
Uncastrated males >1yo (450kg)			
Total cattle			



Animal units on land

The next step is to convert cattle numbers to animal units. This is required because different types of cattle consume different amounts of feed. The following table is a guide.

Table 2. Animal units for different types of cattle in Vanuatu.

Animal unit	450kgs
	AU
Pregant cow	1.2
Cow and calf	1.6
Weaner 160kg	0.3
Yearling 250kg	0.5
Mature bull	2

Source: Macfarlane, David and Shelton, Max (1986) Pastures in Vanuatu, ACIAR Technical Reports Series No 2.

If we combine the cattle numbers of Joseph with the animal unit conversions, this is how many animal units Joseph has.

Animal units carried by Joseph in different paddocks								
Jospeh's cattle			**Numbers**	**AU**	**AU carried**	**Paddock kept**		
	To calculate:		Use stock numbers from above					
				Multiply by these animal units				
					To find the total number of animal units			
						Write the paddocks they are held in		
Lactating cows			10	1.2	12	Copra		
Calves <1yo			6	0.4	2.4	Copra		
	Female	3						
	Male	3						
Heifers >1yo			6	0.75	4.5	Copra		
	1-2 yo	3						
	2-3yo	3						
	3-4yo	0						
Steers >1yo			6	0.75	4.5	Bush		
	1-2 yo	3						
	2-3yo	3						
	3-4yo	0						
Breeding bulls (mature)			1	2	2	Copra		
Uncastrated males >1yo (450kg)			0	1	0	Bush		
Total cattle / animal units			**29**		**25.4**			

Look at the example of Joseph and then fill out the table for your cattle herd. Following the instructions and we'll help to do the calculations if required.

Animal units carried on your farm in different paddocks								
Cattle			**Numbers**	**AU**	**AU carried**	**Paddock kept**		
	To calculate:		Use stock numbers from Module 4					
				Multiply by these animal units				
					To find the total number of animal units			
						Write the paddocks they are held in		
Cows (lactating)				1.2				
Calves <1yo				0.4				
	Female							
	Male							
Heifers >1yo (250kg)				0.5				
	1-2 yo							
	2-3yo							
	3-4yo							
Steers >1yo (350kg)				0.75				
	1-2 yo							
	2-3yo							
	3-4yo							
Breeding bulls (mature)				2				
Uncastrated males >1yo (450kg)				1				
Total cattle								

Calculating under- or over-stocking rates

We can pull the information above together to calculate if the stocking rates for the farm are in balance, are under-stocked or over-stocked.

Animals carried compared to carrying capacity on Joseph's farm								
Copra					**Bush**			
Animal units under copra			16.4		Animal units in bush			9
Total carrying capacity			7.5		Total carrying capacity			13.5
Number over-stocked			8.3		Number under-stocked			-4.5

As shown in the table below, Joseph has too many cows, calves and bulls under copra (over-stocked by 8.3 AUs). This will mean that his reproduction (calving rates) will be low (e.g. 60%). However, his stocking rates are low in the bush where he keeps his heifers and steers (under-stocked by 4.5AUs), which means his growth rates are reasonable for unimproved grasses (0.3kg ADWG).

Based on the example of Joseph, fill out the table below to determine if your land (of different types) is stocked in balance, is over-stocked or under-stocked.

Animals carried compared to carrying capacity on Joseph's farm								
Copra					**Bush**			
Animal units under copra					Animal units in bush			
Total carrying capacity					Total carrying capacity			
Number over-stocked					Number under-stocked			

Instructions
Add up the number of animal units raised in each paddock
Multiply carrying capacity per ha by land area (ha) to calculate total carrying capacity
Subtract the actual number carried from the carrying capacity to calculate how much the land is over-stocked or under-stocked

As a group, review the tables above.

If Joseph is over-stocked for cows, calves on the copra and under-stocked for his heifers and steers in the bush, what should he do? Joseph could move cows from the copra land to bush, but then they would be less visible and protected, and may have more mortalities or losses. Should he fix this problem, or just live with the lower reproductive rates?

The data also suggests that the bush block is very under-stocked. Joseph has a lot of potential to increase stock numbers there, but this would require either more labour to tie up the cattle, or more money and labour to clear and fence the block. Should he spend more money on fencing?

What did you find from your farm? You can write notes below.

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Module 7.2 Calving rate

In this module you will learn to calculate your calving rates. If it is too difficult to calculate a percentage, then just use cow and calf numbers.

The productivity of the breeding herd (cows and breeding bulls) is very important for your farm. It provides the calves that can be used to grow the herd (especially females) or to sell (especially males).

There are many ways to calculate how productive your breeding operation is. The simplest way is the calving rate. It is simply the number of calves born per year as a proportion of / divided by the number of breeding cows that you have.

As can be seen from the numbers above, Joseph has 10 cows (that have had calves before) and has 6 calves (under the age of 1 year old). That means 6 cows produced a calf and 4 cows didn't. 6 calves divided by 10 cows = a calving rate of 60%.

In a high output breeding system, each cow would produce a calf every year (10 calves or 100% calving rate).

Low calving rates are an indicator of several problems that might include:

- Cows that have low nutrition and body condition so do not enter oestrus or get pregnant
- The bull may have been able to impregnate cows due to poor condition or access to the cows when they were cycling.
- The calf may have aborted.
- As seen in Module 7.1, the cows, bulls, heifers and calves are heavily stocked under coconuts. So it is likely that that they are not getting a lot of nutrition

It is also important to note if cows are in poor condition, then they are more likely to have a poor calf or for it to die due to poor lactation (milk). Calf mortality reduces further the weaning rate (another indicator of productivity in cow-calf production).

Divide the number of calves that you have per year by the number of cows to calculate a calving rate on your farm. Write down your calculations and answer here.

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 As a group, discuss your calving rate. Is it high or low? What are the reasons for this rate? Can anything be done to improve the rate? You can write answers here

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Module 7.3 Growth rates

In this module you will learn to calculate the growth rates of your cattle.

Calculating growth rates accurately requires weighing. If weighing is not possible, then estimates can be used.

Growth rates are important to understanding and improving the productivity of your farm. High growth rates are better regardless of the use of the cattle. For example, heifers must reach a certain weight (250-300kgs) before they will reach puberty and breed. If they grow too slow, they will be too old before they can produce a calf.

For simplicity we will focus here just on the growth of castrated steers. It is especially important that the steers grow quickly so they can be sold earlier, more can be sold, or can be sold at a higher weight and price. Even if bullocks are used for ceremony, it is beneficial for them to grow quickly so they are big enough to slaughter. If growth rates are higher, cattle can be sold earlier, which reduces stocking rates.

Growth is the increase (or decrease) in live weight in your cattle. It is measured in kilograms over any time period – from a day to a year.

Calculating growth rates

Joseph is fortunate because he has access to scales so he can weigh cattle. The cattle were weighed 3 times over the period, but it could be done at any time. From this we can work out the weight gain – done here by day and year.

Weight and weight gain of steers on Joseph's farm								
Date of weighing	Weight recorded	Weight gain over period	Days in period	Av daily weight gain				
Jan 1 2018	300							
July 1 2018	365	65	182	0.36				
Dec 31 2018	420	55	183	0.30				
Increase over year (2018)		**120**	**365**	**0.33**				
		Calculations:						
		Weight at second weighing minus weight at first weighing						
				Weight gain divided by number of days in period				

As can be seen, Joseph's bullocks grow at 0.33kgs (330 grams) per day from January to June, which is (mainly) wet season. Growth rates are lower in the second half of the year (0.30 kgs/day) because that is (mainly) dry season. The average daily gain over the year is 0.33 kgs per day. At this rate, the bullocks gain 120kgs per year.

If the calf weighs 25kgs at birth, and grows at 120kgs per year, these are the weights it will be at ages 1-4. Based in these growth rates it would take the steer a bit more than 3 years (3.1 years) to reach 400kgs liveweight, where WSS prices step up. It would also take a heifer a bit more than 2 years (2.1 years) to reach a liveweight of 280kgs, when it might reach puberty. Note that because the growth rates are low/moderate, then more cattle have to be kept on the property, which increases the stocking rates. Joseph has to keep 3 generations (years) of male calves and steers. If the growth rate was faster (0.5 per day) only 2 generations would be required.

Weight of Joseph's steers by age		
Years	Weight gain per year	Total weight
0	25	
1	120	145
2	120	265
3	120	385
4	120	505

Other recorded growth rates

If the farmer is not able to weigh cattle, estimates can be used from the literature.

Basic value can be used from the table above. In native pastures, if stocking rates are not exceeded, and the pastures are not weed-infested or heavily shaded (or parasites, water, moved on the tether), the then small-holders can expect growth rates of around 120kgs per year (0.33 per day).

However, there can be a lot of variability, as shown in this table, where liveweight gains can range from just 40kgs/head/year, up to 500kgs/head/year.

Table 3. Liveweight production (kg/head/year) from different pasture systems

	50% Shaded Pasture		Open Past. >70% Light	
Rainfall--> Pasture	<1500mm coralline	>1500mm fertile	<1500mm coralline	>1500mm fertile
50% Weed Infested Native Pasture	40	65	85	115
T-Grass/Legume	70	120	160	225
Buffalo/Legume	100	170	250	325
Signal/Koronivia/ Legume	na	na	400	500

Source: Mullen, B (1993) "Economics of new pasture establishment and different rehabilitation techniques" in Evans, T.R., Macfarlane, D.C., and Mullen, B.F. (1993) Sustainable beef production from smallholder and plantation and farming systems in the South Pacific: proceedings of a workshop. Port Vila and Luganville, Vanuatu, 2-12 August, 1993

If you have weighed cattle and have measurements, write down the weight gains in the first table. In the second table, write down the average weight of animals per year. How many years would it take for steers to reach the 400kgs liveweight? How many years would it take for heifers to reach puberty (280kgs)?

Weight and weight gain of steers on your farm								
Date of weighing	Weight recorded	Weight gain over period	Days in period	Av daily weight gain				
Date 1								
Date 2								
Date 3								
Date 4								
Increase over period								
		Calculations:						
		Weight at second weighing minus weight at first weighing						
				Weight gain divided by number of days in period				

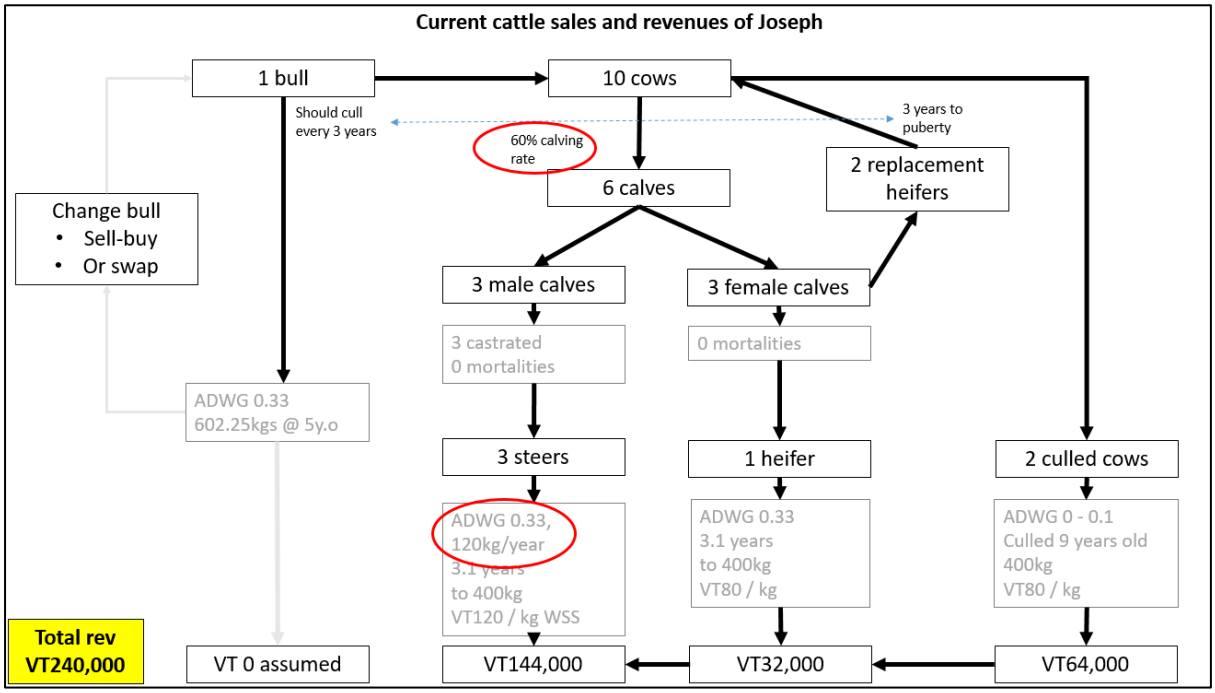
Weight of your steers or heifers by age		
Years		
0		
1		
2		
3		
4		

As a group, review the tables above. How do the growth rates compare? Are they satisfactory, low or high? What are the reasons for your growth rates? How do you think they could be increased? In the following modules we will review the benefits and costs.

Module 8. Calculating Revenues

Session overview. In this module, you will calculate the revenues (money that comes in) from cattle sales. Households can sell all types of cattle (steers, weaners, heifers, bulls, cows). Each of these should be accounted for. The information that you need to do this comes from modules above, but additional calculations are needed.

The overview of the sales and revenue from Joseph's farm is shown in the figure below. This will be broken down in the modules that follow. After going through these modules, you will be asked to fil out your own diagram



Module 8.1 Revenues from steers

In this module you will calculate revenues from sales of steers.

Numbers of steers for sale

As discussed earlier, Joseph has 10 cows that produce 6 calves. On average, half of the calves (50%) will be male and half will be female. So there will be 3 males born every year.

- If all the male calves are castrated, there are no deaths, 3 steers will be available for sale every year (see below on calculating slaughter weights and ages).
- If there are deaths, or if they are not castrated properly (so become bulls), fewer steers are available for sale. This is very important and has a huge impact on revenues.

Look at the way that Joseph has calculated how may steers he will have for sale every year (see below). Fill out the table for your farm

Number of steers available per year on Jospeh's farm	
Cows	10
Calving rate	60%
Calves	6
% male calves	50%
Male calves per year	3
Deaths	0
Ceremonies	0
Uncastrated	0
Total available for sale	3

Number of steers available per year on your farm	
Cows	
Calving rate	
Calves	
% male calves	
Male calves per year	
Deaths	
Ceremonies	
Uncastrated	
Total available for sale	

Weight and age of slaughter

How do we calculate the age when cattle will reach slaughter weight?

- First, we must select a target weight. Joseph wants sell the cattle when they weigh 400kgs. This will allow him to reach the specifications of SMP as an S-3 steer, with good prices (VT120/kg liveweight). It is also not too heavy, so will not have to keep too many steers on his farm. (See notes below about how to calculate liveweight prices)
- When the calves are born, they weigh about 25kgs. The calves might grow slowly if the cows cannot give much milk. But after they are weaned, they will grow at 120kgs per year, as shown in Module 7.3.
- Over 3 years, the steer would reach 352kgs (25+120+120+120). So it would take a bit longer than 3 years to reach 400kgs
- The precise formula would be (400-25)/120 = 3.1 years.

- The farmer has to keep the steers for 3.1 years before they are sold. [If the growth rates were lower, it would take longer and there would be higher stocking rates (so less feed) and more labour (to look after them). If growth rates are higher than can be sold quicker].
- It also means that there will be 1 generations of male calves (1*3 = 3 head) on the copra block and 2 generations of steers (2*3 = 6 head) on the bush block

Look at the way that Joseph has calculated how long it will take him to produce his steers to the target weight for sale. Fill out the table for your farm.

Weight and age calculations for steers on Joseph's farm	
Sales weight (kg)	400
Calf weight (kg)	25
Weight gain per year	120
Years to reach 400kg	3.1

Weight and age calculations for steers on your farm	
Sales weight (kg)	
Calf weight (kg)	25
Weight gain per year	
Years to reach 400kg	

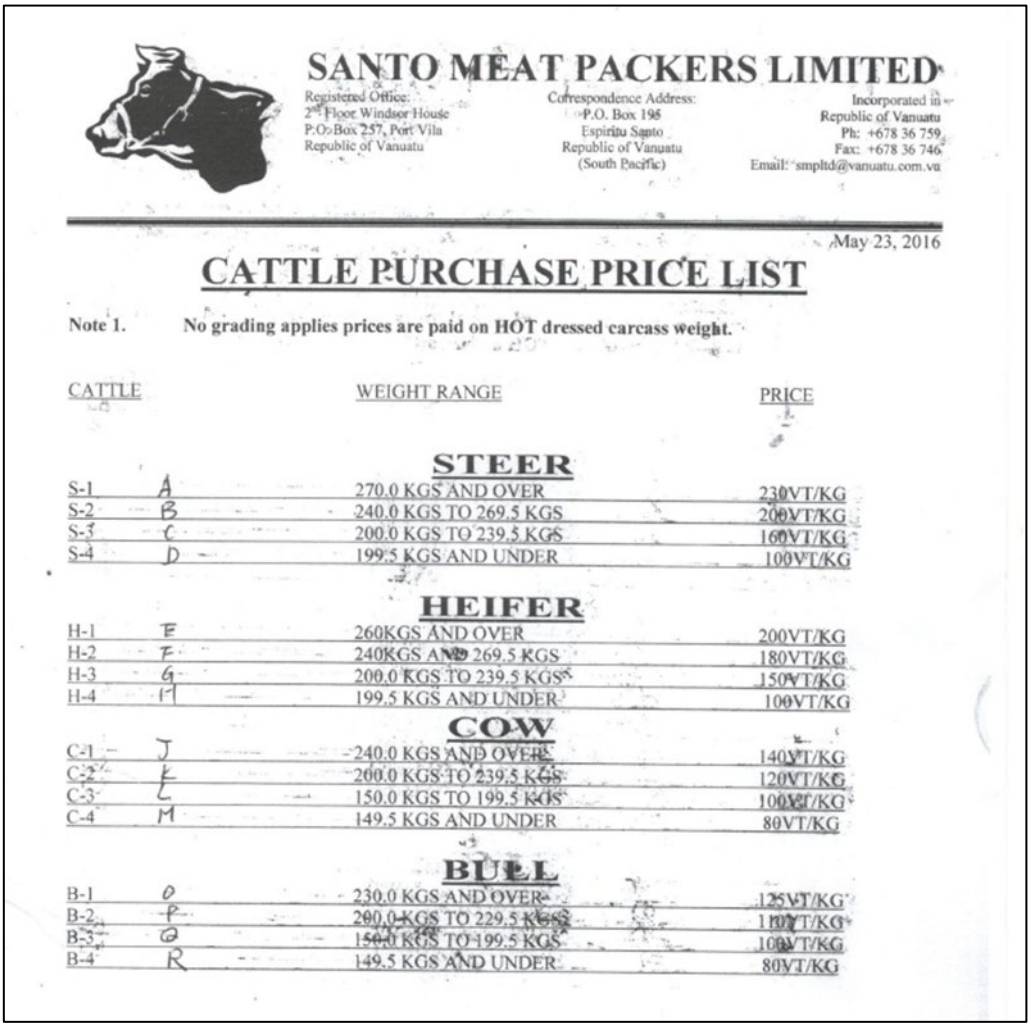
Prices

In addition to product (sold), revenues are also determined by prices. There are several buyers for cattle in Santos that offer considerably different prices and buying terms. It is therefore important for farmers to choose the buyer that offer the best prices and terms, but is can be difficult compare. For example, WSS buys on liveweight, while SMP buys on carcass weight, and other buyers (butchers, traders) buy on a per head basis. There are also differences transport costs and payment terms. This section will help you compare.

The WSS price schedule is straightforward because it is based on liveweight. The price schedule appears below. (However, the price was reduced by VT10/kg in late 2019). In contrast, WSS pays on a liveweight basis. The price for steers it is VT120/kg liveweight X 400kgs = **VT48,000**. They don't charge transport costs.

WSS Price schedule April 2018				
VT/kg live weight				
	Steers			
		>400kg		120
		<400kg		110
	Heifer			80
	Cow			80
	Bull			
VT/kg carcass weight				
	Steers			230

The price schedule of SMP is below.



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May 23, 2016

CATTLE PURCHASE PRICE LIST

Note 1. No grading applies prices are paid on HOT dressed carcass weight.

CATTLE		WEIGHT RANGE	PRICE
		STEER	
S-1	A	270.0 KGS AND OVER	230VT/KG
S-2	B	240.0 KGS TO 269.5 KGS	200VT/KG
S-3	C	200.0 KGS TO 239.5 KGS	160VT/KG
S-4	D	199.5 KGS AND UNDER	100VT/KG
		HEIFER	
H-1	E	260KGS AND OVER	200VT/KG
H-2	F	240KGS AND 269.5 KGS	180VT/KG
H-3	G	200.0 KGS TO 239.5 KGS	150VT/KG
H-4	H	199.5 KGS AND UNDER	100VT/KG
		COW	
C-1	J	240.0 KGS AND OVER	140VT/KG
C-2	K	200.0 KGS TO 239.5 KGS	120VT/KG
C-3	L	150.0 KGS TO 199.5 KGS	100VT/KG
C-4	M	149.5 KGS AND UNDER	80VT/KG
		BULL	
B-1	O	230.0 KGS AND OVER	125VT/KG
B-2	P	200.0 KGS TO 229.5 KGS	110VT/KG
B-3	Q	150.0 KGS TO 199.5 KGS	100VT/KG
B-4	R	149.5 KGS AND UNDER	80VT/KG

Note that the prices are listed in carcass weights. To be comparable to liveweight (for WSS) it has to be converted. Liveweight is converted to carcass weight based on a dressing percentage. Standard conversions are shown in the table below.

Table 4. Assumed dressing percentage for different cattle & weight ranges

Price schedule SMP	Live weight range		Assumed dressing %
Class			
Steer			
S-1	474	and over	57%
S-2	436	490	55%
S-3	377	452	53%
S-4	391	and under	51%
Heifer			
H-1	448	and over	58%
H-2	429	463	56%
H-3	370	444	54%
H-4	384	and under	52%
Cow			
C-1	480	and over	50%
C-2	426	510	47%
C-3	349	464	43%
C-4	374	and under	40%
Bull			
B-1	411	and over	56%
B-2	370	425	54%
B-3	288	384	52%
B-4	299	and under	50%

Source: derived from www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/103992/dressing-percentages-for-cattle.pdf

For steers of 400kgs, the carcass weight is about 53% of the liveweight, or 212kgs. The price of steers with this carcass weight is VT160/kg carcass weight. So the total price would be 212kgs X VT160/kg = **VT33,920**. However, SMP charges transport costs of about VT2,000 per head.

Comparison of prices for Joseph's steers			
		SMP	**WSS**
Liveweight		400	400
Dressing percentage		53%	
Carcass weight		212	
Price			
	VT/kg carcass weight	160	
	VT/kg live weight		120
Total		**33,920**	**48,000**
Minus transport costs		2,000	0

Comparison of prices for your steers			
		SMP	**WSS**
Liveweight		400	400
Dressing percentage		53%	
Carcass weight		0	
Price			
	VT/kg carcass weight	160	
	VT/kg live weight		120
Total		-	**48,000**
Minus transport costs		2,000	0

When revenues and costs are taken into account, it is usually better to sell lighter cattle to WSS and heavier cattle (about 470kgs liveweight) to SMP. However, there are also other factors to take into account (see below).

Look at the way that Joseph has calculated and compared prices from different buyers. Fill the table out for your farm.

Comparison of prices for your steers				
		SMP		**WSS**
Liveweight				
Dressing percentage				
Carcass weight				
Price				
	VT/kg carcass weight			
	VT/kg live weight			
Total				
Minus transport costs				

As a group, discuss the pros and cons of selling through different channels.

- How do the revenues, costs and terms compare?
- Payment (on the spot, or delayed involving travel to the abattoir)
- Accuracy of weighing scales at the abattoirs
- The WSS price was reduced by in late 2018
- SMP cut out any bruised meat (in transport) which will reduce the carcass weight and may discount male cattle (from bulls to steers) is not castrated correctly.
- If a buyer was to offer you a per head price, with cash on the spot, what price would you accept?
- There are big differences in the (per kg) prices between different types of cattle (heavy and lighter). Is it worth trying to produce heavier cattle to get these higher prices? What are the production systems and costs involved?

Calculating total steer revenues

Given all these factors, Joseph's revenues from steers are:

- 1 steer. 400kgs * VT120/kg = **VT48,000**
- 3 steers VT38,400 * 4 = **VT1,000**
- Joseph decided to sell 2 of the steers for VT96,000 in December (before Christmas and school fees) and another 2 in May because another farmer was organising a truck

Look at way that Joseph calculated his total revenues. Fill out the table for your farm

Total revenues from steers in Joseph's farm	
Number of steers	3
Total each with best	48,000
Total for all steers	144,000

Total revenues from steers on your farm	
Number of steers	
Total each with best price	
Total for all steers	

Module 8.2 Revenues from the sales of cows

In this module you will calculate revenues from the sales of cows.

The number of cows that are sold every year depends on the management of the farmers. If farmers want to build up their breeding herd, they will keep as many heifers as possible (for breeding) and will keep cows to an old age. If a farmer wants to increase cash revenues, they sell heifers and even some breeding cows in good condition.

Joseph's strategy is to maintain the same size breeding herd.

- At low growth rates, it takes 3 years for heifers to reach puberty (320kgs). If mated successfully, it takes another year for them to calve at 4 years old.
- After another 5 years (total 9 years old), the farmer sells 2 of the cows.
- It is important to note that there will be fewer cattle available if there are mortalities or sales for ceremonies
- (With 10 cows in the herd and 2 sold at an old age this is a 20% culling rate (which is quite high!).
- The cows have only grown slowly (0.13kg/day) and can stop growing especially as they get older, and they weigh 400kgs when they are sold.
- The prices from SMP for cows are low and the best price is from WSS which offers VT80/kg live weight.
- So Joseph can sell 2 cows at 400kgs for VT/80/kg. This totals VT64,000.

Look at way that Joseph calculated his total revenues. Fill out the table for your farm

Revenue from the sale of culled cows on Jospeh's farm	
Cows	10
Culls / replacements	2
Av weight at sale (kg	400
Price (WSS) (VT/kg l	80
Revenue per head	32000
Total cow revenue	64,000

Revenue from the sale of culled	
Cows	
Culls / replacements per year	
Av weight at sale (kgs)	
Price (WSS) (VT/kg l	80
Revenue per head	0
Total cow revenue	-

Module 8.3. Revenues from the sale of heifers

In this module you will calculate revenues from the sales of heifers.

The number of heifers that are available for sale depends on how many are left over after heifers are used to replace culled cows in the breeding herd. Joseph uses 2 replacement heifers per year, so this leaves 1 heifer that can be sold. The heifer could be sold at a young age (especially to Vila markets) but Joseph decides to keep it with the steers in the bush block. It grows at about the same rate as the steers (0.3 kgs/day) and is also sold at 400kgs liveweight. It is assumed that these heifers are sold to another farm (big or small). A price of VT80/kg is assumed, but higher prices may be achieved for good heifers for breeding.

The revenues from the sale of heifers on Joseph's farm is shown below. Fill out the table for your farm next to it.

Revenues from the sales of heifers on Jospeh's farm	
Female calves per ye	3
Number used for rep	2
Mortalities	0
Ceremonies	0
Available for sale	1
Sales weight (kg)	400
Calf weight (kg)	25
Weight gain per yea	120
Years to reach 400kg	3.1
Price (VT/kg)	80
Returns	32,000

Revenues from the sales of heifers on your farm		
Female calves per year		
Number used for replacements		
Mortalities		
Ceremonies		
Available for sale		
Sales weight (kg)		
Calf weight (kg)		25
Weight gain per year		
Years to reach 400kg		
Price (VT/kg)		
Returns		-

Module 8.4 Revenues from the sale of culled bulls

In this module you will calculate revenues from the sales of bulls.

Most farms keep a bull to breed with their cows. About 1 bull is required for 20-30 cows. So Joseph has 1 bull. As shown in Module 7.2, it takes 3 years for the heifers to reach puberty. The bull should not be used to mate when these heifers reach puberty, so a new bull should be bought in to the farm every 3 years. This means that the old bull can be sold (for slaughter or to another farm).

It is assumed that the bull will start breeding at 2 years old and will be used for 3 year. If the bull grows at 0.33 kgs per day, it will reach about 600kgs by the time it is 5 years old. The price of bulls is relatively low VT90/kg liveweight, which is VT54,203. However, if the bull is sold another bull will be required. It is assumed that Joseph's heavier bull can be swapped with another lighter but younger bull, without any cost. Or bulls can be swapped between neighbours.

The revenues from the sale of heifers on Joseph's farm is shown below. Fill out the table for your farm next to it.

Revenues from the sales of bulls on Joseph's farm			**Revenues from the sales of bulls on your farm**	
Calf weight	25		Calf weight	
Years to puberty	2		Years to puberty	
Years service	3		Years service	
Age sold	5		Age sold	
ADWG	0.33		ADWG	
Days in year	365		Days in year	
Weight at cull	627.25		Weight at cull	
Price (WSS) (VT/kg)	90		Price (WSS) (VT/kg)	
Value per bull	56,453		Value per bull	
Number sold per yea	0		Number sold per year	
Swapped				
Rev per year	-		Rev per year	

Module 8.5. Recording all revenues in a figure

At the start of this module (8), you saw a figure of the production, sales and revenues of Joseph's farm. Based on the information about, fill it out for your farm from last year.

You can also ask some questions.

- How much revenue does your farm make from cattle?
- Which type of cattle generates the most revenue?
- What are the factors that affect revenues (numbers, productivity, ceremonies, deaths, prices)?
- Run the figures again with a death.

In Part 3 we will revisit this diagram for farm planning purposes.

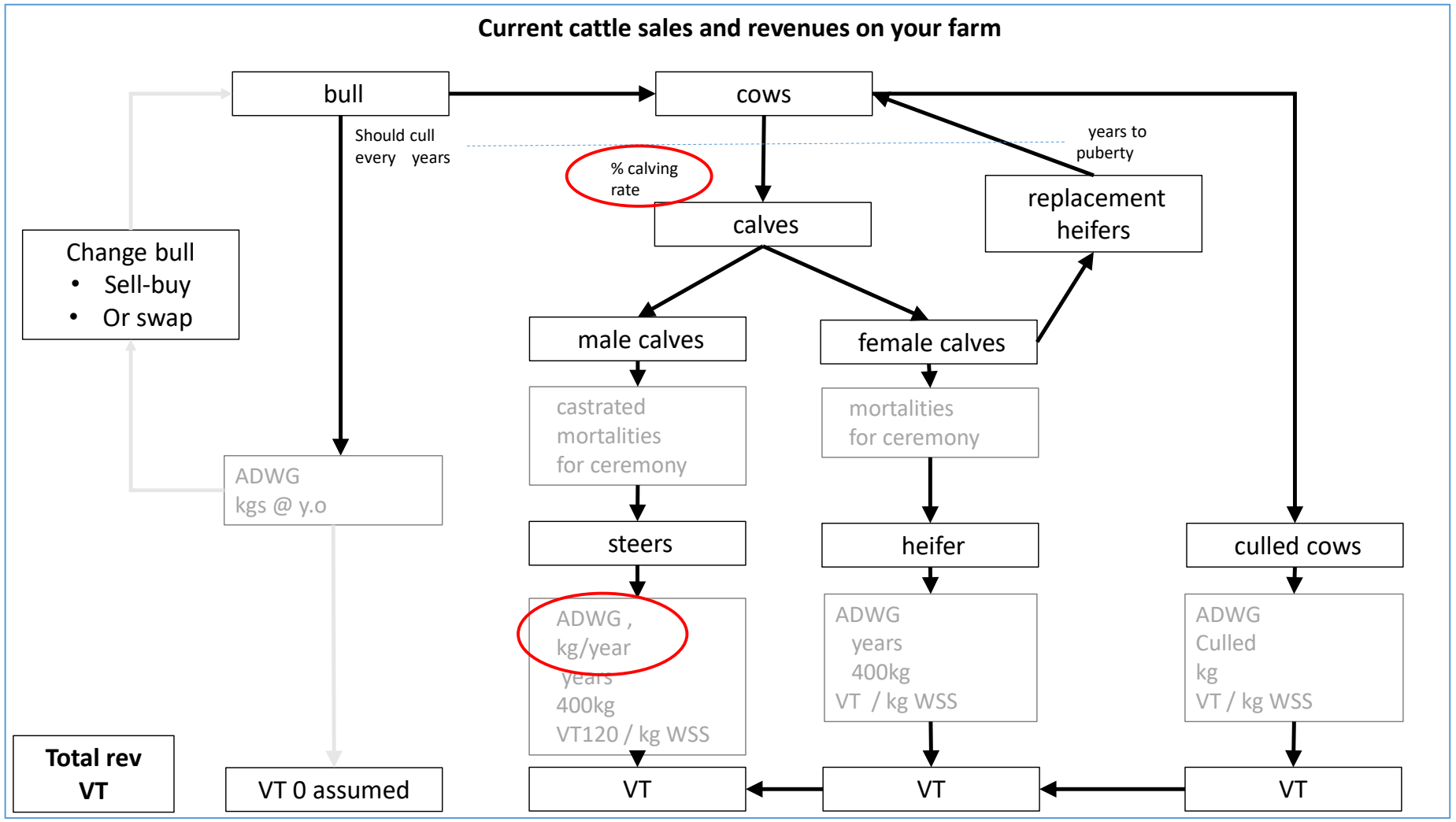

Figure 2. A diagram of our farm's cattle production, sales and revenues

Module 8.6. The timing of cattle sales

Now that you have recorded all the sales, production and revenue data for the year, the next step is to write down when you sold them and why. This will help you think about selling strategies and also in filling out a monthly cash flow sheet in the next module.

Farmers sell different numbers of cattle at different times of the year. Cattle can be sold:

- When the farmer needs or wants money
- To meet a specific expense (e.g. school fees or house construction) or for investment in something else (e.g. land clearing, wire)
- For seasonal reasons – e.g. coming into dry season when the cattle are in good condition but when feed supply will decrease
- To make selling easier and cheaper. E.g. if a neighbour is selling some cattle and a truck is coming out. Selling in the same lot will reduce transport costs per head.
- Prices may increase in peak demand (when a buyer needs cattle)
- Cattle are sometimes sold or donated for a ceremony

The timing of selling can be important in in increasing prices and productivity.

Look at Joseph's table on when he sold cattle and why. Fill out your own table.

Timing of cattle sales for Joseph							
Type of cattle		Month(s) sold	Number	Reason			
Steers		May	1	Coming into dry season			
		December	2	Chistmas, school fees			
Cows		March	2	Didn't look like it was in calf, getting old			
Heifers		April	1	Coming into dry season			
Bulls		December		Swapped every 3 years			

Timing of cattle sales for your farm							
Type of cattle		Month(s) sold	Number	Reason			
Steers							
Cows							
Heifers							
Bulls							

Module 8.7. Recording revenue in a monthly cash flow sheet

Now that you have recorded all the sales for the year, and the timing of the sales, the next step is to enter the information in a cash flow sheet.

Proper cash flow management is an important part of running a successful business Poor cash flow management is one of the main reasons for business failure.

A cash flow planner records the revenues (money coming in), costs (money going out) and profits (the difference between revenues and costs) each month and at the end of the year. This help farmers to predict if there will be a shortfall, surplus or profit at the end of the month/year, so that farmers can smooth out the cash flow. It also allows farmers to assess how business costs could be reduced or sales increased to make a better profit.

In this exercise, only the revenues are added. We will do the costs later (in Module 9.1).

Look at Joseph's table on revenues from different types of cattle by month. Fill out your own table on the next page.

Monthly revenues from cattle sales on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers					48,000							96,000	144,000
	Cows			64,000										64,000
	Heifers					32,000								32,000
	Bulls													-
	Other (uncastrated bulls)													-
	Total	**0**	**0**	**64,000**	**0**	**80,000**	**0**	**0**	**0**	**0**	**0**	**0**	**96,000**	**240,000**

Monthly revenues from cattle sales on your farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers													
	Cows													
	Heifers													
	Bulls													
	Other (uncastrated bulls)													-
	Total													

Module 9. Calculating costs and profits

Now that you have calculated the revenues from cattle production, the next step is to calculate costs. Once the costs have been calculated, these can be compared / combined with the revenues to calculate profits (or “returns”).

There are two ways to calculate costs and profits. These are:

- Cash costs and cash flows recorded on money (Vatu). This is done in Module 9.1.
- Labour costs and profits from labour (or “returns to labour”) recorded in labour time (working days) and Vatu. This is done in Modules 9.2.

It is also relevant to note that it is possible to calculate other types of costs (overhead costs and “capital costs”. These are not included in the budgeting (although the costs of longer-term investments are discussed in Module 10).

Module 9.1. Cash costs and cash flow

Cash costs

Farmers have to pay some expenses to keep the farm running. These are usually smaller costs paid in cash and are made quite often (e.g. every month or year). This can include cattle transport costs, vet costs, wire or rope. Costs vary depending on the size of the farm or number of cattle (so can also be called variable costs).

This is different to larger investments that are only made every few years and that last a long time (e.g. building a new fence, stockyards or water). This are called investments or capital costs and incur costs like depreciation. Don't include these costs in this module – it's done in Module 10.

Joseph has direct cash costs, but not too many.

- He does not pay any vet costs (vaccinations, drenches)
- He doesn't have any transport costs. Joseph sells to WSS, he hasn't bought any cattle in, or moved between areas
- Every 2 years, Joseph has to buy new rope so that he can tether his (4) steers in the bush block, and he also sometimes ties up calves (for weaning or castrating). The ropes last 2 years, so he has to buy about 4 per year. The ropes are about 10 metres long and cost VT95 per metre (VT950 each). Joseph buys ropes in February.
- Joseph occasionally has to fix some fencing.
    - He uses about one roll of barb wire of 250m and uses Chinese wire (VT3,450). And some nails or staple which might cost about VT150. So the total is VT3,600, paid in June.
    - On average every year he has to replace some posts on his fence. This requires renting a chainsaw and paying for fuel to cut a tree on his own land. VT400 in October.
- He doesn't have any outlays for pasture improvement (herbicide, seeds)
- Joseph and his family and family does most of the work on the farm himself. But occasionally he has to pay someone to help him with a wage of VT1,000 per day. This is done once a year to replace fence posts (2 days in June), for weaning (1 day in October) and to look after cattle when he is away (2 days in March and December).
- Joseph doesn't have any loans yet, so doesn't have to make repayments
- Joseph doesn't lease any land yet, so doesn't pay lease costs
- There are no other cash outlays

Have a look Joseph's cash costs. Fill out the table for your farm and include calculations.

Based on your calculations, ask the following questions

- Are the cash costs high, medium or low?
- What are the major costs?
- Are there ways to reduce costs?

Monthly costs for cattle on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash out	Veterinary													-
	Transport													-
	Rope		2,800											2,800
	Fencing material						3,600				400			4,000
	Pasture improvement													-
	Hired labour			2,000			2,000				1,000		2000	7,000
	Loan repayments													
	Other													-
	Total	**0**	**2,800**	**2,000**	**0**	**0**	**5,600**	**0**	**0**	**0**	**1,400**	**0**	**2,000**	**13,800**

Monthly costs for cattle on your farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash out	Veterinary													-
	Transport													-
	Rope													-
	Fencing material													-
	Pasture improvement													-
	Hired labour													
	Loan repayments													
	Other													
	Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Cash flow

Now that you have established cash costs, you can combine these with the revenues (from Module 8.7) to produce a cash flow sheet. Net cash flow is calculated by finding the difference between cash in and cash out. If you have more cash in, your business has made a profit for the month. If you have more cash out, you have made a loss for the month.

A cash flow allows you to know how much money if coming in or going out. This helps in many ways:

- To ensure that there is enough money coming in to pay for costs. If not, then need to get money from other sources
- To apply for banks loans, so that banks know if farmers can repay loans

To calculate cash flow, combine the revenues in the table in Module 8.7 and the in Module 9.1 above. More specifically:

- From the cattle revenue sheet, transfer the monthly total revenues to the “cash in” row of the cash flow sheet every month
- From the cattle costs sheet, transfer the total monthly costs to the “cash out” row of the cash flow sheet every month
- To calculate the “cash on hand end of month”, subtract the costs from the revenues
- To calculate the “cash on hand at beginning of month”, transfer the amount “cash on hand end of month” from the previous month
- Do this for every month until you reach “cash on hand end of month” in December. This is the yearly position. This can be transferred into the next year.

You can from Joseph’s farm that he has a negative number in February because he didn’t have any sales but did have costs. This cost will be paid for by money carried over from the previous year, of from other household cash on hand. However, from March to December, Joseph’s cattle business is “cash flow” positive. This is mainly because the cash costs on his farm are low.

Of course, Joseph will use some of this money for household expenses (food, housing, education, consumption) However, if he manages the money carefully (doesn’t spend too much), he will be able to pay for cattle costs, or would be able to save money for an investment in cash or take out a loan for investment.

Go through Joseph’s cash flow sheet. Complete one for your own farm. Some questions might be:

- In the months when cash flow is negative, where will you get money from?
- In months where cash flow is positive
    - What money will you need to carry over into future months (to meet costs)?
    - If there is money left over, what will you spend the money on?
    - What money will you save (and how)
    - By the end of the year, how much money will you have? Start thinking about what investments you could have

Monthly revenues from cattle sales on Joseph's farm

	Month	1	2	3	4	5	6	7	8	9	10	11	12	Total for year
Cash in	Steers					48,000							96,000	144,000
	Cows			64,000										64,000
	Heifers					32,000								32,000
	Bulls													-
	Other (uncastrated bulls)													-
	Total	**0**	**0**	**64,000**	**0**	**80,000**	**0**	**0**	**0**	**0**	**0**	**0**	**96,000**	**240,000**

Monthly costs for cattle on Joseph's farm

	Month	1	2	3	4	5	6	7	8	9	10	11	12	Total for year
Cash out	Veterinary													-
	Transport													-
	Rope		2,800											2,800
	Fencing material						3,600				400			4,000
	Pasture improvement													-
	Hired labour			2,000			2,000				1,000		2000	7,000
	Loan repayments													
	Lease of land													
	Other													
	Total	**0**	**2,800**	**2,000**	**0**	**0**	**5,600**	**0**	**0**	**0**	**1,400**	**0**	**2,000**	**13,800**

Monthly cash flow on Jospeh's farm

	Month	1	2	3	4	5	6	7	8	9	10	11	12
Cash at start of month		0	0	-2,800	59,200	59,200	139,200	133,600	133,600	133,600	133,600	132,200	132,200
Cash in during month		0	0	64,000	0	80,000	0	0	0	0	0	0	96,000
Cash out during month		0	2,800	2,000	0	0	5,600	0	0	0	1,400	0	2,000
Cash on hand end of month		**0**	**-2,800**	**59,200**	**59,200**	**139,200**	**133,600**	**133,600**	**133,600**	**133,600**	**132,200**	**132,200**	**226,200**

Monthly revenues from cattle sales on your farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers													
	Cows													
	Heifers													
	Bulls													
	Other (uncastrated bulls)													
	Total													

Monthly costs for cattle on your farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash out	Veterinary													
	Transport													
	Rope													
	Fencing material													
	Pasture improvement													
	Hired labour													
	Loan repayments													
	Lease of land													
	Other													
	Total													

Cash flow on your farm													
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cash at start of month													
Cash in during month													
Cash out during month													
Cash on hand end of month													

Module 9.2. Labour costs

While the previous section listed cash costs of running the farm, it did not account for the labour of running the farm. This is a much bigger cost and is measured not in VT / money but in time. Farmers spend a lot of time on their farm, but don't usually record it. In this module you will estimate the time you spend on your farm. This will help you understand how you spend your time on the farm.

Then the module will combine this information with the revenue information (form Module 8.7) to calculate "returns" (profit) to every day of labour. This will help you understand how much you make from cattle per day (8 hours of labour), which can be compared to other activities (e.g. coconuts or off-farm labour).

The table below shows Joseph's labour use, by different types of cattle activities. He does some types of jobs every week (fencing, tethering, weeding, moving cattle). For these jobs, it is easiest to remember labour use on a daily basis. Other jobs he just does every now and then. It is easiest to calculate how much time he spends on these every year.

Joseph works nearly every day or second day for some activities:

- To check, fix and clear fences
- To tether and move cattle

He does a few other jobs every week:

- Move cattle around paddocks
- And a larger day of weeding

The number of hours used to do these jobs per day is estimated. Joseph does most of these by himself, or if he is away, a relative will do it. So there are recorded as "one person" jobs. Except moving cattle around paddock, which is a "two person" job.

To calculate the number of hours spent doing these jobs

- Records the hours that are done per job per day, and the number people that do them, to calculate daily "person hours" per day. This is done vertically in the worksheet.
- Daily person hours are then added to calculate weekly costs, and converted to yearly costs (multiply by 52, because there are 52 weeks in a year). This is done horizontally

There are other jobs that are done just a few times a year

- As discussed above, Joseph sells 8 cattle per year and it is assumed each takes about 4 hours of work (total 32 hours).
- Joseph gets his cattle into the yards occasionally for jobs like castration, dehorning, assistance with calving or sick cattle and weaning. Every year, he might spend about 3 days doing this and requires a bit of help. This is from three relatives and neighbours, not paid

The number of hours, people doing the work and "person days" can be put straight into the yearly column.

Once all these costs have been calculated in the "Person hours per year", they are converted to "person days per year" by dividing by 8, because it is assumed there are 8 hours in a working day. This is done for each labour activity, horizontally.

Add "person days per year" for each labour activity (vertically in right hand column) and put the final "person days per year" in the bottom right hand corner. Joseph spends the equivalent of 230 labour days every year on his cattle, or 60% of his time.

Go through the labour dairy and calculations for Joseph’s farm and do the same for your farm.

Questions you should ask yourself are:

- What types of activities do you spend the most time on?
- What activities do you spend the least on?
- Is this surprising?
- Is this a good use of your time?

	Labour use for cattle on Joseph's farm												
	Labour activity	**Calculation**	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**	**Hours per week**	**Person hours per year (*52)**		**Person days per year (/8)**
Labour calculated weekly	Checking, fixing, clearing fences	Hours		2			2						
		People		1			1						
		Person hours		2			2			4	208		26
	Managing tethered cattle	Hours	2	2	2	2	2	2					
		People	1	1	1	1	1	1					
		Person hours	2	2	2	2	2	2		12	624		78
	Moving cattle (around paddocks or between blocks)	Hours			2		2						
		People			1		1						
		Person hours			2		2			4	208		26
	Cutting feed	Hours			2			2					
		People			1			1					
		Person hours			2			2		4	208		26
	Weeding	Hours		2			2						
		People		1			1						
		Person hours		2			2			4	208		26
	Nursery	Hours											
		People											
		Person hours								0	0		0
Labour calculated yearly	Pasture improvement and transp	Hours											
		People											
		Person hours									0		0
	Weaning / castration / dehorning	Hours									32		
		People									3		
		Person hours									96		12
	Buying or selling cattle	Hours									48		
		People									1		
		Person hours									48		6
	Other – e.g. water, animal health	Hours									36		
		People									1		
		Person hours									36		4.5
	Total days per year												**204.5**

	Labour use for cattle on your farm												
	Labour activity	**Calculation**	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**	**Hours per week**	**Person hours per year (*52)**		**Person days per year (/8)**
Labour calculated weekly	Checking, fixing, clearing fences	Hours											
		People											
		Person hours											
	Managing tethered cattle	Hours	2										
		People	1										
		Person hours	2										
	Moving cattle (around paddocks or between blocks)	Hours											
		People											
		Person hours											
	Cutting feed	Hours											
		People											
		Person hours											
	Weeding	Hours											
		People											
		Person hours											
	Nursery	Hours											
		People											
		Person hours											
Labour calculated yearly	Pastue improvement & transplan	Hours											
		People											
		Person hours											
	Weaning / castration / dehorning	Hours											
		People											
		Person hours											
	Buying or selling cattle	Hours											
		People											
		Person hours											
	Other – e.g. water, animal health	Hours											
		People											
		Person hours											
	Total days per year												

Module 9.3. Returns to labour

Now that you have worked out and recorded how much labour you use on cattle per year, you can work out how much money you make form that labour per day. This is quite simple.

You will remember that in Module 9.1, that we calculated the cash profits from Joseph's cattle, which totalled **VT226,200**. If we divide this by the number of labour days spent on cattle per year **(204.5)**, we calculate the "returns to labour" which was **VT1,106** (or AUD14) per day for Joseph.

	Cash profit		**Labour days**		
	226,200		**204.5**		
		Cash profit per labour day			
		VT	AUD		
		1,106	13.8		

Look at how we have calculated Joseph's "returns to labour" (VT/day) for cattle and calculate your own returns to labour.

Questions are:

- Is this a lot or not much?
- Were you surprised with the answer?
- How does this compare with other activities? You have to compare the returns, but also how consistent the incomes is:
    - The average *household* daily income in SANMA in 2010 was VT3,090.
    - The basic wage of off-farm labour is about VT1,000 per day
    - We can work out income from other activities (e.g. coconuts and kava)
- Do you think there is potential to increase or change these returns?

Notes:

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Part 3. Planning for change

Session overview:

Now that we have worked the productivity, the revenues, the costs, and the profits of your farm, we think about and plan ways to improve it.

Each farmer that did the budgeting above had different results. Each farmer also different farm objectives and farm activities and assets. However, in general the farmer can improve returns from cattle production in several ways.

Choice of activities. The farmer can change into more profitable activities. For example

- The farmer can move more into raising cows and less into raising steers (or vice-versa)
- Or it can move in (or out) of cattle production and into something else more profitable (e.g. kava)
- Or move out of other activities (e.g. kava) and more into cattle.

Productivity can be increased, e.g.

- In the productivity indicators used above:
    - The calving rate can be increased (from 80% to 100% or calf every year).
    - Steers can grow faster so they can be sold at an earlier age or for a higher price (increase from 120 to 150kgs per year).
    - These will have a big impact on revenues
- However increasing productivity requires some changes on the farm
- Cattle must be fed better by (for example) weed and pasture improvement (which takes extra work). So there are costs involved
- Or the stocking rate has to be reduced (by selling cattle, or old unproductive cattle). So numbers may have to decrease

Production can be increased, e.g.

- Cattle numbers can be increased by building up the herd (keeping heifers) or buying cattle. If productive, this can increase revenues.
- However, this often requires new investment (e.g. clearing, fences) and cash costs (e.g. wire) and labour (managing cattle).

Costs will be used more efficiently / profitably. E.g.

- The farmer can use labour better (e.g. less time tethering) to produce cattle more productively or to increase production

Cattle marketing can be improved, e.g.

- The farmer can choose the buyer that offers the highest prices (as calculated in Module 8.1).
- Or the farmer can reduce transport costs by choosing another buyer that charges lower transport costs, or by cooperating with a buyer / truck to lower costs (e.g. filling a truck in one area)

Different farmers will have different strategies depending on their household resources (land, labour, money) and plans (e.g. for money, family or custom). Some households don't want to change at all.

Think about the ways that cattle production and marketing can be improved, and consider the way that Joseph is improving his farm of farm management improved. This will be explored more in the future.

Module 11. Joseph's plans

Joseph is considering ways to improve his cattle operation.

He would like more income so that he can build a new house in the future, and help his children into the future

With regard to the **strategies** in Module 10, Joseph thinks the best strategy is to:

- Remain in mixed cow-calf and fattening operations
- **Expand production** from 10 cows to 16 cows. With increasing productivity, this means increasing cattle numbers from 29 to 52.
- He also hopes to increase **productivity**, through
    - Higher calving rates (from 60% to nearly 90%) through controlled weaning in weaning paddock
    - And higher growth of steers (from 120kgs per year to 160kgs for steers and heifers) through pasture improvement
- If he can get high growth rates, he hopes to sell them to SMP for higher **prices**

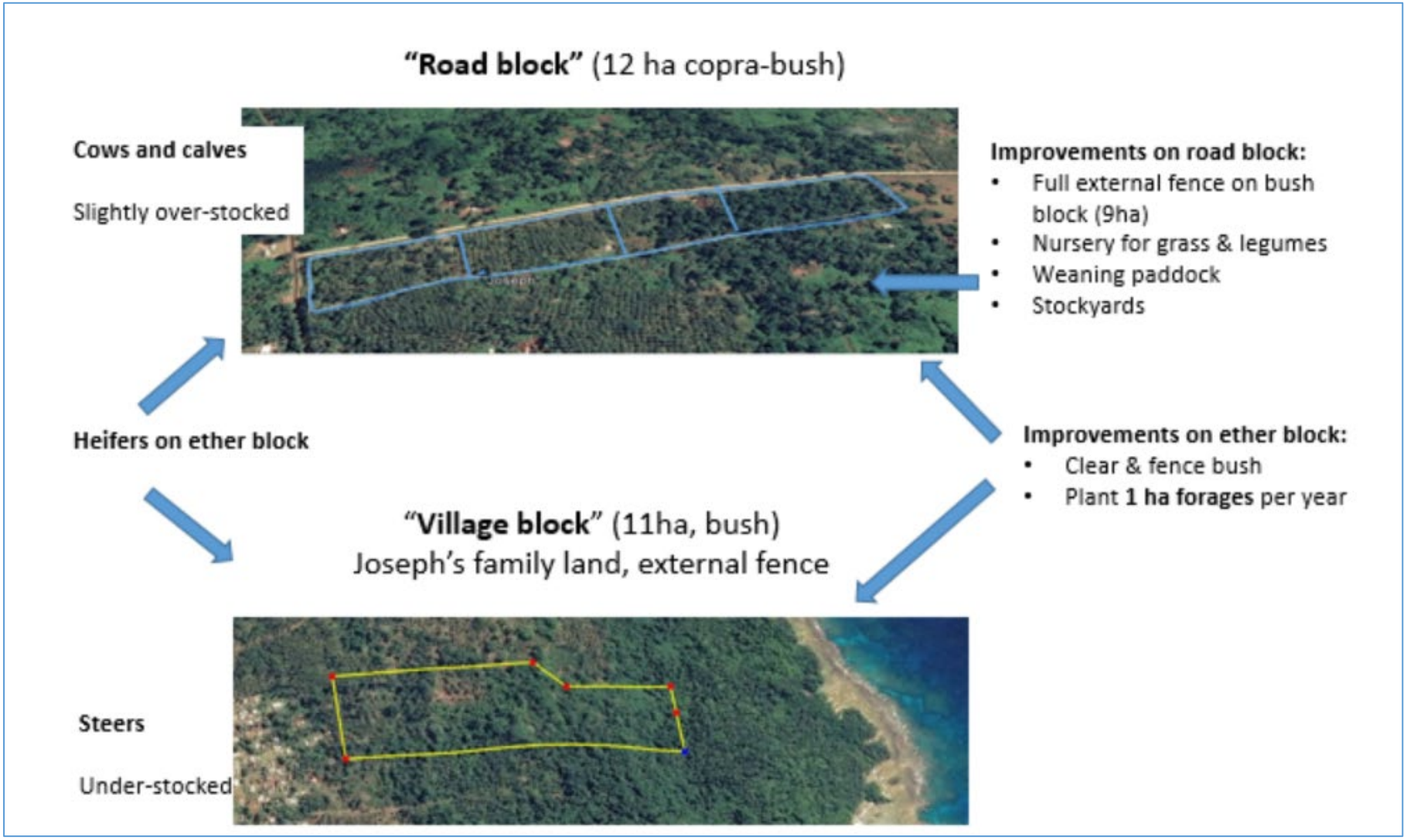
For **land, t**o realise his plans, Joseph will have 2 blocks and improve both

- On his "**road block**" (copra and bush above). The improvements are
    - To build a nursery and weaning paddock with improved forges, for cows and calves
    - He will also fence off the bush area so steers and heifers can be grazed there. He may also do some pasture improvement there through fencing off paddocks and planted grass and legumes; or planting runners into the bush. This will be mainly for heifers and steers, but cows could use the land into the future if well managed.
    - If these improvements are made, he would not need to use the 2 ha of his neighbour.
- He also has access to a "**village block**". This is mostly bush with some clearings, is about 11ha and currently has an adequate fence. Joseph and his brother have inherited this land. Joseph's brother uses it now, but they have agreed to use it to improve the pastures and use it for steers and heifers.

Cattle management. With the planned changes, some of his cattle management would change

- The cows and calves will remain on the "road block", with one bull. Joseph will be strict about castration and weaning at an early age (6 months).
- He will also have moved the cattle around more, within the paddocks in the road block, and between the road block and the village block.
- He will sell the heifers that he doesn't use for herd replacement at an earlier age, to reduce labour and feed demands.
- The steers will be run in the fenced road block and village block, which will be improved bit-by-bit every year.

The summary of the plans are presented below:



Map of Joseph's planned land use in improved systems

These plans will have a big effect on **labour:**

- Joseph is already very busy and spends about 60% of his time on cattle. But he likes cattle, thinks he is a good producer and that it has the best potential. He is prepared to spend about 80% of his time on cattle and leave time for copra and community activities. Relatives especially his brother can help with the extra workload and will have to hire extra labour where required.
- With 21 steers and heifers, Joseph won't have to tether them so he will graze them by building more fences. This will mean that he can spend less time tethering and more time fencing and checking and clearing fences.
- When he checks fences, he will also have to spend more time walking around the cattle and cutting feed to keep them quiet.
- The road block will have a full external fence, and there will be four internal paddocks, a nursery and a weaning paddock, plus a set of permanent yards. This will enable him to separate and rotate herds to utilise his feed better.

Infrastructure. The new systems mean that Joseph will have to invest in a few types of infrastructure.

On the road block he will build:

- A full secure fence around the bush on the "road block",
- A grass and legumes nursery on the "road block",
- A weaning paddock on the "road block", and
- A set of permanent stockyards on the "road block".

He will also have to do pasture improvement, either on the bush part of the "road block" or the "village block".

Pasture improvement. Joseph has committed to improving 1 ha of bush per year. To do this, he will build a nursery and transplant legumes and grasses to paddocks.

- Clearing that amount of land is the biggest job, which can be done by machinery, by hand (chainsaw and machete), by grazing or herbicide,
- Many different types of grasses, tree legumes or ground legumes could be used,
- Most require that the improved area is kept free of stock for a period – 3-4 months for grasses and ground legumes and 1-2 years for tree legumes. This means that the land needs to fenced and can't be grazed for a period of time, and
- Another way of improving bush is to clear new land every year, plant vegetables to generate income, and to introduce grasses and legumes every year, before moving to the next area. The same can be done with kava though over longer periods (3-5 years).

Joseph has chosen to grow grasses and ground legumes in his nursery, clear and fence 1 ha of land per year, and transplant into that. This requires exclusion for 3-4 months. This will be done very year.

While Joseph thinks this is a good plan, he is not sure and wants to work out if the plans are worth it for him and his family. The modules below help us do that.

Consider Joseph's plans. Do they sound reasonable? What would you do in that situation? What ideas do you have for your cattle business? Write it down on this page and we will explore further

Module 12. Investment costs

To implement his plans, Joseph will have to pay for some quite large costs for fences and yards. It is important to know what this will cost, so these will be budgeted below.

Module 12.1 Fence costs

Perimeter

The first step is to calculate the perimeter of the fence he has to build:

- Joseph knows he has 9 ha of land in the bush (or 90,000 sq m) and
- He has paced out the boundary and thinks that it is 300m wide by 300m long on each side in rectangular block.

So the total perimeter would be 1200m. The formula is 2*(width + length)

Calculation of perimter of fence on Joseph's bush block		
Item	**Value**	**Way to calculate**
Ha	9	
sq m	90,000	Multiply ha * 10,000
length (m)	300	l*w=sq m
width (m)	300	
perimeter (m)	1,200	2*(w+l)

Calculate the perimeter of the block you want to fence

Calculation of perimter of fence on your bush block		
Item	**Value**	**Way to calculate**
Ha	-	
sq m	-	Multiply ha * 10,000
length (m)		
width (m)		l*w=sq m
perimeter (m)	-	2*(w+l)

Consider how Joseph calculated the cost of his fence

Calculating the cost or wire and fixings

- The fence will have 4 wires * 1,200m = 4,800m,
- The cost of Chinese wire per 500m roll is VT6,900. See prices below. Fijian and Waratah wire will last longer (~12 years),
- So 5,000m (10 rolls) would cost VT69,000, and
- There are additional costs in tie wire (VT5,000) and staples (VT5,000).

Barbed wire prices - Santo Hardware Mar 2017						
	Chinese wire		Fjian wire		Australian wire	
Metres in roll	250	500	250	500	250	500
Cost	3,450	6,900		14,880		18,300

Posts

- The posts are spaced 4m a part, so need 300 of them. These include corner posts and hibiscus posts / spacers.
- These are cut from the bush block but there are costs in cutting them (chainsaw) and transport (ute) of about VT10,000.

Labour

- It took 15 days to clear the boundary for the fence, 10 days to cut and stand the posts, and 5 days to roll out and fix the wires (total 30 days).
- Joseph employed a neighbour to help him build the fence at a cost of VT1,000 per day, to total VT30,000.
- It also cost him 30 days of his own labour.

Total costs

The budgeting below suggests that the total cash costs of building the yards are VT129,000. Is this a lot?

- It would take most households a lot of time to save this amount of money.
- The cash profits of Joseph this year was VT274,000. So the fence would use about half the profit from cattle. This would leave less money for other activities.
- If Joseph didn't have the money to pay for a fence, he MAY be able to lend money for it. However, the bank would charge interest on the loan. If the rate was 13% per year for VT129,000 that would be VT16,770 per year in interest (and would still have to pay down the principal of the loan).
- It is also important to note that this is a one-off cost. A fence that would last for 10 years without replacement of wire and posts would only cost VT12,900 per year (VT129,000 divided by 10). This is known as a **depreciation** cost.

Go through the budget for Joseph's fence. If you are building a fence, complete one for your paddock.

Budget to build fence on Jospeh's bush block			Calculations	Sub-totals	Notes
Fence type					
	Area (ha)		9		From above
	Perimeter length of fence (m)		1,200		From above
	Wires		4		Specify
Materials					
	Barbed wire			69,000	
		Metres required	4,800		Perimeter * no. of wires
		Metres per roll	500		See price list
		Number of rolls required	10		
		Type	Chinese		See price list
		Cost per roll	6,900		See price list
	Posts and stays			20,000	
		Spacing b/t posts (m)	4		Specify
		Posts required	300		Perimeter / spacing
		Chainsaw & transport	20,000		Calculate
	Staples			5,000	Specify
	Tie wire			5,000	Specify
	Transport				
Hired labour					
	Person days			30,000	
		Clearing	15		Specify
		Post standing	10		Specify
		Wire	5		Specify
	Rate (VT/day)		1,000		Specify
Total cost				**129,000**	

Budget to build fence on your block			Calculations	Sub-totals	Notes
Fence type					
	Area (ha)		-		From above
	Perimeter length of fence (m)		-		From above
	Wires				Specify
Materials					
	Barbed wire			-	
		Metres required	-		Perimeter * no. of w
		Metres per roll			See price list
		Number of rolls required			
		Type			See price list
		Cost per roll	-		See price list
	Posts and stays			-	
		Spacing b/t posts (m)			Specify
		Posts required			Perimeter / spacing
		Cost chainsaw & transport			Calculate
	Staples				Specify
	Tie wire				Specify
	Transport				
Hired labour					
	Person days				
		Clearing			Specify
		Post standing			Specify
		Wire			Specify
	Rate (VT/day)				Specify
Total cost					

Module 12.2 Nursery costs

To do pasture improvement, Joseph has to establish a nursery. It could grow various types of forages and species, but Joseph is planting a mix of grasses and legumes.

Size of nursery

The first step is to calculate how much land is required for a nursery to grow enough runners and seedlings to transplant into the land to improved (this is one hectare for Joseph)

The BBB project has estimated that a nursery of 25m by 25m is required. Use the same methods as the module above to calculate the perimeter.

Calculation of size of Joseph's nursery			
Item	Value	Comments	
Ha	0.0625		
sq m	625		
length (m)	25		
width (m)	25		
perimeter (m)	**100**		

Calculation of size of your nursery			
Item	Value	Comment	
Ha			
sq m			
length (m)			
width (m)			
perimeter (m)			

Fence

The nursery will have to be fenced so cattle can't get in and the forages can get established. The method to calculate fence costs are also the same as above.

Cost of fence of Kospeh's nursery			
Wire			
Perimeter	100	From above	
Number of wires	4		
Wires required (m)	400		
Metres per roll	500		
Number of rolls require	0.8		
Type	Chinese		
Cost per roll	6,900		
Other fence items			
Posts	0	Cut from bush	
Staples	50		
Tie wire	50		
Transport			
Total cost	**5,520**		

Cost of fence of your nursery			
Wire			
Perimeter			
Number of wires			
Wires required (m)			
Metres per roll			
Number of rolls required			
Type			
Cost per roll			
Other fence items			
Posts			
Staples			
Tie wire			
Transport			
Total cost			

Clearing and hired labour

Joseph has decided to build the nursery near the stockyards. The land is already quite clear but has to be cleaned up. He has decided not to use herbicide, and to do it by hand. This is big job so employs a group to help.

Joseph also employs someone to help with other jobs including building the fence and planting the forages

Hired labour to establish nursery on Joseph's farm				
		People	Days	Person days
Land clearing		6	1	6
Fence				
	Post cutting	1	1	1
	Post standing	1	1	1
	Wire	1	1	1
Seeding / planting		1	1	1
Total hired labour required				**10**
Rate (VT/day)				1,000
Total hired labur cost				**10,000**

Hired labour to establish nursery on your farm				
		People	Days	Person da
Land clearing				
Fence				
	Post cutting			
	Post standing			
	Wire			
Seeding / planting				
Total hired labour required				
Rate (VT/day)				
Total hired labur cost				

Other and total costs

The table below calculates total costs of building the nursery. It includes:

- Other cash costs – machinery and seeds. Insert these in below,
- And bring in the costs calculated above – fence and hired labour,
- Add these to calculate total costs for the nursery.

Total cost of establishing a nursery			
Item	**Sub-item**	**Value**	**Comments**
Clearing			
	Machinery	0	
	Herbicide	0	
Fence		5,520	From above
Seeds		100	Provided by government or project
Hired labour		10,000	From above
Other costs		0	
Total costs		**15,620**	

Total cost of establishing a nursery			
Item	**Sub-item**	**Value**	**Comments**
Clearing			
	Machinery		Insert if used
	Herbicide		Insert if used
Fence			From above
Seeds			
Hired labour			From above
Other costs			
Total costs		-	

Module 12.3 Pasture improvement costs

To increase the productivity of his cattle, Joseph will have to improve has pastures. The grasses and legumes will be transplanted from the nursery to land that he wants to improve. He wants to improve 1 hectare per year, in the bush either on the road block or the village block. The methods to improve this land is similar to that used for the nursery.

Size of paddock to be improved

The size of Joseph's improved pasture			
Item		Value	Comments
Ha		1	
sq m		10,000	
length (m)		100	
width (m)		100	
perimeter (m)		**400**	

The size of your improved pasture			
Item		Value	Comment
Ha			
sq m			
length (m)			
width (m)			
perimeter (m)			

Fence

The improved pasture will have to be fenced so cattle can't get in and the forages can get established. The pasture should be established with 3-4 months in wet season, so cattle can be grazed after that.

Joseph can leave the fence there after that so that he can use the paddocks for rotation. In this case, the forage area planted in the next year can use the same fence line, so the fence costs will be halved. Total fence costs will then VT11,040

Cost of fence of Jospeh's improved pasture			
Wire			
Perimeter	400	From above	
Number of wires	4		
Wires required (m)	1,600		
Metres per roll	500		
Number of rolls requ	3.2		
Type	Chinese		
Cost per roll	6,900		
Other fence items			
Posts	0	Cut from bush	
Staples	500		
Tie wire	500		
Transport			
Total cost	**22,080**		

Cost of fence of yourimproved pasture			
Wire			
Perimeter			
Number of wires			
Wires required (m)			
Metres per roll			
Number of rolls required			
Type			
Cost per roll			
Other fence items			
Posts			
Staples			
Tie wire			
Transport			
Total cost			

Clearing and hired labour

The land that Joseph wants to improve is bush, with some open areas and some trees. He will use some of the trees for post, and leave big trees, but has to clear the bush to transplant the seedlings from the nursery. He has decided not to use herbicide, and to do it by hand. This is big job so employs a group to help. If labour costs are too high in the first year, he will see if it is cheaper to use herbicide the next year.

Joseph also employs someone to help with other jobs including building the fence and planting the forages.

Hired labour to establish Joseph's improved pasture						Hired labour to establish your improved pasture				
		People	Days	Person days				People	Days	Person da
Land clearing		6	14	84		**Land clearing**				
Fence						**Fence**				
	Post cutti	1	4	4			Post cutting			
	Post stanc	1	4	4			Post standing			
	Wire	1	2	2			Wire			
Seeding / planting		3	2	6		**Seeding / planting**				
Total hired labour required				**100**		Total hired labour required				
Rate (VT/day)				1,000		Rate (VT/day)				
Total hired labur cost				**100,000**		Total hired labur cost				

Other and total costs

The table below calculates total costs of building the nursery. It includes:

- Other cash costs – machinery and seeds. Insert these in below,
- And bring in the costs calculated above – fence and hired labour,
- Add these to calculate total costs to improve the paddock. (Note that fence costs will be halved in subsequent years)

Total cost of pasture improvement on Jospeh's farm per year			
Item	**Sub-item**	**Value**	**Comments**
Clearing			
	Machinery	0	
	Herbicide	0	May have to use if labour costs too high
Fence		22,080	From above
Seeds			From nursery
Hired labour		100,000	From above
Other costs		0	
Total costs		**122,080**	

Total cost of pasture improvement on your farm per year			
Item	**Sub-item**	**Value**	**Comments**
Clearing			
	Machinery		Insert if used
	Herbicide		Insert if used
Fence			From above
Seeds			From nursery
Hired labour			From above
Other costs			
Total costs		**-**	

Module 12.4 Stockyard costs

Joseph has set of cattle yards made from bush material. But he has to do a lot of upkeep on them and they are not secure – to work with and hold cattle. As mentioned, Joseph's plans mean that he needs a good set of permanent yards so that he can manage cattle well (castration, weaning, measurement, selling).

The budget below, estimates the costs of building a set of strong cattle yards. Joseph can cut timber from his block in an arrangement with a mobile miller. So Joseph won't pay for the costs of the timber or milling, and will provide some of the timber to the miller. Other costs are outlined below.

The estimated figures below suggest that the yards would cost about VT49,450 to build.

- If the yards lasted 10 years, this would VT4,945 per year,
- If a loan was taken out, it would cost about VT6,429 per year.

Go through the budget for Joseph's stockyard. If you plan to build yards, complete one for your farm

Yard budget for Joseph			**Sub-total**	**Totals**	**Notes**
	Materials			39,450	
		Posts	-		Cut from own land
		Rails	-		Share arrangement with miller
		Concrete	23,000		Used for race
		Bolts	1,450		
		Transport	10,000		Transport from paddock to yard
		Chainsaw	5,000		Cut timber again in yards
		Other	-		
	Labour bought in			10,000	
		Person days	5		
		Rate	2,000		
	Total cost			**49,450**	

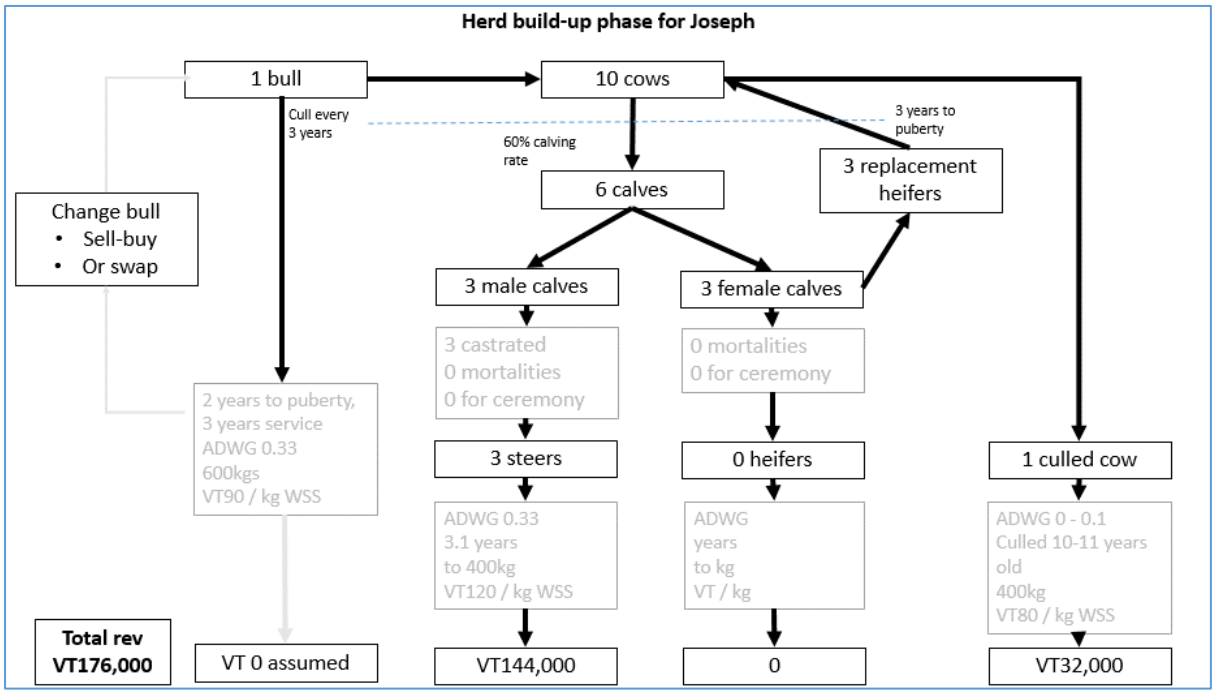
Yard budget for your farm			**Sub-total**	**Totals**	**Notes**
	Materials			-	
		Posts	-		
		Rails	-		
		Concrete			
		Bolts			
		Transport			
		Chainsaw			
		Other	-		
	Labour bought in				
		Person days			
		Rate			
	Total cost				

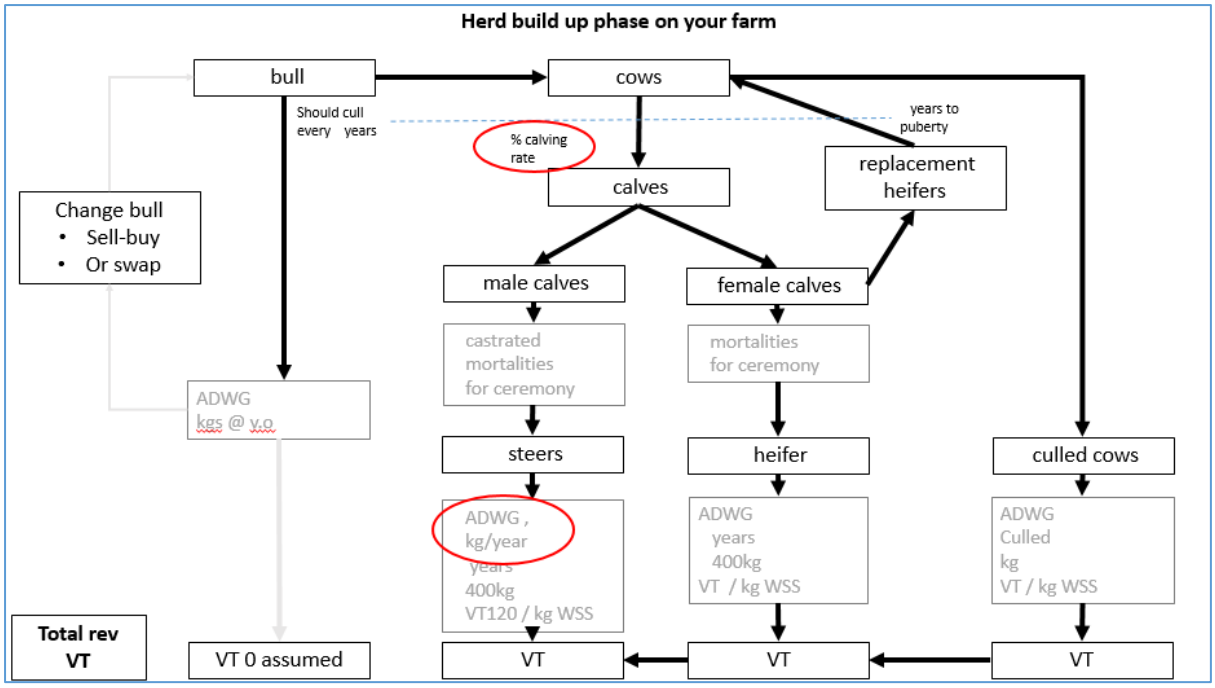
Module 12.5. Lost income while building a herd

Joseph wants to build stock numbers from 10 to 16 cows. There are several ways he could build a herd: by buying cows; or by breeding them himself. Joseph has decided to breed up himself. This means that:

- In his current production system (above), he has 3 female calves per year, 2 are used for replacement and 1 sold. While he is breeding up, all 3 heifers will be kept adding to the breeding herd (in 3 years' time), and none will be sold. This means that Joseph will lose the revenue from one heifer (VT32,000).
- Also, in his current system, he culls 2 cows per year worth VT64,000. However, he will now hold his old cows for longer and cull only one cow worth VT32,000. This means that he will lose the revenue from one cow (VT32,000).
- As result of the herd build up, his cattle revenue will decrease by VT64,000 per year for 3 years (VT192,000), until the heifers reach puberty and can have a calf.

Have a look at changes on Joseph cattle herd as he builds it up. Show the way that to you plan to do this and show the revenue losses and periods.




Herd build up phase on your farm
bull
cows
Should cull every years
% calving rate
years to puberty
calves
replacement heifers
Change bull
• Sell-buy
• Or swap
male calves
female calves
castrated mortalities for ceremony
mortalities for ceremony
ADWG kgs @ y.o
steers
heifer
culled cows
ADWG , kg/year years 400kg VT120 / kg WSS
ADWG years 400kg VT / kg WSS
ADWG Culled kg VT / kg WSS
Total rev VT
VT 0 assumed
VT
VT
VT

Module 12.6. Total costs of transition

Now that we know the costs above, we can add them to calculate total investment costs in Year 1.

Investment costs for Joseph in year 1	
Fence around bush on road block	129,000
Nursery	15,620
Pasture improvement	122,080
Stockyards	49,450
Total	**316,150**
Lost revenue during herd buildup (years 1-3)	**64,000**

Investment costs for your famr in year 1	
Fence around bush on road block	-
Nursery	-
Pasture improvement	-
Stockyards	-
Total	**-**
Lost revenue during herd buildup (years 1-3)	

The total costs of investment of Joseph in year 1 is 316,000. This is a lot of money. Part 4 will help you decide if it's worth making this investment. If it is, then you will you make a savings plan for the investment (see Module 12.7).

It is important to note that these are big "upfront costs". Only the costs of pasture improvement will be made in subsequent years. As mentioned, this will be half of the fence costs. These costs are annual costs, so will be included in cash costs in Part 4. Also, after year 3, the herd will be built up so cattle revenues will increase again.

Costs for Joseph to improve systems year 1-10	
Fence around bush on road block	-
Nursery	-
Pasture improvement	111,040
Stockyards	-
Total	**111,040**
Lost revenue during herd buildup (years 1-3)	**64,000**

Costs for Joseph to improve systems year 1-10	
Fence around bush on road block	-
Nursery	-
Pasture improvement	-
Stockyards	-
Total	**-**

Module 12.7. Saving for investment

In the example above there are large investments in expanding the herd and improving the farm and pastures (VT316,15). This could come from a number of sources:

- In the unimproved system, the total cash income from VT216,000 per year (excluding own labour costs). So if the farmer saved all money from cattle (and relied on other activities for household expenses and consumption), then it would take 1-2 years of cattle sales to save the money for the improvements.
- However, if half of cattle income is required for expenditure, then in might take a farmer 3 years to save this amount.

However, different plans have different investment requirements – yours may be lower.

Develop your own savings plan for the investments you are planning.

Part 4. Improved systems

After Joseph has gone through the transition and herd build-up stage, he will arrive at the new production and marketing system. We will go through this step-by-step just as we did for Modules 7, 8 and 9.

Module 13. Cattle productivity

We will work through the same productivity indicators (stocking rate, calving rate, growth rate) as we did in Module 7, but with the new systems.

Module 13.1 Stocking rate

After building it up, Joseph has a new herd profile.

- Cow numbers have increased (from 10 to 16),
- The calving rate has increased so calf numbers have increased (from 6 to 14),
- This means more steers in the paddocks, and if they are kept for 3 years like in the previous system, numbers will increase (from 6 to 14),
- There are also more heifers per year, but because they are growing faster in the new system, they reach puberty earlier (<2 years old, instead 2.5 years old) and can be moved earlier from the heifer herd to the cow herd. This changes the number of heifers from (from 6 to just 7),
- One bull can service the cows (so that hasn't changed),
- So overall cattle numbers have increased (from 29 to 52).

While the herd numbers have increased, Joseph's stocking capacity has also increased a lot for a number of reasons.

- His land areas has increased. Although he stops lending the 2 ha of his neighbour, he can now use the 11ha of his brother on the village block,
- He now has a weaner paddock, so calves are moved out of the copra land into the weaning paddock form 6-12 months of age. This reduced stocking rates on the copra, and
- His stocking capacity on the bush blocks will increase because of the pasture improvement. While this is gradual (1 ha per year), this is assumed to increase stocking capacity from 1.5 AU/ha to 2 AU/ha.

Look at the example of Joseph and then fill out the table for your stock numbers and convert to animal units. Note that all Joseph's heifers will be grazed in the new paddock

Animal units carried by Joseph in different paddocks - new system								
Cattle			**Numbers**	**AU**	**AU carried**	**Paddock kept**		
	To calculate:		Use stock numbers from Module 4					
				Multiply by these animal units				
					To find the total number of animal units			
						Write the paddocks they are held in		
Lactating cows			16	1.2	19.2	Copra		
Calves <1yo			14	0.3	4.2	Copra		
	Female	7						
	Male	7						
Heifers >1yo			7	0.75	5.25	Copra		
	1-2 yo	7						
	2-3yo	0						
	3-4yo	0						
Steers >1yo			14	0.75	10.5	Bush		
	1-2 yo	7						
	2-3yo	7						
	3-4yo	0						
Breeding bulls (mature)			1	2	2	Copra		
Uncastrated males >1yo (450kg)			0	1	0	Bush		
Total cattle			**52**		**41.15**			

Animal units carried on your farm in different paddocks								
Cattle			**Numbers**	**AU**	**AU carried**	**Paddock kept**		
	To calculate:		Use stock numbers from Module 4					
				Multiply by these animal units				
					To find the total number of animal units			
						Write the paddocks they are held in		
Cows (lactating)				1.2				
Calves <1yo				0.3				
	Female							
	Male							
Heifers >1yo (250kg)				0.5				
	1-2 yo							
	2-3yo							
	3-4yo							
Steers >1yo (350kg)				0.75				
	1-2 yo							
	2-3yo							
	3-4yo							
Breeding bulls (mature)				2				
Uncastrated males >1yo (450kg)				1				
Total cattle								

The extra cattle places extra pressure on Joseph's limited land. As mentioned, he plans to overcome this by leasing copra land from a neighbour to run the extra cows and calves. He also wants to use the bush block to capacity. The stocking rates are below. You can see that the copra blocks are still over-stocked (but less than before) and the bush block is at about capacity.

Fill out the stocking rates for your new herd below that.

Animal carried compared to carrying capacity on Joseph's farm			
Copra		**Bush**	**Instructions**
Animal units on road bloack	25.4	Animal units on bush blo	15.75	Add up the number of animal units raised in each paddock
Carry capacity animal units per hectare (buffalo & carpet grass under old coconuts)	1.5	Carry capacity animal units per hectare in bush	2	Use this carrying capacity per ha
Hectares	12	Hectares	11	
Total carrying capacity	18	Total carrying capacity	22	Multiply carrying capacity per ha by land area (ha) to calculate total carrying capacity
Number over-stocked	7.4	Number over-stocked	-6.25	Subtract the actual number carried from the carrying capacity to calculate how much the land is over-stocked or under-stocked

Animal carried compared to carrying capacity on your farm				
Copra		**Bush**		**Instructions**
Animal units under copra		Animal units in bush		Add up the number of animal units raised in each paddock
Carry capacity animal units per hectare (buffalo & carpet grass under old coconuts)	1.5	Carry capacity animal units per hectare in bush	2	Use this carrying capacity per ha
Hectares		Hectares		Use land areas form Module 4
Total carrying capacity		Total carrying capacity		Multiply carrying capacity per ha by land area (ha) to calculate total carrying capacity
Number over-stocked		Number under-stocked		Subtract the actual number carried from the carrying capacity to calculate how much the land is over-stocked or under-stocked

As a group, review the tables above.

Joseph still looks over-stocked on the copra blocks. If he finds that the cows aren't doing well, he may have to solve the problem by for example: de-stocking cow numbers; running some of the cows in the bush; weaning early and moving weaners into the bush; by selling steers at a younger age (e.g. 2 y.o instead of 3y.o) so there are fewer generations of steers on the bush block; pasture improvement; or leasing more land.

What did you find on your farm?

Notes:

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Module 13.2 Calving rate

An important part of Joseph's improvements is to increase the calving rate. It was previously low at 60%. Now with his 16 cows he aims to produce 14 calves a year, which would be a calving rate of 87.5%. He thinks he can achieve this because he has quite young cows (although they became older in the build-up phase) and through controlled weaning. He also hopes to increase the average calf weight from 25kgs to 30kgs.

Divide the number of calves that you have per year by the number of cows to calculate a calving rate on your farm. Write down your calculations and answer here.

As a group, discuss your calving rate. Is it high or low? What are the reasons for this rate? Can anything be done to improve the rate? You can write answers here.

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Module 13.3 Growth rates

Joseph thinks that he can increase the growth rates of the steers and the heifers run in the bush block. There is good feed in the block and the cattle will be able to graze more freely rather than being tethered. He will also occasionally cut feed and fruit for the cattle to keep them quiet.

Growth rate of Joseph's steers - new system				
Date of weighing	Days in period	Weight recorded	Weight gain over period	ADWG
Jan 1 2018		300		
July 1 2018	182	390	90	0.49
Dec 31 2018	183	460	70	0.38
Increase over year	365		160	0.44

Over the whole year, Joseph's bullocks grow at 0.44kgs (440 grams) per day, or 160kgs per year, a significant increase over the previous system.

Using the same methods, fill out the table to calculate growth rates for your farm below.

Date of weighing	Days in period	Weight recorded	Weight gain over period	ADWG				
Date 1								
Date 2								
Date 3								
Year	365							
			Calcualtions:					
			Weight at second weighing minus weight at first weighing					
				Weight gain divided by number of days in period				

As a group, review the tables above. How do the growth rates compare? What are the reasons for your growth rates?

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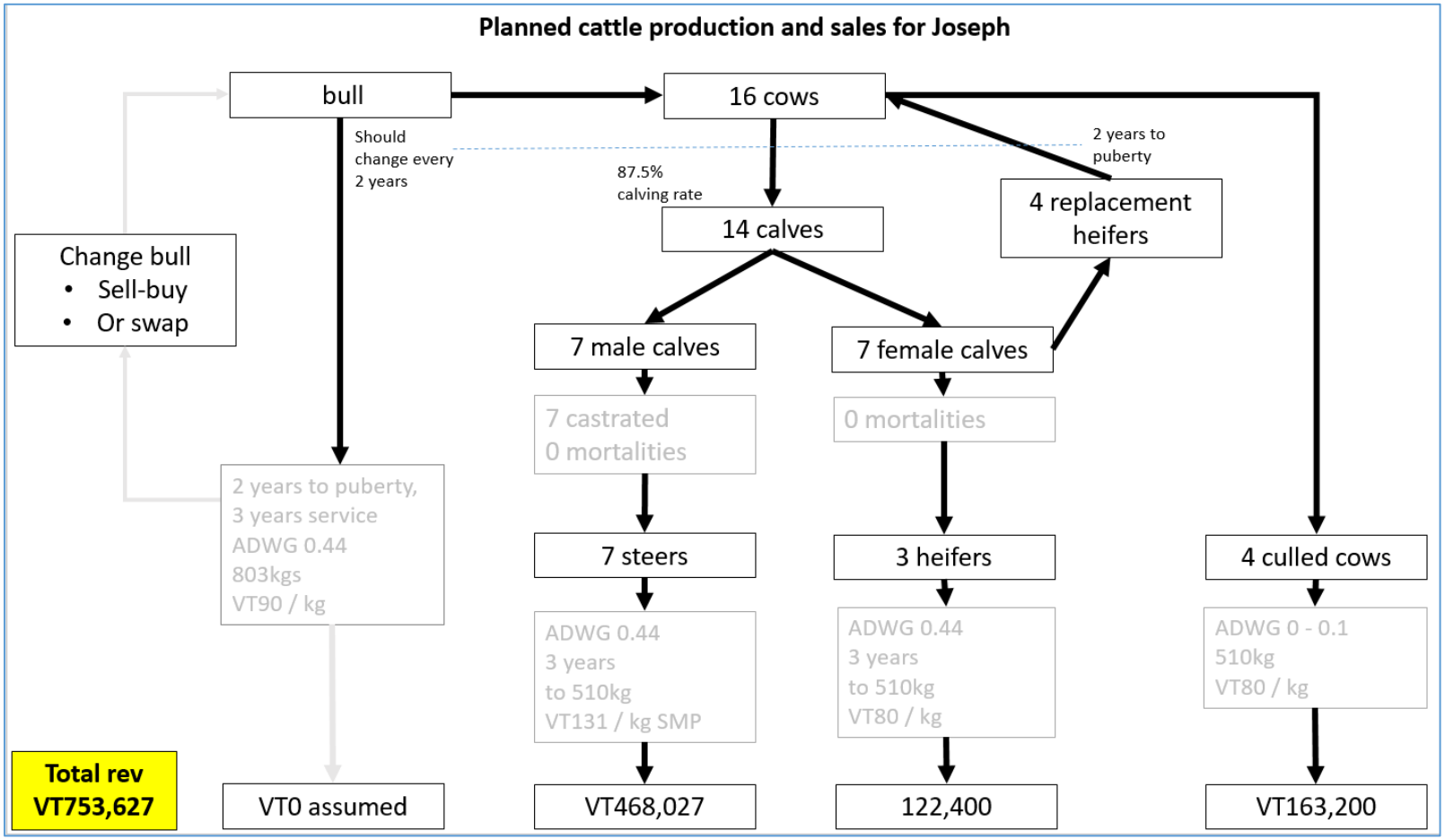
Session overview.

The overview of Joseph's expanded, and more productive cattle system is shown below.



Module 14.1 Revenues from steers

In this module you will calculate revenues from sales of steers.

Numbers of steers for sale

In the new production system, there will be 7 male calves every year. **IF** all the male calves are castrated, there are no deaths, 7 steers will be available for sale every year (see below on calculating slaughter weights and ages).

Because of the higher growth rates of the steers, Joseph has a choice. He could:

- Sell the steers at the same weight as before (400kgs) but because of the higher growth rate, he could sell them at 2.3 years of age, instead of 3.1. This would reduce steers numbers by 7 (and a lower stocking rate). This is what he does with the heifers (that aren't used for replacements),
- However, he wants to try to grow the steers to a heavier weight to get a premium price. This means keeping steers for 3 years to reach 510kgs liveweight.

Look at the way that Joseph has calculated how may steers he will have for sale every year (see below). Fill out the table for your farm

Number of steers available per year on Jospeh's farm	
Cows	16
Calving rate	88%
Calves	14
% male calves	50%
Male calves per year	7
Deaths	0
Ceremonies	0
Uncastrated	0
Total available for sale	7

Number of steers available per year on your farm	
Cows	
Calving rate	
Calves	
% male calves	
Male calves per year	
Deaths	
Ceremonies	
Uncastrated	
Total available for sale	

Weight and age of slaughter

How do we calculate the age when cattle will reach slaughter weight?

- As discussed, Joseph wants to sell the cattle at 510kgs liveweight, Because the cattle are much heavier, the dressing percentage is higher (57%) and the carcass weight will classify them as S-1 steers, with good prices (VT131/kg liveweight).

- When the calves are born, they weigh about 30kgs. The calves should grow well, and the steers at about 160kgs per year (see Module 13.3).
- Over 3 years, the steer would reach 510kgs (30+160+160+160). So it would take about 3 years to reach 510kgs,
- The precise formula would be (510-30)/120 = 3 years.
- The farmer has to keep the steers for 3 years before they are sold.
- It also means that there will be 3 generations of steers on the farm (3*3.4) = 9.
- One of those years would be as a calf (less than one year old on the copra block) and two of the years would be as a steer over one year old on the bush block.

Look at the way that Jospeh has calculated how long it will take him to produce his steers to the target weight for sale. Fill out the table for your farm.

Weight and age calculations for steers on Joseph's farm	
Sales weight (kg)	510
Calf weight (kg)	30
Weight gain per year	160
Years to reach 400kg	3.0

Weight and age calculations for steers on your farm	
Sales weight (kg)	
Calf weight (kg)	30
Weight gain per year	
Years to reach 400kg	

Prices

Liveweight is converted to carcass weight based on a dressing percentage. For steers of 510kgs, the carcass weight is about 57% of the liveweight, or 290.7kgs.

If you look at the price schedule of SMP, then the price of steers with this carcass weight is VT210/kg carcass weight. So the total price would be 290.7kgs X VT230/kg = **VT66,861**. However, SMP charges transport costs of about VT2,000 per head (see Module 15.1).

For cattle of 510kgs liveweight, WSS pays VT120/kg liveweight, which is **VT61,200**. However, the WSS scales are said to under-weigh heavy cattle (10% is assumed).

So Joseph prefers to sell to SMP.

Look at the way that Joseph has calculated and compared prices from different buyers. Fill the table out for your farm.

Comparison of prices for Joseph's steers				
		SMP		WSS
Liveweight		510		510
Dressing percentage		57%		
Carcass weight		290.7		
Price				
	VT/kg carcass weight	230		
	VT/kg live weight			120
Total		**66,861**		**61,200**
Minus transport costs		2,000		0
Minus 10% discount on scales				6,120

Comparison of prices for your				
		SMP		WSS
Liveweight				
Dressing percentage				
Carcass weight				
Price				
	VT/kg carcass weight			
	VT/kg live weight			
Total				
Minus transport costs				
Minus 10% discount on scales				

Calculating total steer revenues

Given all these factors, Joseph's revenues from steers are:

- 1 steer. 290.7kgs carcass weight * VT210/kg = **V66,861,**
- 7 steers * VT**66,861** * = **VT468,027,**
- Joseph decided to sell 3 of the steers for VT200,583 in May and another 4 steers in December (before Christmas and school fees) for Vt267,444.

Look at way that Joseph calculated his total revenues. Fill out the table for your farm

Total revenues from steers in Joseph's farm		
Number of steers		7
Total each with best		66,861
Total for all steers		**468,027**

Total revenues from steers on your farm		
Number of steers		
Total each with best price		
Total for all steers		

Module 14.2 Revenues from the sales of cows

After Joseph has reached 16 cows, he will stabilise the herd (not increase or decrease it) unless necessary.

- At higher growth rates, it takes 2 years for heifers to reach puberty (320kgs). If mated successfully, it takes another year for them to calve at 3 years old.
- In higher productivity systems, the farmer culls cows at an early age, with a culling rate of 25%.
- With 16 cows in the herd this is 4 culled cows per year sold at 510kgs.
- The prices for culled cows are only VT80/kg live weight.
- So Joseph can sell 4 cows at 510kgs for VT80/kg to total VT163,200.

Look at way that Joseph calculated his total revenues. Fill out the table for your farm

Revenue from the sale of culled cows on Joseph's farm	
Cows	16
Culls / replacements	4
Av weight at sale (kg	510
Price (WSS) (VT/kg lv	80
Revenue per head	40,800
Total cow revenue	163,200

Revenue from the sale of culled cows on your farm	
Cows	
Culls / replacements per year	
Av weight at sale (kgs)	
Price (WSS) (VT/kg lw)	
Revenue per head	
Total cow revenue	

Module 14.3. Revenues from the sale of heifers

In this module you will calculate revenues from the sales of heifers in improved systems.

Joseph uses 4 replacement heifers per year, so this leaves 3 heifers that can be sold. The heifers could be kept on either the road block or the village block with the steers. They grow at about the same rate as the steers (0.44 kgs/day) and are also sold at 510kgs liveweight. However, the price for heifers is low partly because of the slaughter ban, and the price is assumed to be VT80/kg.

The revenues from the sale of heifers on Joseph's farm is shown below. Fill out the table for your farm next to it.

Revenues from the sales of heifers on Jospeh's farm	
Female calves per ye	7
Number used for rep	4
Mortalities	0
Ceremonies	0
Available for sale	3
Sales weight (kg)	510
Calf weight (kg)	30
Weight gain per yea	160
Years to reach 510kg	3.0
Price (VT/kg)	80
Returns	40,800

Revenues from the sales of heifers on your farm	
Female calves per year	
Number used for replacements	
Mortalities	
Ceremonies	
Available for sale	
Sales weight (kg)	
Calf weight (kg)	30
Weight gain per year	
Years to reach 400kg	
Price (VT/kg)	80
Returns	-

Module 14.4 Revenues from the sale of culled bulls

In this module you will calculate the value of breeding bulls.

In the improved systems, the cows are still held together on the road block in a herd, so the same number of bulls is required (one). As shown in Module 14.2, it takes 2 years for the heifers to reach puberty so the bull should be replaced every 2 years. Even though the bull grows at a higher rate while it is on the farm (0.44kgs/day) and can be sold, it is assumed that the bull is swapped for another bull, with no cost associated.

The value of bulls is calculated below, but revenues are generated.

Revenues from the sales of bulls on Joseph's farm	
Calf weight	30
Years to puberty	2
Years service	3
Age sold	5
ADWG	0.44
Days in year	365
Weight at cull	803
Price (WSS) (VT/kg)	90
Value per bull	72,270
Rev per year	0

Revenues from the sales of bulls on your farm	
Calf weight	
Years to puberty	
Years service	
Age sold	
ADWG	
Days in year	
Weight at cull	
Price (WSS) (VT/kg)	
Value per bull	
Rev per year	

Module 14.5. Recording all revenues in a figure

At the start of this module (14), you saw calculations on the production, sales and revenues of Joseph's farm. Based on the information about, fill it out for your farm from last year.

You can also ask some questions.

- How much revenue does your farm make from cattle?
- Which type of cattle generates the most revenue?
- What are the factors that affect revenues (numbers, productivity, ceremonies, deaths, prices)?
- Run the figures again with a death

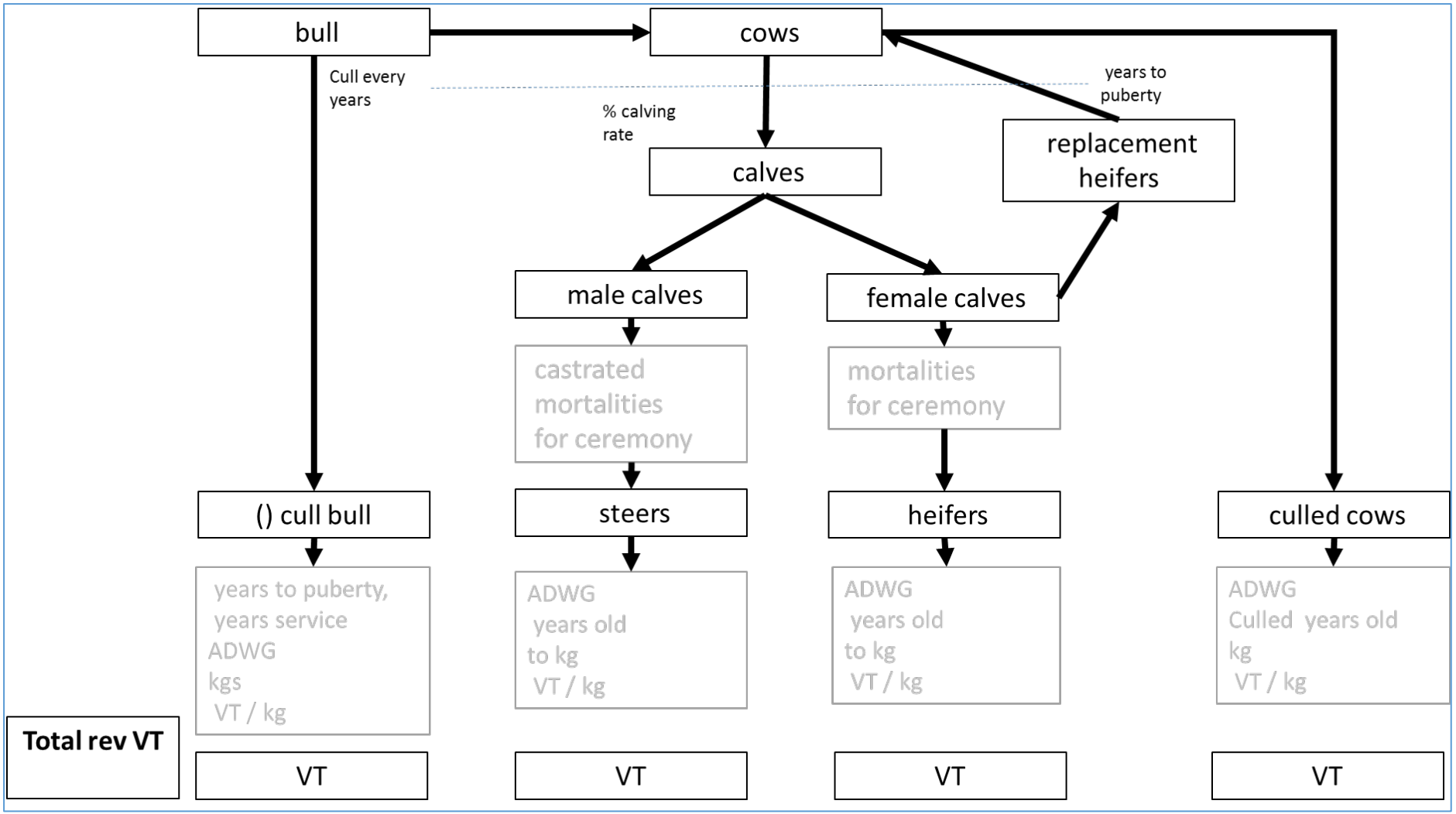


Figure 3. A diagram of our farm's cattle production, sales and revenues

Module 14.6. The timing of cattle sales

This is the timing of sales of cattle from Joseph's improved systems

.

Look at Joseph's table on when he sold cattle and why. Fill out your own table.

Timing of cattle sales for Joseph							
Type of cattle		**Month(s) sold**	**Number**	**Reason**			
Steers		May	3	Coming into dry season			
		December	4	Chistmas, school fees			
Cows		March	4	Didn't look like it was in calf, getting old			
Heifers		April	3	Coming into dry season			
Bulls		December	1	Should have done all mating by then, put in the same truck as the steers			

Timing of cattle sales for your farm							
Type of cattle		**Month(s) sold**	**Number**	**Reason**			
Steers		May					
		December					
Cows		March					
Heifers		April					
Bulls		December					

Module 14.7. Recording revenue in a monthly cash flow sheet

Now that you have recorded all the sales for the year, and the timing of the sales, the next step is to enter the information in a cash flow sheet.

Look at Joseph's table on revenues from different types of cattle by month. Fill out your own table.

Monthly revenues from cattle sales on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers					200,583							267,444	468,027
	Cows			163,200										163,200
	Heifers					122,400								122,400
	Bulls												-	-
	Other (uncastrated bulls)													-
	Total	**0**	**0**	**163,200**	**0**	**322,983**	**0**	**0**	**0**	**0**	**0**	**0**	**267,444**	**753,627**

Monthly revenues from cattle sales on your farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers													
	Cows													
	Heifers													
	Bulls													
	Other (uncastrated bulls)													-
	Total													

Module 15. Calculating costs and profits

Now that you have calculated the revenues from cattle production, the next step is to calculate costs.

Module 15.1. Cash costs and cash flow

Cash costs

In the improved systems, Joseph has higher cash costs.

- He still does not pay vet costs (vaccinations, drenches),
- However, he has higher transport costs, especially to move cattle between his road and villages blocks. He has to hire a local truck to do this three times a year, for VT2,000 each time.
- The costs of rope to tether cattle are lower because of his investment in fencing (see Module 12.1 above).
- However, because of the additional fencing, Joseph has higher costs to buy fencing material (VT8,000 3 times per year).
- As shown in Module 12.3, Joseph will improve 1Ha of pastures per year, which has a substantial cost (of VT55,000) in the wet season months of January and February)
- With the extra cattle and land, Joseph hires some help on the farm (VT4,000) per month for work with cattle and the farm.
- There are no costs for loans, land leases or other cash outlays.

Have a look Joseph's cash costs. Fill out the table for your farm and include calculations.

Based on your calculations, ask the following questions

- Are the cash costs high, medium or low?
- What are the major costs?
- Are there ways to reduce costs?

Monthly costs for cattle on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for y**
Cash out	Veterinary													-
	Transport					2,000			2,000			2,000		6,000
	Rope			1,000										1,000
	Fencing material		8,000				8,000				8,000			24,000
	Pasture improvemer		55,000	55,000										110,000
	Herbicide				4,000									4,000
	Hired labour		4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	44,000
	Loan repayments													
	Lease of land													
	Other													
	Total	**0**	**67,000**	**60,000**	**8,000**	**6,000**	**12,000**	**4,000**	**6,000**	**4,000**	**12,000**	**6,000**	**4,000**	**189,000**

Monthly costs for cattle on your farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for y**
Cash out	Veterinary													-
	Transport													-
	Rope													-
	Fencing material													-
	Pasture improvement													-
	Herbicide													
	Hired labour													
	Loan repayments													
	Lease of land													
	Other													-
	Total													

Cash flow

Now that you have established cash costs, you can combine these with the revenues (from Module 14) to produce a cash flow sheet.

For instructions on how to do this, see Module 9.1. Joseph's farm that he has a negative number in February because he didn't have any sales but did have costs. He still had high costs for pasture improvement in March but sold some bulls to pay for this. From March to December, Joseph's cattle business is "cash flow" positive. The money can be used for household expenses or re-investment.

Go through Joseph's cash flow sheet. Complete one for your own farm. Some questions might be:

- In the months when cash flow is negative, where will you get money from?
- In months where cash flow is positive:
    - What money will you need to carry over into future months (to meet costs)?
    - If there is money left over, what will you spend the money on?
    - What money will you save (and how)?
    - By the end of the year, how much money will you have? Start thinking about what investments you could have.

Monthly revenues from cattle sales on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers					200,583							267,444	468,027
	Cows			163,200										163,200
	Heifers					122,400								122,400
	Bulls												-	-
	Other (uncastrated bulls)													-
	Total	**0**	**0**	**163,200**	**0**	**322,983**	**0**	**0**	**0**	**0**	**0**	**0**	**267,444**	**753,627**

Monthly costs for cattle on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash out	Veterinary	-	-	-	-	-	-	-	-	-	-	-	-	-
	Transport	-	-	-	-	2,000	-	-	2,000	-	-	2,000	-	6,000
	Rope	-	-	1,000	-	-	-	-	-	-	-	-	-	1,000
	Fencing material	-	8,000	-	-	-	8,000	-	-	-	8,000	-	-	24,000
	Pasture improvem	-	55,000	55,000	-	-	-	-	-	-	-	-	-	110,000
	Herbicide	-	-	-	4,000	-	-	-	-	-	-	-	-	4,000
	Hired labour	-	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	44,000
	Loan repayments	-	-	-	-	-	-	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**0**	**67,000**	**60,000**	**8,000**	**6,000**	**12,000**	**4,000**	**6,000**	**4,000**	**12,000**	**6,000**	**4,000**	**189,000**

Monthly cash flow on Jospeh's farm												
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cash on hand start of month	0	0	-67,000	36,200	28,200	345,183	333,183	329,183	323,183	319,183	307,183	301,183
Cash in during month	0	0	163,200	0	322,983	0	0	0	0	0	0	267,444
Cash out during month	0	67,000	60,000	8,000	6,000	12,000	4,000	6,000	4,000	12,000	6,000	4,000
Cash on hand end of month	**0**	**-67,000**	**36,200**	**28,200**	**345,183**	**333,183**	**329,183**	**323,183**	**319,183**	**307,183**	**301,183**	**564,627**

Monthly revenues from cattle sales on your farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers													
	Cows													
	Heifers													
	Bulls													
	Other (uncastrated bulls)													
	Total													

Monthly costs for cattle on your farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash out	Veterinary													
	Transport													
	Rope													
	Fencing material													
	Pasture improvement													
	Hired labour													
	Loan repayments													
	Lease of land													
	Other													
	Total													

Cash flow on your farm													
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cash at start of month													
Cash in during month													
Cash out during month													
Cash on hand end of month													

Module 15.2. Labour costs

This section calculates the amount of labour used by Joseph in the improved system.

Compared to the unimproved system Joseph has changed labour use in the following ways. For weekly tasks he spends:

- double the time checking fences,
- saves 78 person days previously tethering cattle (which is not required now because of the fencing),
- But spends 3 times more time moving cattle between paddocks (because of the 2 blocks),
- And more time feeding and weeding

For occasional tasks done a few times per year,

- Joseph has a very large increase in time in pasture improvement (52 days per year) in addition to hired labour,
- The improved systems require roughly double the amount of time in cattle management, marketing and other cattle jobs).

Once all these costs have been calculated in the “Person hours per year”, they are converted to “person days per year” by dividing by 8, because it is assumed there are 8 hours in a working day. This is done for each labour activity, horizontally.

Add “person days per year” for each labour activity (vertically in right hand column) and put the final “person days per year” in the bottom right hand corner. Joseph spends the equivalent of 270 labour days every year on his cattle.

Using the calculation methods in Module 92, go through your (realistic) estimates of labour required in your planned system.

Questions you should ask yourself are:

- What types of activities do you spend the most time on?
- What activities do you spend the least on?
- Is this surprising?
- Is this a good use of your time?

	Labour use for cattle on Joseph's farm												
	Labour activity	**Calculation**	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**	**Hours per week**	**Person hours per year (*52)**		**Person days per year (/8)**
Labour calculated weekly	Checking, fixing, clearing fences	Hours		4		4		4					
		People		1		1		1					
		Person hours		4		4		4		12	624		78
	Managing tethered cattle	Hours											
		People											
		Person hours								0	0		0
	Moving cattle (around paddocks or between blocks)	Hours	2		2		2						
		People	1		1		1						
		Person hours	2		2		2			6	312		39
	Cutting feed	Hours	2		2			2					
		People	1		1			1					
		Person hours	2		2			2		6	312		39
	Weeding	Hours		4		4		4					
		People		1		1		1					
		Person hours		4		4		4		12	624		78
Labour calculated yearly	Pasture improvement	Hours									208		
		People									2		
		Person hours									416		52
	Weaning / castration / dehorning	Hours									32		
		People									3		
		Person hours									96		12
	Buying or selling cattle	Hours									48		
		People									1		
		Person hours									48		6
	Other – e.g. water, animal health	Hours									96		
		People									1		
		Person hours									96		12
	Total days per year												**316**

	Labour use for cattle on your farm													
	Labour activity	**Calculation**	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**		**Hours per week**	**Person hours per year (*52)**		**Person days per year (/8)**
Labour calculated weekly	Checking, fixing, clearing fences	Hours												
		People												
		Person hours												
	Tethering cattle	Hours												
		People												
		Person hours												
	Cattle management (moving & handling cattle)	Hours												
		People												
		Person hours												
	Cutting feed	Hours												
		People												
		Person hours												
	Weeding	Hours												
		People												
		Person hours												
	Pasture improvement	Hours												
		People												
		Person hours												
Labour calculated yearly	Weaning / castration / dehorning	Hours												
		People												
		Person hours												
	Buying or selling cattle	Hours												
		People												
		Person hours												
	Other – e.g. water, animal health	Hours												
		People												
		Person hours												
	Total days per year													

Module 15.3. Returns to labour

In the same way that we worked out "returns to labour day" in Module 9.3, we will do the same here for Joseph's improved system.

In Module 14.7 we worked out that cash revenues for cattle for the year are **VT564,627**. If we divide this by the number of labour days spent on cattle per year **(316 days)**, we calculate the "returns to labour" which was **VT1,787** (or AUD22.3) per day for Joseph.

Compared to the low productivity system, the cattle revenues are much (2.5 times) higher. Labour is also significantly (1.4 times) higher. However, because increases in revenues are higher than labour input, the "returns to labour" are much (1.8 times) higher.

Improved system		
Cash profit		**Labour da**
564,627		**316**
	Cash profit per labour day	
	VT	AUD
	1,787	22.33

Look at how we have calculated Joseph's "returns to labour" (VT/day) for cattle and calculate your own returns to labour in your planned system.

Questions are:

- Is this a lot or not much?
- Were you surprised with the answer?
- How does this compare with other activities? You have to compare the returns, but also how consistent the incomes is:
    - The average *household* daily income in SANMA in 2010 was VT3,090.
    - The basic wage of off-farm labour is about VT1,000 per day,
    - We can work out income from other activities (e.g. coconuts).
- Do you think there is potential to increase or change these returns?

Part 5. Prioritized actions

Work step-by-step, session-by-session to prioritize the actions you have listed in the previous sessions.

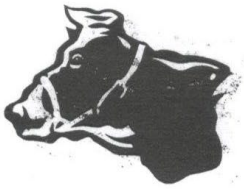
Work through the following table about your priority changes, how and when they will be implemented and by who.

Table 3A: Priority action plan			
My priority changes	How will I make the changes?	When?	Who is responsible?

Part 6. Training Manual Appendices

Appendix 1. Price schedules

SMP Price schedule May 2016. VT/kg hot carcass weight



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May 23, 2016

CATTLE PURCHASE PRICE LIST

Note 1. **No grading applies prices are paid on HOT dressed carcass weight.**

CATTLE		WEIGHT RANGE	PRICE
		STEER	
S-1	A	270.0 KGS AND OVER	230VT/KG
S-2	B	240.0 KGS TO 269.5 KGS	200VT/KG
S-3	C	200.0 KGS TO 239.5 KGS	160VT/KG
S-4	D	199.5 KGS AND UNDER	100VT/KG
		HEIFER	
H-1	E	260KGS AND OVER	200VT/KG
H-2	F	240KGS AND 269.5 KGS	180VT/KG
H-3	G	200.0 KGS TO 239.5 KGS	150VT/KG
H-4	H	199.5 KGS AND UNDER	100VT/KG
		COW	
C-1	J	240.0 KGS AND OVER	140VT/KG
C-2	K	200.0 KGS TO 239.5 KGS	120VT/KG
C-3	L	150.0 KGS TO 199.5 KGS	100VT/KG
C-4	M	149.5 KGS AND UNDER	80VT/KG
		BULL	
B-1	O	230.0 KGS AND OVER	125VT/KG
B-2	P	200.0 KGS TO 229.5 KGS	110VT/KG
B-3	Q	150.0 KGS TO 199.5 KGS	100VT/KG
B-4	R	149.5 KGS AND UNDER	80VT/KG

2016			2018			2019			
Class	Weight range	Price VT/kg CW	Class	Weight range	Price VT/kg CW	Class	Weight range	Price VT/kg CW	
				Steers					
S-1	270 kg and over	190	S-1	270 kg and over	230		S-1	240 kg and over	255
S-2	240 to 269.5 kg	170	S-2	240 to 269.5 kg	200		S-2	210 to 239.5 kg	200
S-3	200 to 239.5 kg	130	S-3	200 to 239.5 kg	160		S-3	180 to 209.5 kg	180
S-4	199.5 kg and under	90	S-4	199.5 kg and under	100		S-4	179.5 and under	120
				Heifer					
H-1	240 kg and over	150	H-1	260kgs and over	200		H-1	240 kg and over	255
H-2	240 kg and over	150	H-2	240 kg and over	180		H-2	210 to 239.5 kg	200
H-3	200 to 239.5 kg	130	H-3	200 to 239.5 kg	150		H-3	180 to 209.5 kg	170
	199.5 kg and under	90		199.5 kg and under	100		H-4	179.5 and under	120
Cow			Cow			Cow			
C-1	240 kg and over	130	C-1	240 kg and over	140		C-1	240kg and over	150
C-2	200 to 239.5 kg	110	C-2	200 to 239.5 kg	120		C-2	200kg to 239.5kg	125
C-3	150 to 199.5 kg	80	C-3	150 to 199.5 kg	100		C-3	150kg to 199.5kg	110
C-4	149.5 kg and under	60	C-4	149.5 kg and under	80		C-4	149.5kg and under	80
Bull			Bull			Bull			
B-1	230 kg and over	115	B-1	230 kg and over	125		B-1	230kg and over	135
B-2	200 to 229.5 kg	110	B-2	200 to 229.5 kg	110		B-2	200 kg to 229.5kg	115
B-3	150 to 199.5 kg	80	B-3	150 to 199.5 kg	100		B-3	150kg to 199.5kg	100
B-4	149.5 kg and under	60	B-4	149.5 kg and under	80		B-4	149.5kg and under	80

Appendix 3.2. Further cattle scenarios and agricultural activities

Prepared by: Scott Waldron

Scenarios in cattle production systems and returns

Four scenarios were modelled. The following two scenarios are modelled in the BBB training manual (Appendix 3.1), which includes a detailed explanation of the modelling process.

1. "Medium herd (10 cows), low productivity" (Scenario 1, MHLP). Land is unimproved and over-grazed. This is the base (typical) case, and
2. "Large herd (16 cows), high productivity" (Scenario 2, LHHP). New land is added and improved, and stocking rate is balanced.

Two other scenarios were added:

3. "Small herd (6 cows), high productivity" (Scenario 3, SHHP). Land is improved and the stocking rate is balanced, and
4. "Large herd (16 cows), low productivity" (Scenario 4, LHLP). New land is added but is unimproved and over-grazed.

The project therefore compared a total of four small holder cattle production models. In turn, these are compared with two other non-cattle (substitute/complementary) activities. This enables policy makers, extension agents, development agencies, and farmers to assess the range of activities and options available to farmers and which might be most suitable to different types of farmers. Note that the numbering below (e.g. SHHP11) are designed to relate to the numbering in the training manual (Appendix 3.1).

Scenario 3. Smaller herd, improved land, high productivity (SHHP)

SHHP 11. Joseph's plans

The plan in this scenario is to reduce the size of the herd and to improve existing land (Scenario 1) in order to have a more productive system. His strategy is to:

- **Reduce cow numbers** from 10 to 6, which (with higher productivity) will reduce cattle numbers from 29 to 24.
- **Productivity** increases include:
    - Higher calving rates (from 60% to nearly 88.75%) through controlled weaning in weaning paddock and lower stocking rates in copra paddock, and
    - Higher growth of steers (from 120kgs per year to 160kgs for steers and heifers) through pasture improvement.

If he can get high growth rates, he can replace culled cows with young heifer (2 y.o) and grow steers efficiently with high slaughter weights (672kgs at 4y.o) with a high dressing percentage (57%) and premium price (VT230/kg CW).

For **land,** to realise his plans, Joseph will just keep his "road block" (copra and bush in Scenario 1). The improvements are:

- To build a nursery and weaning paddock with improved forges, for cows and calves,
- Fence off the bush area so steers and heifers can be grazed there and won't need to be tethered,
- Pasture improvement through planted grass and legumes or planting runners into cleared areas of the bush. This will be mainly for steers, and
- Keep using the 2 ha block of his neighbour.

SHHP 12. Investment costs

This section outlies the investments required for this strategy

SHHP 12.1 Fence costs

Fencing was already completed in Scenario 1. These are assumed to be the same as the nursery costs for Scenario 2.

HHP 12.2 Nursery costs

Total cost of establishing a nursery			
Item	**Sub-item**	**Value**	**Comments**
Clearing			
	Machinery	0	
	Herbicide	0	
Fence		5,520	From above
Seeds		100	Provided by government or prc
Hired labour		10,000	From above
Other costs		0	
Total costs		**15,620**	

SHHP12.3 Pasture improvement costs

In Scenario 2, 1 ha of land was to be improved per year. This will be less in Scenario 3 (0.5 ha per year) and will be less intensive (i.e. planting runners into semi-cleared land rather than large monoculture cleared areas). Thus, total pasture costs are assumed to be half of Scenario 2.

Total cost of pasture improvement on Jospeh's farm per year			
Item	**Sub-item**	**Value**	**Comments**
Clearing			
	Machinery	0	
	Herbicide	0	
Fence		22,080	From above
Seeds			From nursery
Hired labour		100,000	From above
Other costs		0	
Total costs		**61,040**	

Module 12.4 Stockyard costs

Joseph builds the same set of yards in Scenario 2 to cater for the heavy steers.

Yard budget for Joseph			Sub-total	Totals	Notes
	Materials			39,450	
		Posts	-		Cut from own land
		Rails	-		Share arrangement with miller
		Concrete	23,000		Used for race
		Bolts	1,450		
		Transport	10,000		Transport from paddock to yard
		Chainsaw	5,000		Cut timber again in yards
		Other	-		
	Labour bought in			10,000	
		Person days	5		
		Rate	2,000		
	Total cost			**49,450**	

SHHP 12.5. Income effects of building a herd

Other scenarios involve building the herd, which means that households keep, rather than sell cows and heifers, during the herd build-up period and therefore forgo money. However, in this scenario, households can sell cattle to destock. Four of the least productive cows will be sold for VT40,000 each (VT160,000). This can be used to pay for the investments above.

SHHP 12.6. Total costs of transition

Given the above:

Investment costs for Joseph in year 1 (VT)	
Fence around bush on road block (9ha)	-
Nursery (25m * 25m)	15,620
Pasture improvement (1ha)	61,040
Stockyards	49,450
Total	**126,110**
Revenue generated during herd buildup (years	- 160,000

Production systems

After Joseph has gone through the transition and herd build-up stage, he will arrive at the new production and marketing system.

SHHP 13. Cattle productivity

SHHP 13.1 Stocking rate

After adjustments, Joseph has a new herd profile:

- Cow numbers have decreased (from 10 to 6),
- At a calving rate of 88.75% these cows produce 5.25 calves per year, with a weight of 30kgs with an ADWG of 0.44 (160kg/year),

- Heifers reach puberty (350kgs) and are able to replace culled cows at 2y.o. The other heifer is sold at his age to reduce stocking pressure and also because it is low value / price,
- However, steers are kept to a heavy weight (672kgs) at 4y.o, meaning there will be 3 generations of steers,
- One bull can service the cows (so that hasn't changed) and it may be worth investing in a better bull, and
- Overall cattle numbers have decreased (from 29 to 24).

While the herd numbers have decreased, Joseph's stocking capacity has also increased:

- He now has a weaner paddock, so calves are moved out of the copra land into the weaning paddock form 6-12 months of age. This reduces the stocking rates on the copra, and
- His stocking capacity on the bush block will increase because of the pasture improvement. While this is gradual (0.5 ha per year), this is assumed to increase stocking capacity from 1.5 AU/ha to 2 AU/ha.

Animal units carried by Joseph in different paddocks								
Cattle			**Numbers**	**AU**	**AU carried**	**Paddock kept**		
	To calculate:		Stock numbers					
				Multiply by these animal units				
					To find the total number of animal units			
						Write the paddocks they are held in		
Cows			6	1.2	7.2	Copra		
Calves <1yo			5.25	0.3	1.575	Copra		
	Female	2.625						
	Male	2.625						
Heifers >1yo			3	0.75	2.25	Copra		
	1-2 yo	3						
	2-3yo							
	3-4yo							
Steers >1yo			9	0.75	6.75	Bush		
	1-2 yo	3						
	2-3yo	3						
	3-4yo	3						
Breeding bulls (mature)			1	2	2	Copra		
Uncastrated males >1yo (450kg)			0	1	0	Bush		
Total cattle			**24.25**		**19.775**			

The new stocking rates are:

Animal carried compared to carrying capacity on Joseph's farm							
Copra					**Bush**		
Animal units under copra			10.775		Animal units in bush		9
Carry capacity animal units per hectare (buffalo & carpet grass under old coconuts)			1.5		Carry capacity animal units per hectare in bush		1.5
Hectares			5		Hectares		9
Total carrying capacity			7.5		Total carrying capacity		13.5
Number over-stocked			3.275		Number under-stocked		-4.5

SHHP 13.2 Calving rate

Because of the weaning yard and de-stocking, and weeding and pasture improvement on the copra block, calving rates have increased from 60% (in Scenario 1) to 88.75% (to the same as Scenario 2).

SHHP Growth rates

With de-stocking and better pasture management on the bush block, growth rates increase from 120kgs/year (Scenario 1) to 160kgs (Scenario 2). Calf weight increase from 25kgs at birth to 30kg.

SHHP 14. Calculating revenues

SHHP 14.1 Revenues from steers

Numbers of steers for sale

Number of steers available per	
Cows	6
Calving rate	88%
Calves	5.25
% male calves	50%
Male calves per year	2.625
Deaths	0
Uncastrated	0
Total available for sale	2.625

Weight and age of slaughter

This is the calf weight, weight gain, and slaughter weight of steers kept for 4 years on semi-improved pastures.

Weight and age calculations	
Sales weight (kg)	672.4
Calf weight (kg)	30
Weight gain per yea	160.6
Years to reach 672.4k	4.0

Prices

Because of the high slaughter weights, the carcass yields, and the prices (offered by SMP) are high, leading to high revenues.

Comparison of buyer prices for Joseph's steers				
		SMP		WSS
Liveweight		672.4		672.4
Dressing percentage		57%		
Carcass weight		383.268		
Price				
	VT/kg carcass weight	230		
	VT/kg live weight			120
Total		**88,152**		**80,688**

Calculating total steer revenues

Total revenues from steers in	
Number of steers	2.625
Total each with best	88,152
Total for all steers	231,398

SHHP 14.2 Revenues from the sales of cows

Another way to maintain high calf weights and calving rates is to cull cows whenever they are unproductive. Joseph has a very high culling rate of 2 out of 6 cows per year (33%). However, this can be a good strategy because the cows are heavier than the replacement heifers and sell for the same (per kg) price.

Revenue from the sale of culled cows on Jospeh's farm	
Cows	6
Culls / replacements	2
Av weight at sale (kg	500
Price (WSS) (VT/kg l\	80
Revenue per head	40,000
Total cow revenue	80,000

SHHP 14.3. Revenues from the sale of heifers

Due of the high culling rate, most heifers go to herd replacements (2 per year) and the rest (1 or less) are sold. Because of the low per kg prices, there are advantages in selling these at a young age (351kgs, 2y.o).

Revenues from the sales of heifers on Jospeh's farm	
Female calves per ye	2.625
Number used for rep	2
Mortalities	0
Available for sale	0.625
Sales weight (kg)	351.2
Calf weight (kg)	30
Weight gain per yea	160.6
Years to reach 351.2k	2.0
Price (VT/kg)	80
Revenue per head	28,096
Sales revenue	17,560

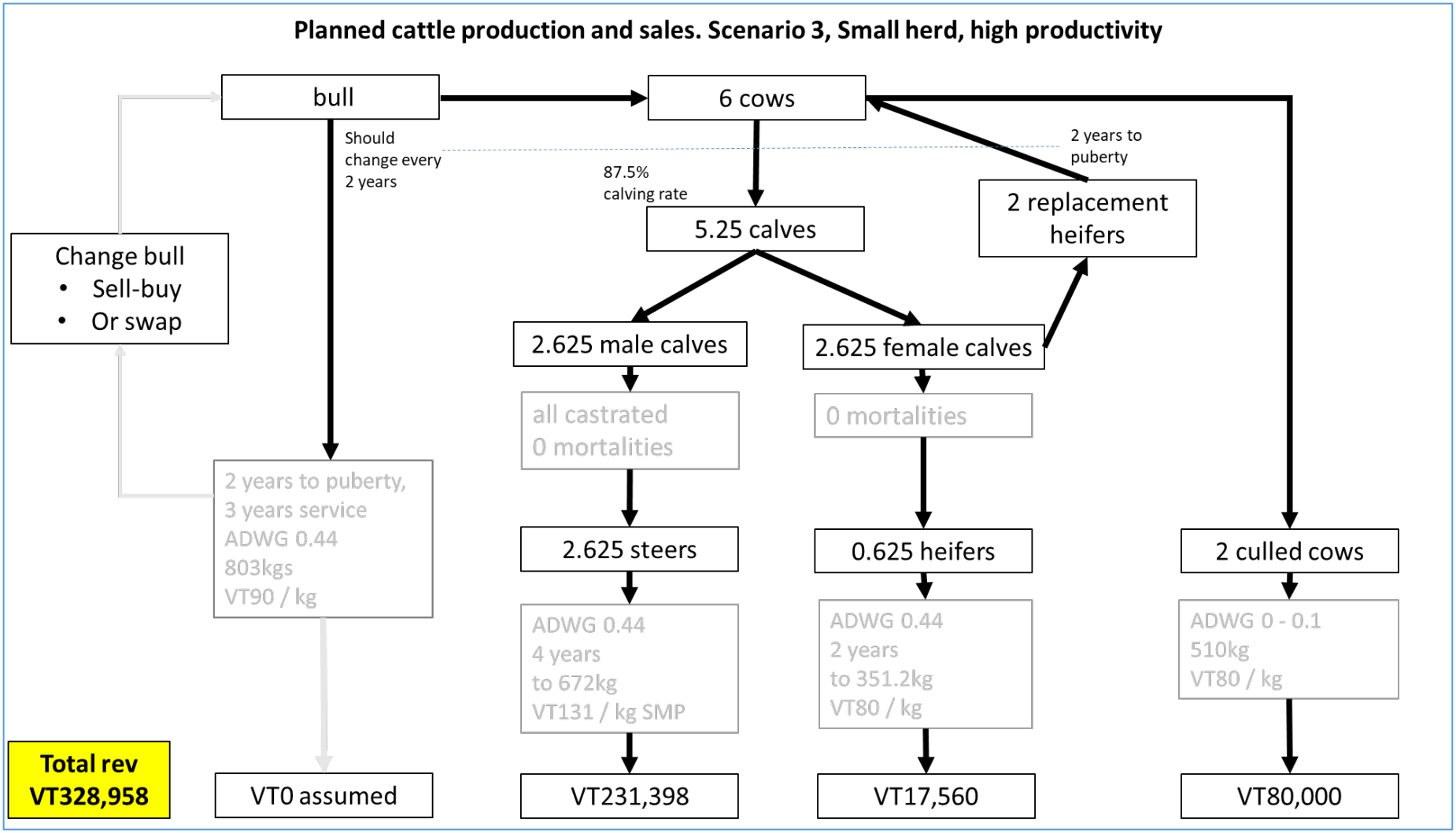
SHHP 14.4 Revenues from the sale of culled bulls

Same bull VALUE as Scenario 2. Only one needed.

Revenues from the sales of bulls on Joseph's farm	
Calf weight	30
Years to puberty	2
Years service	3
Age sold	5
ADWG	0.44
Days in year	365
Weight at cull	833
Price (WSS) (VT/kg)	90
Value per bull	74,970
Number sold per yea	0
Swapped	
Rev per year	0

SHHP 14.5. Recording all revenues in a figure

Information from above is collated and presented here



SHHP 14.6. The timing of cattle sales

Same timing as other scenarios:

Type of cattle		Month(s) sold	Number	Reason			
Steers		May	0.625	Coming into dry season			
		December	2	Chistmas, school fees			
Cows		March	2	Didn't look like it was in calf, getting old			
Heifers		April	0.625	Coming into dry season			
Bulls		December		Swapped every 3 years			

SHHP 14.7. Recording revenue in a monthly cash flow sheet

Monthly revenues from cattle sales on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers					55,095							176,303	231,398
	Cows			80,000										80,000
	Heifers					17,560								17,560
	Bulls													-
	Other (uncastrated bulls)													-
	Total	**0**	**0**	**80,000**	**0**	**72,655**	**0**	**0**	**0**	**0**	**0**	**0**	**176,303**	**328,958**

SHHP 15. Calculating costs and profits

SHHP 15.1. Cash costs and cash flow

Cash costs

Monthly costs for cattle on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for y**
Cash out	Veterinary													0
	Transport													0
	Rope		1,000											1,000
	Fencing material		4,000				4,000							8,000
	Pasture improvemer		20,000											20,000
	Herbicide													
	Hired labour			4,000			4,000				2,000		2,000	12,000
	Loan repayments													
	Lease of land													
	Other													-
	Total	**0**	**25,000**	**4,000**	**0**	**0**	**8,000**	**0**	**0**	**0**	**2,000**	**0**	**2,000**	**41,000**

Cash flow

Collated here

Monthly revenues from cattle sales on Joseph's farm

	Month	1	2	3	4	5	6	7	8	9	10	11	12	Total for year
Cash in	Steers	-	-	-	-	55,095	-	-	-	-	-	-	176,303	231,398
	Cows	-	-	80,000	-	-	-	-	-	-	-	-	-	80,000
	Heifers	-	-	-	-	17,560	-	-	-	-	-	-	-	17,560
	Bulls	-	-	-	-	-	-	-	-	-	-	-	-	-
	Other (uncastrated	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**0**	**0**	**80,000**	**0**	**72,655**	**0**	**0**	**0**	**0**	**0**	**0**	**176,303**	**328,958**

Monthly costs for cattle on Joseph's farm

	Month	1	2	3	4	5	6	7	8	9	10	11	12	Total for year
Cash out	Veterinary	-	-	-	-	-	-	-	-	-	-	-	-	-
	Transport	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rope	-	1,000	-	-	-	-	-	-	-	-	-	-	1,000
	Fencing material	-	4,000	-	-	-	4,000	-	-	-	-	-	-	8,000
	Pasture improvem	-	20,000	-	-	-	-	-	-	-	-	-	-	20,000
	Hired labour	-	-	-	-	-	-	-	-	-	-	-	-	-
	Loan repayments	-	-	4,000	-	-	4,000	-	-	-	2,000	-	2,000	12,000
	Lease of land	-	-	-	-	-	-	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**0**	**25,000**	**4,000**	**0**	**0**	**8,000**	**0**	**0**	**0**	**2,000**	**0**	**2,000**	**41,000**

Monthly cash flow on Jospeh's farm

	Month	1	2	3	4	5	6	7	8	9	10	11	12
Cash at start of month		0	0	-25,000	51,000	51,000	123,655	115,655	115,655	115,655	115,655	113,655	113,655
Cash in during month		0	0	80,000	0	72,655	0	0	0	0	0	0	176,303
Cash out during month		0	25,000	4,000	0	0	8,000	0	0	0	2,000	0	2,000
Cash on hand end of month		**0**	**-25,000**	**51,000**	**51,000**	**123,655**	**115,655**	**115,655**	**115,655**	**115,655**	**113,655**	**113,655**	**287,958**

SHHP 15.2. Labour costs

This section calculates the amount of labour used by Joseph in the small-scale improved system.

Compared to the unimproved system (Scenario 1) Joseph spends:

- 30% more time checking fences,
- Saves a lot of time (78 person days) previously tethering cattle,
- Spends less time moving cattle compared to Scenario 2 (where there are 2 blocks a long way from each other), and
- But spends significant time feeding and weeding.

For occasional tasks done a few times per year:

- Joseph spends a significant amount of time on pasture improvement and transplanting (but only half of Scenario 2) (total of 33 days per year) in addition to hired labour, and
- The improved systems require significant time in cattle management, marketing, and other cattle jobs (same as Scenario 2 due to weaning and steer management).

	Labour use for cattle on Joseph's farm												
	Labour activity	**Calculation**	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**	**Hours per week**	**Person hours per year (*52)**		**Person days per year (/8)**
Labour calculated weekly	Checking, fixing, clearing fences	Hours		3		3		3					
		People		1		1		1					
		Person hours		3		3		3		9	468		58.5
	Managing tethered cattle	Hours											
		People											
		Person hours								0	0		0
	Moving cattle (around paddocks or between blocks)	Hours			2		2						
		People			1		1						
		Person hours			2		2			4	208		26
	Cutting feed	Hours			1			1					
		People			1			1					
		Person hours			1			1		2	104		13
	Weeding	Hours		3		3		3					
		People		1		1		1					
		Person hours		3		3		3		9	468		58.5
Labour calculated yearly	Pasture improvement & transpla	Hours									88		
		People									3		
		Person hours								0	264		33
	Weaning / castration / dehorning	Hours									32		
		People									3		
		Person hours									96		12
	Buying or selling cattle	Hours									48		
		People									1		
		Person hours									48		6
	Other – e.g. water, animal health	Hours									36		
		People									1		
		Person hours									0		0
	Total days per year												**207**

SHHP 15.3. Returns to labour

With the revenues and costs above, the returns to labour for Scenario 3 (Small herd, high productivity) is presented below. This is higher than Scenario 1, but lower than Scenario 2, (although without the large investment or transition costs).

Cash profit	Labour days
287,958	207

Cash profit per labour day	
VT	AUD
1,391	17.4

Scenario 4. Large herd, low productivity (LHLP)

LHLP 11. Joseph's plans

In this scenario Joseph wants to expand the size of his herd on additional new land (as in Scenario 2) but in a low input way, without significant investment in farm improvement. His strategy is to:

- **Increase cow numbers** from 10 (in Scenario 1) to 16 (Scenario 2). However, with low productivity, this is an overall increase in the herd from 29 to 50 cattle,
- **Productivity** remains low and the same as Scenario 1 with a calving rate of 60% and growth rate of steers of 120kgs per year, and
- The low growth rate of heifers means that 3 generations must be kept before replacement with culled cows or sale at 400kgs, which adds to grazing pressure. Steers are also grown to 3.1 y.o to reach slaughter weight at 400kg at a modest dressing percentage and price from WSS.

For **land,** Joseph will use:

- His existing "road block" (copra and bush in Scenario 1) with few improvements, and
- He will also use the new "village block" (Scenario 2), including basic rudimentary fencing but without the pasture improvement.

LHLP 12. Investment costs

This section outlies the investments required for this strategy.

LHLP 12.1 Fence costs

Fencing was already done in Scenario 1 on the "road block". He will need to fence the new "village block", but at only partially and at only half the cost of scenario 2 (VT50,000).

HHP 12.2 Nursery costs

None

LHLP12.3 Pasture improvement costs

While Joseph doesn't have a set pasture improvement regime, he does spend a modest amount of money (VT20,000) per year on pasture improvement including hiring a chainsaw and labour to cut back shrub, pull weeds, and transplant some runners.

Module 12.4 Stockyard costs

Joseph does small improvements to his yards compared to Scenario 1 (puts in some new posts and rails and a loading ramp to cater for the two blocks), but only half of the work of Scenario 2. Total VT10,000.

LHLP 12.5. Income effects of building a herd

In Scenario 1, Joseph sold 1 heifer and kept 2 for replacements. He will now keep this heifer, so he will forgo VT32,000 in sales revenue. He also will have to reduce the number of cows culled from 2 to 1, and forgo VT32,000 in sales revenue. This is a total of VT64,000 per year and it will take 3 years to increase cow numbers from 10 to 16, with a total forgone sales revenue of VT192,000.

LHLP 12.6. Total costs of transition

The items above total:

Total cost of pasture improvement on Jos			
Item	**Sub-item**		**Value**
Clearing			
	Machinery		0
	Herbicide		0
Fence			22,080
Seeds			
Hired labour			20,000
Other costs			0
Total costs			**42,080**

Production systems

After Joseph has gone through the transition and herd build-up stage, he will arrive at the new production and marketing system.

LHLP 13. Cattle productivity

LHLP 13.1 Stocking rate

After building up the herd, Joseph has a new herd profile across the two blocks ("road" and "village".

- Cow numbers have increased (from 10 to 16). The calving rate is low (60%) which limits herd build-up. However, the growth rate is also low (120kg/year) so 3 generations of male calves and steers have to be kept just reach the (low) slaughter weight of 400kgs. Female calves and heifers also have to be kept for 3 years to reach maturity, so this increases stocking pressure (only 2 years are required in the high productivity scenarios 2 and 3),
- Overall cattle numbers are 50 head,
- The cows, calves and bull are kept on the "road block", while steers (and a few heifers) are kept on the "village block", and

- Without pasture improvement the carrying capacity of the land remains low (1.5AU per Ha).

Animal units carried by Joseph in different paddocks - new system								
Cattle			**Numbers**	**AU**	**AU carried**	**Paddock kept**		
	To calculate:		Use stock numbers					
				Multiply by these animal units				
					To find the total number of animal units			
						Write the paddocks they are held in		
Cows			16	1.2	19.2	Copra		
Calves <1yo			9.6	0.3	2.88	Copra		
	Female	4.8						
	Male	4.8						
Heifers >1yo			9.6	0.75	7.2	Copra		
	1-2 yo	4.8						
	2-3yo	4.8						
	3-4yo	0						
Steers >1yo			14	0.75	10.5	Bush		
	1-2 yo	4.8						
	2-3yo	4.8						
	3-4yo	0						
Breeding bulls (mature)			1	2	2	Copra		
Uncastrated males >1yo (450kg)			0	1	0	Bush		
Total cattle			**50.2**		**41.78**			

The new stocking rates are:

Animal carried compared to carrying capacity on Joseph's farm							
Copra					**Bush**		
Animal units on road bloack			24.08		Animal units on bush blc		17.7
Carry capacity animal units per hectare (buffalo & carpet grass under old coconuts)			1.5		Carry capacity animal units per hectare in bush		1.5
Hectares			12		Hectares		11
Total carrying capacity			18		Total carrying capacity		16.5
Number over-stocked			6.08		Number over-stocked		1.2

LHLP 13.2 Calving rate

Cow and calf numbers are over-stocked on the copra block, which is not improved or maintained well, which leads to low productivity (calf weight of 25kgs and a calving rate of 60%).

LHLP Growth rates

The steers are not over-stocked on the “village” (bush) block but have to forage a lot to access quality feed so growth rates are low (ADWG of 0.33kg/day or 120kg/year).

LHLP 14. Calculating Revenues

LHLP 14.1 Revenues from steers

Numbers of steers for sale

Number of steers available per year on Jospeh's farm	
Cows	16
Calving rate	60%
Calves	9.6
% male calves	50%
Male calves per year	4.8
Deaths	0
Ceremonies	0
Uncastrated	0
Total available for sale	4.80

Weight and age of slaughter

This is the calf weight, weight gain and slaughter weight of steers kept to 3.1 years of age on unimproved bush.

Weight and age calculations for steers on Joseph’s farm	
Sales weight (kg)	400
Calf weight (kg)	25
Weight gain per yea	120
Years to reach 400kg	3.1

Prices

Because of the modest slaughter weights (400kgs), the steers are best sold to WSS at moderately low prices.

Comparison of prices for Joseph's steers				
		SMP		WSS
Liveweight		400		400
Dressing percentage		53%		
Carcass weight		212		
Price				
	VT/kg carcass weight	160		
	VT/kg live weight			120
Total		**33,920**		**48,000**

Calculating total steer revenues

Total revenues from steers in Joseph's farm	
Number of steers	4.8
Total each with best	33,920
Total for all steers	**162,816**

LHLP 14.2 Revenues from the sales of cows

Joseph culls 4 of his 16 cows per year (25% culling rate), which is a significant source of revenue.

Revenue from the sale of culled cows on Joseph's farm	
Cows	16
Culls / replacements	4
Av weight at sale (kg	400
Price (WSS) (VT/kg l	80
Revenue per head	32,000
Total cow revenue	128,000

LHLP 14.3. Revenues from the sale of heifers

Because of the high culling rate, most heifers go to herd replacements (4 per year) and the rest (1 or less) are sold. These are sold at 400kgs (3.1 y.o).

Revenues from the sales of heifers on Jospeh's farm	
Female calves per ye	4.8
Number used for rep	4
Mortalities	0
Ceremonies	0
Available for sale	0.8
Sales weight (kg)	400
Calf weight (kg)	25
Weight gain per yea	120
Years to reach 510kg	3.1
Price (VT/kg)	80
Returns	32,000

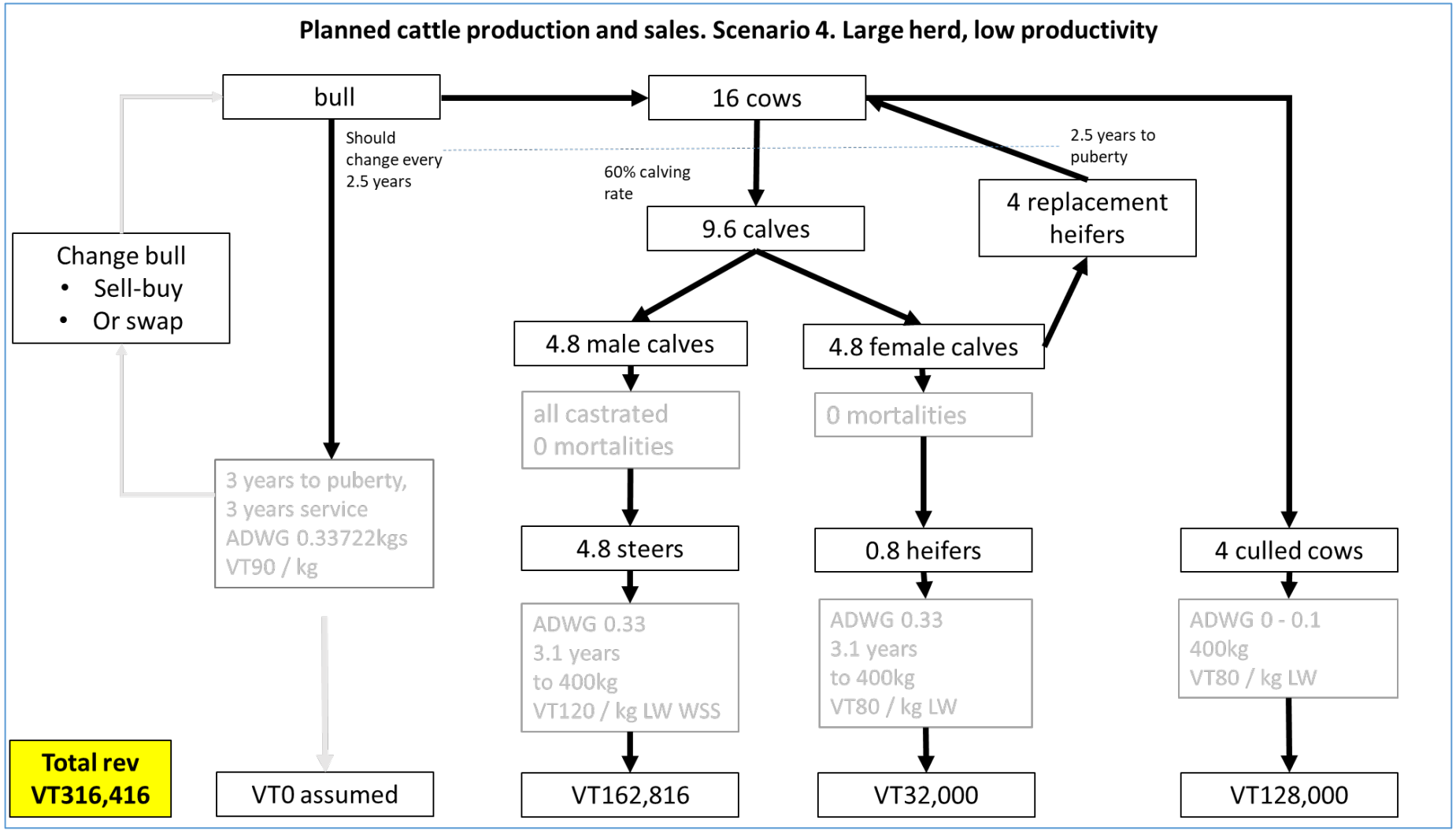
LHLP 14.4 Revenues from the sale of culled bulls

Same bull VALUE as Scenario 1. Only one is needed.

Revenues from the sales of bulls on Joseph's farm	
Calf weight	25
Years to puberty	2
Years service	3
Age sold	5
ADWG	0.33
Days in year	365
Weight at cull	602.25
Price (WSS) (VT/kg)	90
Value per bull	54,203
Rev per year	0

LHLP 14.5. Recording all revenues in a figure

The information from above is collated and presented here.



LHLP 14.6. The timing of cattle sales

The timing is the same as the other scenarios.

Timing of cattle sales for Joseph									
Type of cattle		**Month(s) sold**	**Number**	**Reason**					
Steers		May	2	Coming into dry season					67,840
		December	2.8	Chistmas, school fees					94,976
Cows		March	4	Didn't look like it was in calf, getting old					128,000
Heifers		April	0.8	Coming into dry season					25,600
Bulls		December	1	Should have done all mating by then, put in the same truck as the steers					-
									316,416

LHLP 14.7. Recording revenue in a monthly cash flow sheet

Monthly revenues from cattle sales on Joseph's farm															
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**	
Cash in	Steers					67,840							94,976	162,816	
	Cows			128,000										128,000	
	Heifers					25,600								25,600	
	Bulls												-	-	
	Other (uncastrated bulls)													-	
	Total	**0**	**0**	**128,000**	**0**	**93,440**	**0**	**0**	**0**	**0**	**0**	**0**	**94,976**	**316,416**	

LHLP 15. Calculating costs and profits

LHLP 15.1. Cash costs and cash flow

Cash costs

Monthly costs for cattle on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for y**
Cash out	Veterinary													-
	Transport					2,000			2,000			2,000		6,000
	Rope			2,800										2,800
	Fencing material		4,000				4,000				4,000			12,000
	Pasture improvement													-
	Herbicide													
	Hired labour		2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	22,000
	Loan repayments													
	Lease of land													
	Other													
	Total	**0**	**6,000**	**4,800**	**2,000**	**4,000**	**6,000**	**2,000**	**4,000**	**2,000**	**6,000**	**4,000**	**2,000**	**42,800**

Cash flow

Collated here.

Monthly revenues from cattle sales on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash in	Steers					67,840							94,976	162,816
	Cows			128,000										128,000
	Heifers					25,600								25,600
	Bulls												-	-
	Other (uncastrated bulls)													-
	Total	**0**	**0**	**128,000**	**0**	**93,440**	**0**	**0**	**0**	**0**	**0**	**0**	**94,976**	**316,416**

Monthly costs for cattle on Joseph's farm														
	Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Total for year**
Cash out	Veterinary	-	-	-	-	-	-	-	-	-	-	-	-	-
	Transport	-	-	-	-	2,000	-	-	2,000	-	-	2,000	-	6,000
	Rope	-	-	2,800	-	-	-	-	-	-	-	-	-	2,800
	Fencing material	-	4,000	-	-	-	4,000	-	-	-	4,000	-	-	12,000
	Pasture improvem	-	-	-	-	-	-	-	-	-	-	-	-	-
	Herbicide	-	-	-	-	-	-	-	-	-	-	-	-	
	Hired labour	-	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	22,000
	Loan repayments	-	-	-	-	-	-	-	-	-	-	-	-	
	Other	-	-	-	-	-	-	-	-	-	-	-	-	
	Total	**0**	**6,000**	**4,800**	**2,000**	**4,000**	**6,000**	**2,000**	**4,000**	**2,000**	**6,000**	**4,000**	**2,000**	**42,800**

Monthly cash flow on Jospeh's farm												
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Cash on hand start of month	0	0	-6,000	117,200	115,200	204,640	198,640	196,640	192,640	190,640	184,640	180,640
Cash in during month	0	0	128,000	0	93,440	0	0	0	0	0	0	94,976
Cash out during month	0	6,000	4,800	2,000	4,000	6,000	2,000	4,000	2,000	6,000	4,000	2,000
Cash on hand end of month	**0**	**-6,000**	**117,200**	**115,200**	**204,640**	**198,640**	**196,640**	**192,640**	**190,640**	**184,640**	**180,640**	**273,616**

LHLP 15.2. Labour costs

This section calculates the amount of labour used by Joseph in Scenario 4. There are some increases in labour due to Scenario 1 having a larger herd (16 cows, 50 cattle) and the larger land areas ("road block" and "village block"), however the low levels of farm and pasture improvement means less labour use in these areas.

Compared to the unimproved system (Scenario 1) Joseph spends:

- 6 person hours per week checking fences compared to 4,
- Spends 15 hours per week tethering cattle instead of 12,
- Spends the same amount of time moving cattle (on "road-block"),
- Spends 6 hours cutting feed cattle compared 4, and
- Spends 6 hours instead of 4 weeding.

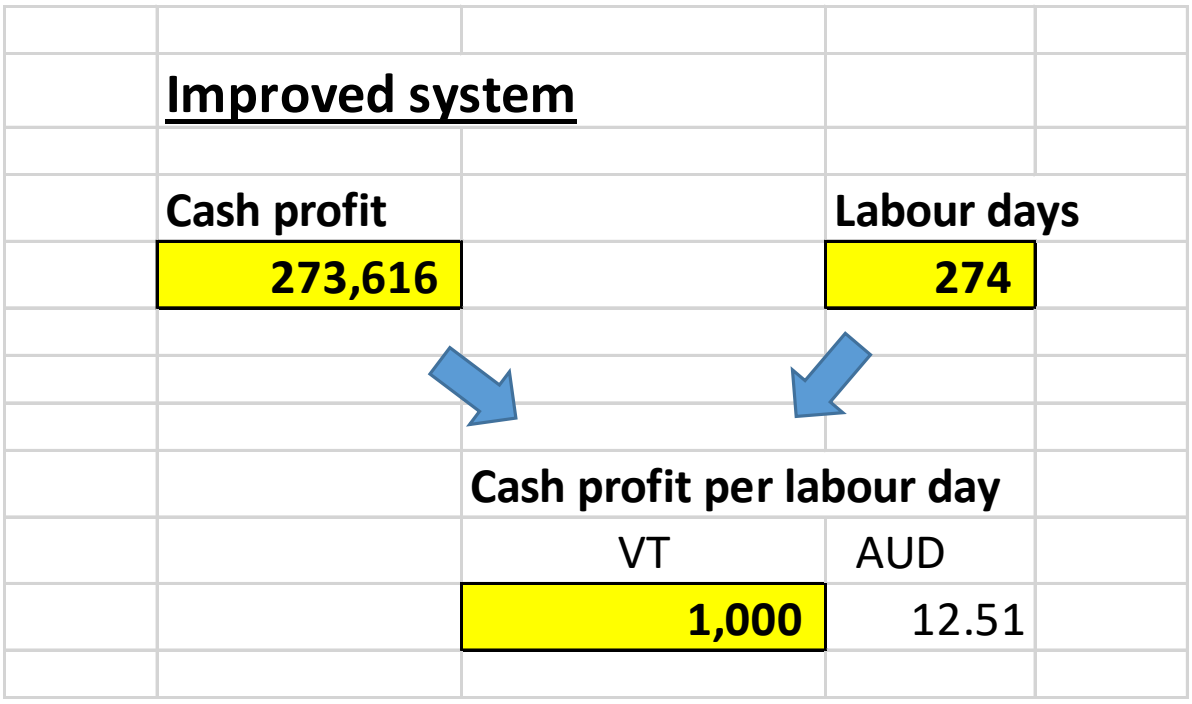
For occasional tasks done a few times per year:

- Joseph doesn't spend a large contiguous period improving pasture In Scenario 4,
- He spends 18 days instead 12 managing cattle (weaning, castration, calving) because of the higher cow numbers,
- There is no change in the buying and selling time (similar numbers sold), and
- Spends 9 days per year instead of 4.5 on "other" cattle activities including water and catching stray cattle in the other bush block.

	Labour use for cattle on Joseph's farm												
	Labour activity	**Calculation**	**Mon**	**Tues**	**Wed**	**Thurs**	**Fri**	**Sat**	**Sun**	**Hours per week**	**Person hours per year (*52)**		**Person days per year (/8)**
Labour calculated weekly	Checking, fixing, clearing fences	Hours		2		2		2					
		People		1		1		1					
		Person hours		2		2		2		6	312		39
	Managing tethered cattle	Hours	2	3	2	3	2	3					
		People	1	1	1	1	1	1					
		Person hours	2	3	2	3	2	3		15	780		97.5
	Moving cattle (around paddocks or between blocks)	Hours			2		2						
		People			1		1						
		Person hours			2		2			4	208		26
	Cutting feed	Hours	2		2			2					
		People	1		1			1					
		Person hours	2		2			2		6	312		39
	Weeding	Hours		2		2		2					
		People		1		1		1					
		Person hours		2		2		2		6	312		39
Labour calculated yearly	Pasture improvement	Hours											
		People											
		Person hours											0
	Weaning / castration / dehorning	Hours									48		
		People									3		
		Person hours									144		18
	Buying or selling cattle	Hours									48		
		People									1		
		Person hours									48		6
	Other – e.g. water, animal health	Hours									36		
		People									2		
		Person hours									72		9
	Total days per year												**273.5**

LHLP 15.3. Returns to labour

With the revenues and costs above, the returns to labour for Scenario 4 (Large herd, low productivity) is presented below. This is the lowest of all scenarios due to the limited productivity and revenues, compared to the higher labour input.



Comparison of four cattle scenarios

Based on the detailed analysis of scenarios 1 to 4, this section provides a brief summary of results, based on the table below.

	Scenario						
	1. Av herd, over-stocked, low productivity	4. Large herd, over-stocked, low productivity	2. Large herd, balanced stocking rate, high productivity	3. Small herd, balanced stocking rate, high productivity			
Herd and land							
Cows	10	16	16	6			
Total animal units	25	42	41	20			
Total land (Ha)	14	23	23	14			
Improved pastures?	N	N	Y	Y			
AU under/over stocked on copra land (mainly fe	8	6	7	3			
AU under/over stocked on bush land (mainly ma	-4	1	-6	-5			
Cattle production & sales							
Calving	60%	60%	88%	88%			
Calves per year	6	10	14	5			
Calf weight	25	25	30	30			
Weight gain per day (kg)	0.33	0.33	0.44	0.44			
Weight gain per year (kg)	120.45	120.45	160.6	160.6			
Female age puberty / replacement	2.5	2.5	2	2			
Steer sales weight	400	400	512	672			
Steer age	3.1	3.1	3	4			
Steer dressing %	53%	53%	57%	57%			
Steer price (VT/kg LW)	120	120	131	131			
Economic indicators							
All revenues	240,000	316,416	753,627	328,958			
Cash costs	13,800	42800	189,000	41,000			
Cash profits	226,200	273,616	564,627	287,958			
Person days	230	273.5	316	207			
Returns to labour (Vt/labur day)	983	1,000	1,787	1,391			
Upfront investments							
Investment costs	Base case	102,080	316,150	126,110			
Forgone revenue herd buildup over 3 years	Base case	192,000	192,000	-160,000			
Total		294,080	508,150	-33,890			

Main findings

The main findings of the analysis are:

- **Scenario 1 "Average herd, over-stocked, low productivity"**. This is the (real) base scenario, as it is typical of small-holder cattle farms on the East Coast of Santo. The household has 10 cows on 14 ha of copra-bush land. While calving rates are low, growth rates are also low which mean the household has to keep females 2.5 years to reach puberty and steers 3 years to reach a (viable) slaughter weight. This increased stocking, on unimproved, weedy pastures, exacerbates over-grazing. The low liveweights and dressing percentage limits price and revenue. Significant labour is still required in the system, largely because of tethering. Returns to labour is consequently modest at VT983 (~AU$12 per day).
- **Scenario 4 "Large herd, over-stocked, low productivity"**. This household increases cow numbers to 16 and land size (on 2 blocks) to 23 ha, which remains unimproved and over-stocked in cow-calf production. Calving and growth rates remain low, but the herd size and sales revenues increase. However, this is mitigated by the additional labour (over 2 blocks and for tethering). As a result, returns to labour barely increase over the base case. There are also significant investment costs in developing the new block (rudimentary perimeter fencing) and the household reduces the sale of culled cows and heifers for 3 years in the herd building up stage (total cost VT300,000).
- **Scenario 2 "Large herd, balanced stocking rate, high productivity"**. In this scenario, cow numbers are also increased (to 16) over 2 blocks (14Ha) but the land is fully fenced, and pastures are improved at a (high) rate of 1ha per year. Higher growth rates lead to a large increase in the sale of heavier steers at higher prices over the hooks. The increase in revenue is higher than the increase in labour (partly due to fencing and reduced tethering), leading to very large increases in income (VT1,787 per labour day or 82% increase over the base case). However, the cost of investment and herd build up are high (VT508,000 AU$6,300), as are the skill and motivational demands and may not be applicable to all households.
- **Scenario 3 "Small herd, balanced stocking rate, high productivity"**. This option involves reducing cow numbers (to 6) on the same land area as the base case but with land improved through grasses, legumes, and fencing. This increases calving rates and growth rates, which means fewer heifers are kept on farm. It also means that steers could be sold at a heavy weight in 3 years (Scenario 3) but also the option of very heavy steers (670kg, 57% dressing) at 4 years of age (Scenario 4). Labour input increases but at lower rate than revenue, which increases returns to labour to VT1,319, 41% higher than the base case. It is (22%) lower than Scenarios 3 but at a much lower cost. Importantly, the revenues from the sale of destocking can be used to cover the initial improvement costs (cost neutral).

The general conclusion is that different management options will be suitable for different households depending on endowments of land, labour and capital, and household objectives. Scenarios 1 appears to be sub-optimal, but here low skill or capital requirements and returns are positive and consistent over a large proportion of the year. Many households interviewed and that attended training choose to expand herd and land sizes. However, without the accompanying improvements (Scenario 4) this is unlikely to be worthwhile or recommended. Households with capital, land, and skills should choose Scenario 3 but may have to forgo other household activities (at least for male labour). Scenario 4 generates good returns, with low net investment costs and would not prohibit other household activities but would require good and consistent application of cattle management skills.

Returns to non-cattle agricultural production

Households have a range of options in cattle production that show a range of results and incentives. However, incentives for cattle and other household activities must also be

assessed in context with a wider range of economic options available to farmers. This section provides budget results from the main non-cattle activities in East Santos – copra, kava and vegetables.

Copra production

Copra is a major activity in East Santos. There are a range of different production systems but a "typical" system is presented here, which is the same as that presented in Scenario 1 cattle).

Production and revenues

The representative household uses a "local tall" variety planted in 1998 with a spacing of 9m by pm (or 143 trees per ha). Mature the trees allow sufficient light for production of shade tolerant grass and legumes. The yield of local tall trees is 1,700kgs (dry) per ha, per year. The most common alternative (improved tall) has the same spacing and shading effects with higher yield (2,700kgs/ha). The household has 5 ha of land planted to copra with a total harvest of 8.5 tonnes of dry copra. When surveyed in 2018, prices were VT40/kg (sacked, dry), leading to total revenues of VT340,000.

Costs

Copra is shelled in the paddock, bagged, moved to drier, dried and the re-bagged, and transported to the buyer, a copra processor in Luganville.

The household incurs a few cash costs including:

- Sacks to bag copra which last 3 years (in swap arrangements with buyers),
- In the case that the household doesn't have a drier (although this is common), the household will need to pay the village for the use of the dryer,
- The household also pays a person from the village to dry the copra (3 days per harvest), and
- The largest cash cost of the household by far is the cost of hiring a ute to transport the wet copra from the paddock to the drier and the dry copra to the buyer.

Labour

Copra is a labour-intensive activity for concentrated periods around harvest. Around 10 people are required to work for 2 days per harvest to collect and shell copra and take to the drier. As these labour requirements can't be met from within the household, other family and neighbours do the work together, which is reciprocated when they harvest, so this is included as a labour cost. Other labour is required for bagging, transport, and other jobs (clearing around trees, repair of bags). This amounts to a significant total labour input of 120 days.

Copra (dry) - variable costs only				Calculations	Sub-totals	Totals
	Background information					
		Variety		Local tall		
		Av year planted		1998		
		Number of plantations		1		
		Area (ha)		5		
		Number of harvests per ye		4		
	Revenue					
		Yield (kg/ha/year dry)		1,700		
		Price per kg		40		
		Revenue over year				**340,000**
	Variable costs (per harvest over whole area)					
		Bags				
			Cost each	120		
			Bags required	85		
			Value	10,200		
			Years used	3		
			Cost per year		3,400	
		Drying				
			Cost to use drye	2,000		
			Fuel for dryer p			
			Cost per year		8,000	
		Transport				
			Bags per ute loa	20		
			Number of ute	4		
			Cost per trip / u	8,000		
			Cost per year		136,000	
		Hired labour (for harvest, dryer, transport)				
			Days per harves	3		
			Number of peo	1		
			Wage per day	1,000		
			Cost per year		12,000	
		Total costs over year				159,400
	Household labour (family, exteneded fmaily, reciprocal) per harvest					
		Per harvest				
			People	10		
			Days per harves	2		
			Total person days per year		80	
		Bagging, transport etc.				
			People	2		
			Days per harves	2		
			Total person days		16	
		Other				
			People	2		
			Days per year	12		
			Total person days		24	
		Total household labour over year				120
	Gross returns					**180,600**
		Revenues		340,000		
		Variable costs		159,400		
	Returns to own labour					**1,505**
		Returns		180,600		
		Labour days		120		

Returns

Given these revenues, cash costs, and labour input, returns to labour for copra production are VT1,505 per 8-hour day. This compares favourably to low productivity cattle production (at any scale, ~VT1,000) and slightly higher than small-scale high-productivity cattle production (~VT1,391). It is important to note however, that the returns to copra are only earned over one-third of the year (so wouldn't generate a livelihood for the household in itself) and also that copra and cattle are broadly complementary. Most importantly, the (positive) returns to cattle production remove the cost of land management under copra (to clear undergrowth) so that coconuts can be seen and collected.

Kava production

While not based on a researched response, interviews have constructed the kava activities of a synthetic household. The household plants just 0.25 ha of kava at a rate of 1 plant per metre square. The household produces export quality kava harvested after 4 years. Evened over 4 years, the kava harvest yields 625kgs of kava when dried, which is sold at a price of VT1,500 per kg. This generates revenues of nearly VT 1 million (VT937,500) per year.

There are some modest costs associated with kava production. It can be time consuming or expensive to obtain seed stock (valued at VT125,000 per year). Kava and is often planted in new plots, which need to be fenced off for the 4 year crop cycle.

However, by far the biggest cost is in household labour. Kava is a labour-intensive activity, often with hard physical work, for planting, maintenance (weeding and pruning), harvesting, and washing/drying. The total labour input is a high 262 days per year.

However, the gross profits are high even relative to this high labour input, resulting in high returns to labour of VT3,088 per year. This is the highest return of all activities analysed.

Copra (dry) - variable costs only	Calculations	Sub-totals	Totals
Background information			
Variety	X qual kava		
Area (ha)	0.25		
Density	1 plant per sq m		
Plants	2,500		
Years to harvest	4		
Revenue			
Yield (kg/plant dry 4 years	1		
Output per year (kg, 4 yea	625		
Price per kg	1,500		
Revenue over year			**937,500**
Variable costs (per harvest over whole area)			0
Seedlings			
Cost each	200		
Total number re	2,500		
Number per (4)	625		
Cost per year		125,000	
Fencing (required per planting)			
Fenced area (sc	2,500		
perimeter (m)	250		
Wire required (	1,000		
Cost Chinese w	13,800		
Cost per year		3,450	
Total costs over year			**128,450**
Household labour (family, exteneded fmaily, reciprocal) per harvest			
Weeding and pruning			
People	2		
Days per week	2		
Total person days per year		208	
Harvest			
People	10		
Days per harves	3		
Total person days		30	
Washing & drying			
People	2		
Days per year	12		
Total person days		24	
Total household labour over year			262
Gross returns			**809,050**
Revenues	937,500		
Variable costs	128,450		
Returns to own labour			**3,088**
Returns	809,050		
Labour days	262		
Investment			
Very large labour investment in clearing and planting			
Not valued - can be used for other purposes after harvest			

Vegetable production

No attempt has been made to record or estimate labour input for vegetable production, which is confounded by the number of crops, often inter-cropped, and usually seasonal. This means that returns to labour is not able to be calculated. However, to provide some context, data is presented in the production cycles, yields, revenue, and cash costs of the various major vegetables. Gross profits (without labour or other costs) appear high (in some cases comparable to cattle and copra) although this is for vegetable / root production on a large scale as a specialised household activity.

Crop	Island Taro	Kumala	Manioc	Taro fiji	Strong Yam (Marrow)	Soft yam	Waelu
Physical							
Spacing	1m X 1m	1m X 1m	1m X1m	1m X 1m	1m X 1m	1m X 1m	1 mX 1m
Area	50m X 50m	50 m X 50 m	50 m X 50 m	50m X 50m	50m X 50m	50m X 50m	50m X 50m
Number of planting material	2,601	5202 vines	2601 cutting	2,601	2,601	2,601	2,601
Harvest time	6- 9 months	3 - 4 months	10-12 months	12- 24 month		9- 10 months	6 month
Planting season	July-Dec	Mar-Aug		July-Dec	Sept-Dec	Aug-Sept	Aug-Sept
Revenues							
Average weight (kg)	1.2	2.0	4.0	2.0	4.0	2.0	10.0
Estimated production	3,121	5,202	10,404	5,202	2601 stamba	5,202	26,010
Losses (10%) kg	312	520	1,040	520	20 stamba	520	2,601
Marketable product (kg)	2,809	4,682	9,364	4,682	2,581	4,682	23,409
Price/kg (vt)	80	40	40	60	1000 vt wan sta	120	120
Total revenues (VT)	**183,120**	**187,280**	**374,544**	**280,908**	**2,581,000**	**561,816**	**2,809,080**
Cash expenses							
Bush clearing (not inc as distributed over the number of years)							
Harvest costs							
Transportation	25,000	25,000	25,000	25,000	200,000	100,000	200,000
Other							
Total cash expenses (VT)	**25,000**	**25,000**	**25,000**	**25,000**	**200,000**	**100,000**	**200,000**
Gross profit (VT)	**158,120**	**162,280**	**349,544**	**255,908**	**2,381,000**	**461,816**	**2,609,080**

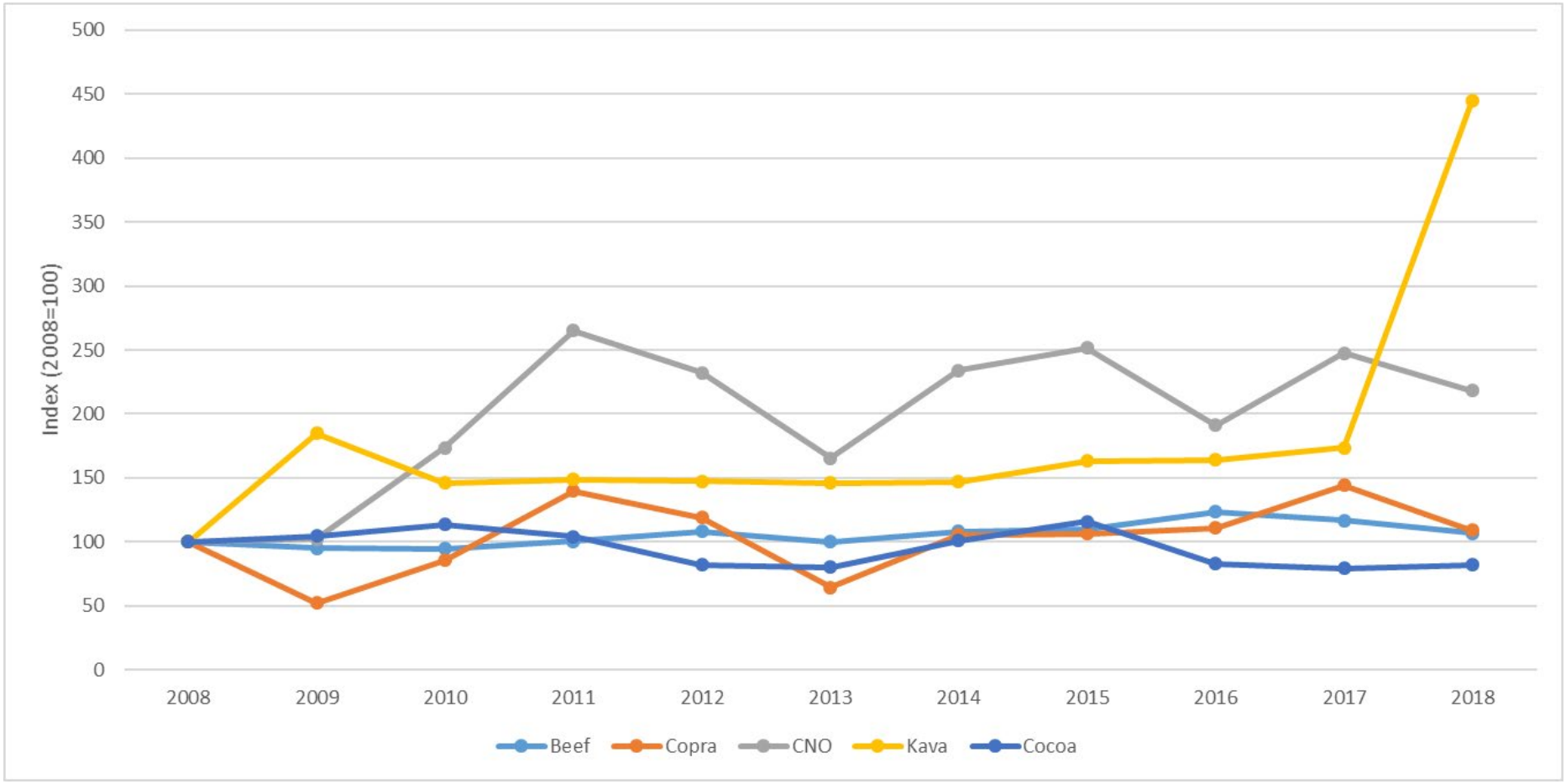
Synthetic vegetable budgets / gross margins. Source: Department of Agriculture, personal communication

Sensitivities across commodities

While the analysis so far shows relative returns to different activities, the returns are not static and vary by a large number of factors. One major factor are prices which are subject to significant variation, which effects returns and incentives for households to select different activities.

Export price movements

Price data for commodities are not systematically collected and reported in Vanuatu. This section therefore draws on export data drawn from Customs data reported by VNSO. It could be expected that there are close relationships between export prices and domestic prices (including in Santo) for copra and kava because the bulk of the commodities are exported. While a perhaps 30% of beef is exported, this is for a specific class of product (heavy steers) that may not apply to others consumed domestically. Domestic prices appear to have increased more than shown in the figure below “Indicative nominal FOB price of major export commodities in Vanuatu, 2008-2018”.

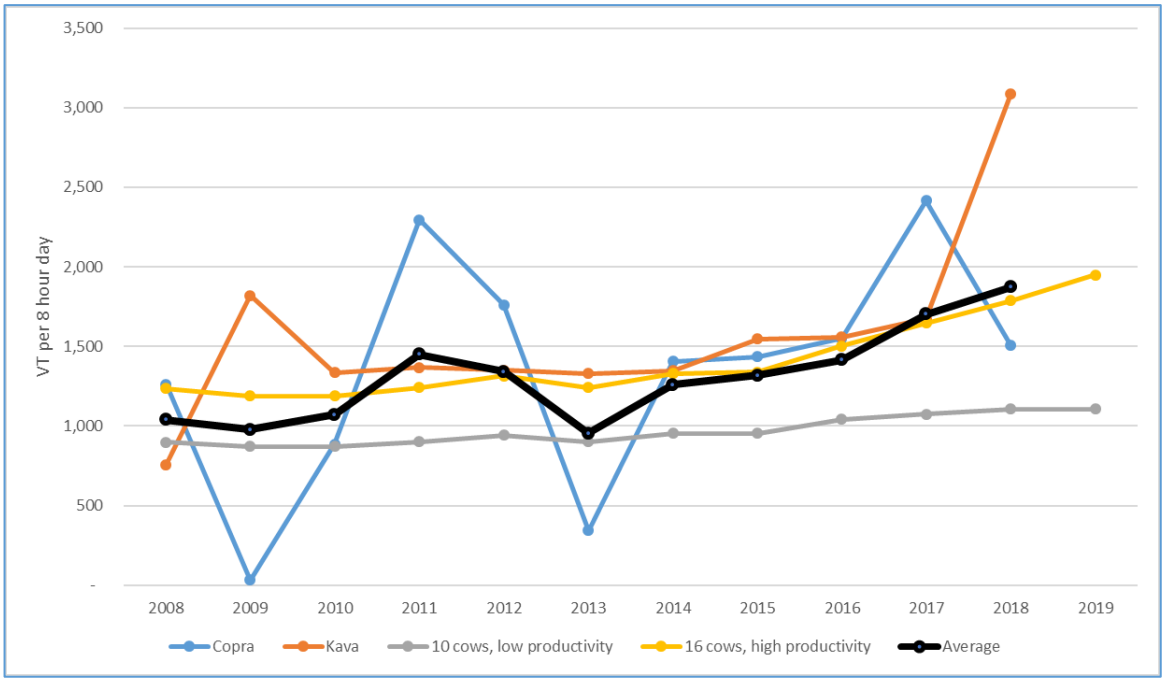


Indicative nominal FOB price of major export commodities in Vanuatu, 2008-2018. Source VNSO.

Impact on returns

This section provides indicators on the relative profitability of the three major economic activities in East Santo from 2008-18. This includes kava, copra, and cattle. The latter is disaggregated into two scenarios at either end of the profitability spectrum: 10 cows, low productivity" (base case in the training manual, Scenario 1); and 16 cows, high profitability (improved case in the training manual, Scenario 2). The results were derived by running budgets for these activities with the price indices presented above "Indicative nominal FOB price of major export commodities in Vanuatu, 2008-2018 ". There are constraints in the results because it did not account for inter-year climate variability or natural disasters and input prices were not adjusted for inflation.

The results shown in the figure below "Relative profitability of major household economic activities in Santo, 2008-19" confirm the large differences in profitability (measured as returns to labour) between the two different cattle production scenarios. Because of the larger increases in prices for heavier cattle, especially since 2015, profits for the high productivity farmers have increased to become nearly double that of the low profitability systems.



Relative profitability of major household economic activities in Santo, 2008-19

Interestingly, the profitability of kava has tracked quite closely to that of higher productivity cattle production, until 2017 when there was a rapid increase in prices, so that kava became by far the most profitable activity. Copra profitability is subject to the volatility of international commodity prices. Copra production is highly profitable in periods of high prices (2010, 2011, and 2017) but low in other years (2009, 2013, and 2019) when farmers may not have bothered harvesting much copra.

If the returns to labour for all activities are averaged over the four activities, there has been an overall steady increase of 80% over the 8 year period, or a 6.1% compound average annual growth rate. In years like 2018, high kava prices compensated for low copra prices.

Labour use

The figure above "Relative profitability of major household economic activities in Santo, 2008-19" shows the benefits to households of running multiple activities. However, there are limits to the number of the scale of activities that households can engage in, including land and capital. Labour is the largest constraint. The figure below "Labour days required

for representative kava, copra, and low productivity cattle household in East Santo" presents labour use for the three main economic activities of households in East Santo, drawn from budget information. The use of time for other activities such as the growing of fruit and vegetables, household work, construction, transport, and off-farm work is not included.

Activity	Labour days / year	Labour
Copra	120	Men, women
Kava	262	Men, women
10 cows, low productivity	230	Mainly men
Total	**612**	

Labour days required for representative kava, copra, and low productivity cattle household in East Santo.

The figure suggest that the three activities require full time labour allotment for two adult family members. Given the other commitments, the family is likely to use labour from children, older generations, relatives, and hired labour.

The labour obligations become higher for households that plan to increase herd numbers and productivity as shown in the figure below "Labour days required for representative kava, copra, and high productivity cattle household in East Santo". This may limit incentives to take this management option and could mean that the family may give up other activities or will hire in additional labour.

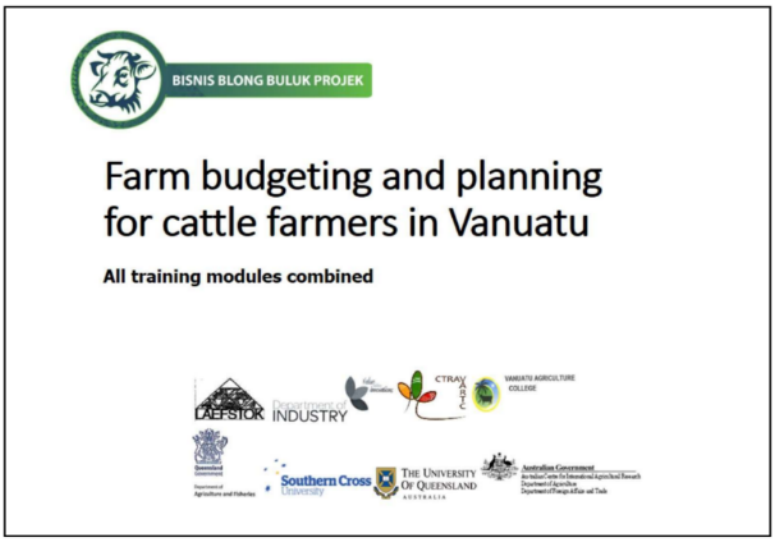
Activity	Labour days / year	Labour
Copra	120	Men, women
Kava	262	Men, women
16 cows, high productivity	316	Mainly men
Total	**698**	

Labour days required for representative kava, copra, and high productivity cattle household in East Santo.

Appendix 3.3. Training modules for farm budgeting and planning for cattle farmers in Vanuatu

Prepared by: Scott Waldron

Training modules



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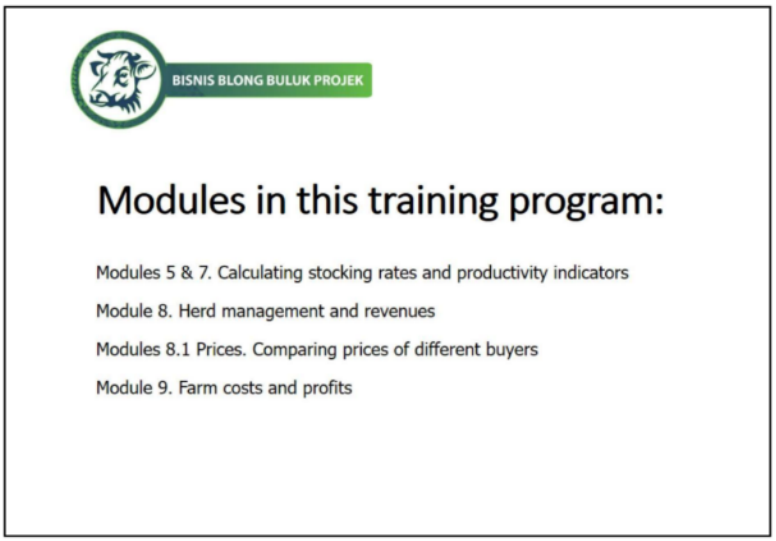
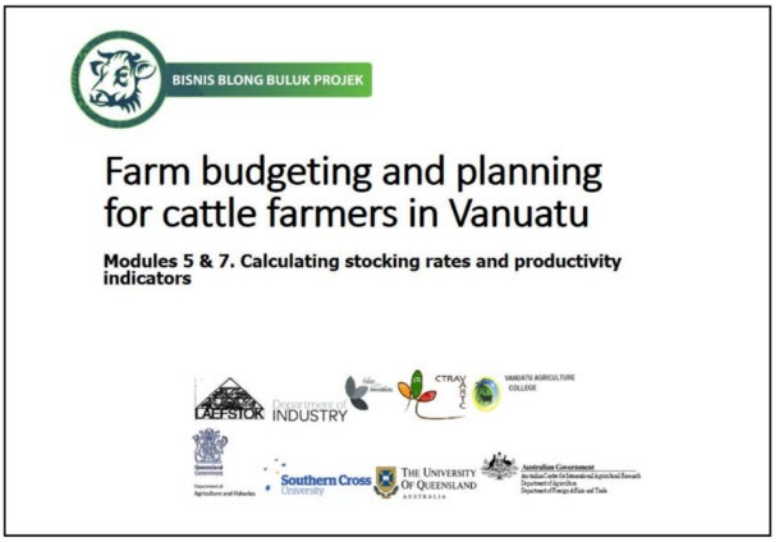
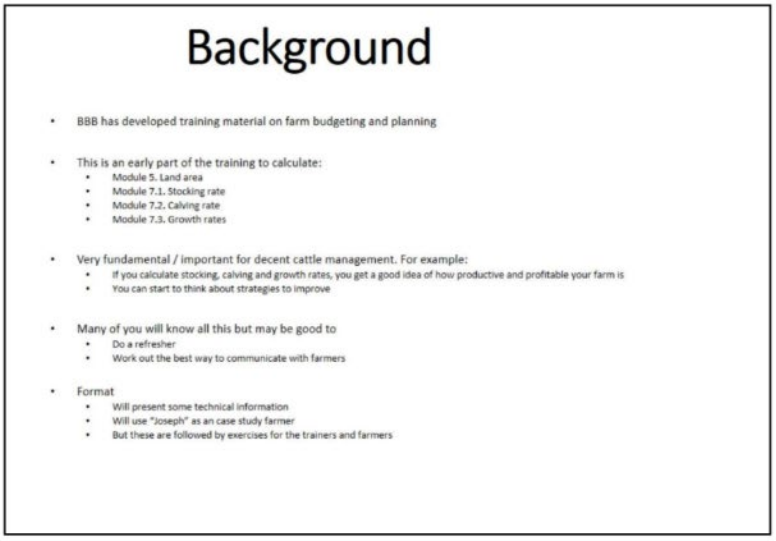


2


BISNIS BLONG BULUK PROJEK
Farm budgeting and planning for cattle farmers in Vanuatu
Modules 5 & 7. Calculating stocking rates and productivity indicators
LAEFSTOK
INDUSTRY
CTRAV
VANUATU AGRICULTURE COLLEGE
Southern Cross University
THE UNIVERSITY OF QUEENSLAND

3


Background
BBB has developed training material on farm budgeting and planning
This is an early part of the training to calculate:
Module 5. Land area
Module 7.1. Stocking rate
Module 7.2. Calving rate
Module 7.3. Growth rates
Very fundamental / important for decent cattle management. For example:
If you calculate stocking, calving and growth rates, you get a good idea of how productive and profitable your farm is
You can start to think about strategies to improve
Many of you will know all this but may be good to
Do a refresher
Work out the best way to communicate with farmers
Format
Will present some technical information
Will use "Joseph" as an case study farmer
But these are followed by exercises for the trainers and farmers

4

Modules 5 and 7.1
Calculating stocking rate

To work out if farmers are under- or over-stocked, need to know:

- Land areas of different types (Module 5)
- The carrying capacity of land of different types
- Number of cattle of different types on the farm, converted to animal units
- And do the calculations

- Will go through each of these

5

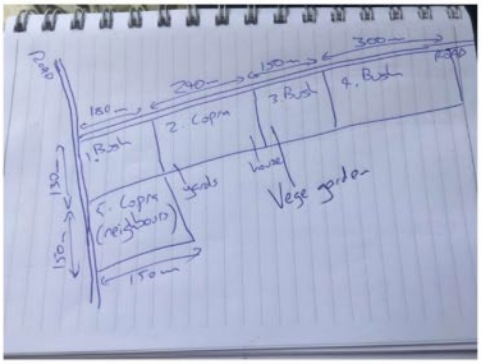
Land areas

- Most farmers have an idea of the place / size of their land, but don't know the numbers.
- Some farmers have maps and land areas in their BBB folders
- But others have to work it out
- Best way to do it is by drawing a "mud map" and stepping out perimeters
- But to be accurate and useful, best to do by a "mud map" including
  - Paddocks
  - And land use

6

Joseph

Mud map of farm

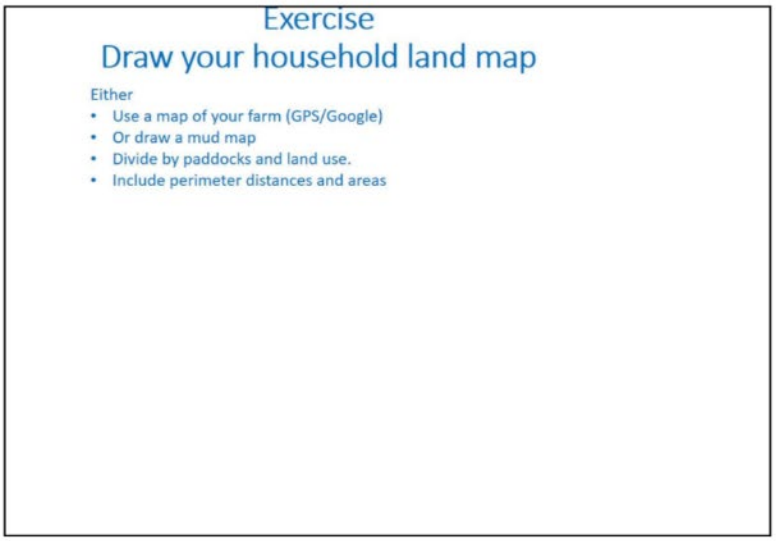


7

Joseph

Google earth & distances

8



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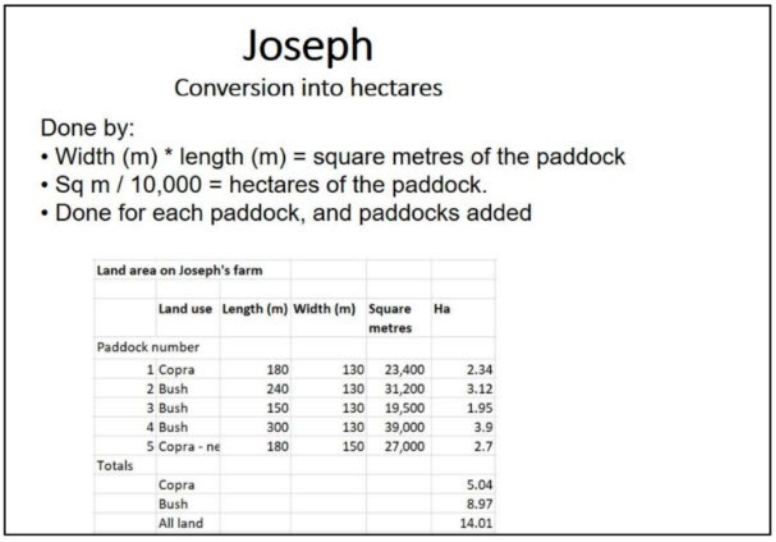


Land area on Joseph's farm					
	Land use	Length (m)	Width (m)	Square metres	Ha
Paddock number					
1	Copra	180	130	23,400	2.34
2	Bush	240	130	31,200	3.12
3	Bush	150	130	19,500	1.95
4	Bush	300	130	39,000	3.9
5	Copra - ne	180	150	27,000	2.7
Totals					
	Copra				5.04
	Bush				8.97
	All land				14.01

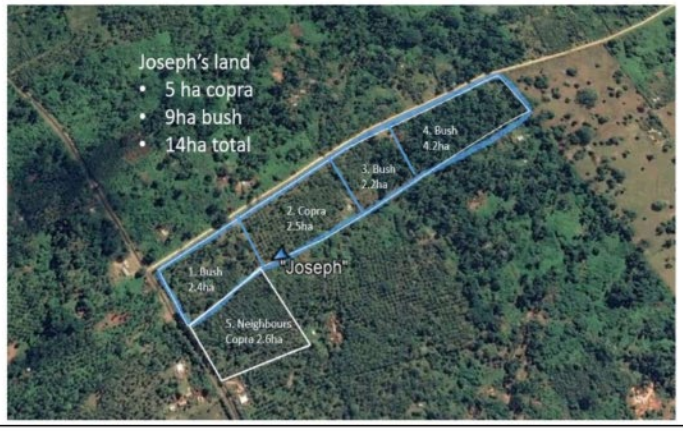
10

Exercise
Calculate your household land areas

Land area on your farm					
	Land use	**Length (m)**	**Width (m)**	**Square metres**	**Ha**
Paddock number					
1					
2					
3					
4					
5					
6					
7					
Totals					
	Copra				
	Bush				
	Open grazing				
	Tether				
	All land				

11

Joseph
Map of land area



12

Carrying capacity

- Now that we have the land areas, what is the carrying capacity of the land?
- This depends a lot on the type of land, pasture, condition etc.
- Some estimates have been made in the literature

	Carrying capcity (animal units per ha)	ADWG	Kg/head/year
Open carpet, native legumes	1.5	0.3	117
Buffalo-carpet under old coconuts	1.5	0.3	117
Improved grass, sown legumes	2.5	0.6	210
Tethered in bush (estimate)	~1.5	~0.3	~117
Heavily shaded coconuts & bush		Low	

Macfarlane, David and Shelton, Max (1986) Pastures in Vanuatu, ACIAR Technical Reports Series No 2. Table 1. In dry season, these carrying capacities should be reduced by about 0.5

13

Carrying capacity

- But varies by season – lower in dry seaosn

Table 6. Stocking rates in relation to pasture type on estates in Vanuatu. (IRHO trials indicate that mean dry season production of the grasses described in this report is 54% of wet season production.)

	Suggested optimum stocking rates (AU/ha)	
Pasture type	*Wet season*	*Dry season*
Open native pastures	1.6–1.8	1.2–1.4
Buffalo grass & native pasture in moderate shade	1.3–1.5	1.0–1.2
Improved grass/legume pastures	2.5	1.8–2.0
Degraded improved pastures	2.2.–2.5	1.5–1.7

Macfarlane, David and Shelton, Max (1986) Pastures in Vanuatu, ACIAR Technical Reports Series No 2. Table 6.

14

Joseph

Carrying capacity

Carrying capcity of Joseph's land				
		Copra (bufflo & carpet grass under old coconuts)	Bush	Total
Hectares		5	9	14
Carrying capacity (animal units per ha)		1.5	1.5	
Total carrying capacity (AU/ha)		**7.5**	**13.5**	**21**

15

Exercise

Calculate the carrying capacity of your land

Carrying capacity of your land						
		Copra (bufflo & carpet grass under old coconuts)	Bush	Other land 1	Other land 2	Total
Hectares						
Carrying capacity (animal		1.5	1.5			
Total carrying capacity						

16

Joseph

Cattle numbers

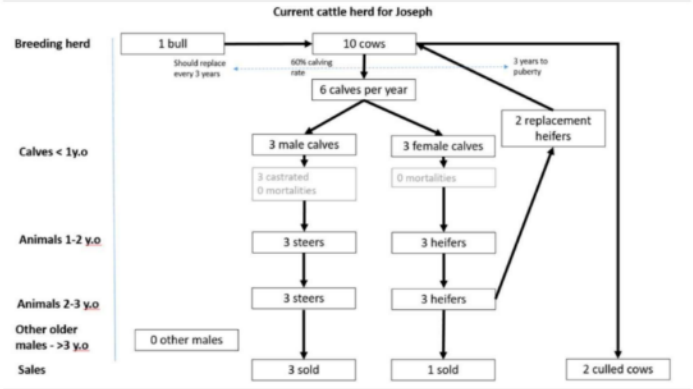
- **Seems** straightforward! But rarely is!
- This is the count in monitoring

Cattle carried by Joseph (head)		
Lactating cows	10	
Calves <1yo	6	
Female		3
Male		3
Heifers >1yo	6	
1-2 yo		3
2-3yo		3
3-4yo		0
Steers >1yo	6	
1-2 yo		3
2-3yo		3
3-4yo		0
Breeding bulls (mature)	1	
Uncastrated males >1yo (450	0	
Total cattle	**29**	

17

Calculating cattle numbers

- And biologically



18

Exercise

Estimate your cattle numbers

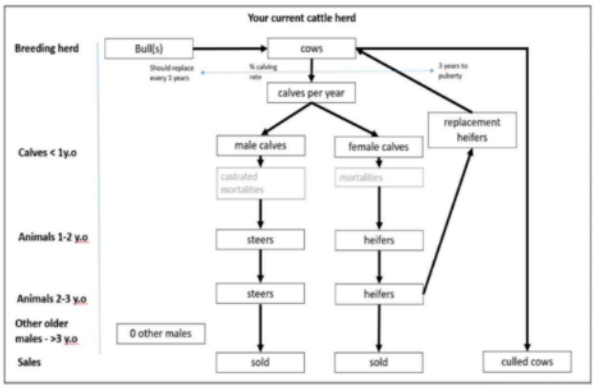
- **Seems** straightforward! But not necessarily!
- This is the count in monitoring

Cattle carried on your farm (head)		
Lactating cows		
Calves <1yo		
Female		
Male		
Heifers >1yo		
1-2 yo		
2-3yo		
3-4yo		
Steers >1yo		
1-2 yo		
2-3yo		
3-4yo		
Breeding bulls (mature)		
Uncastrated males >1yo (450kg)		
Total cattle		

19

Exercise

Your cattle herd



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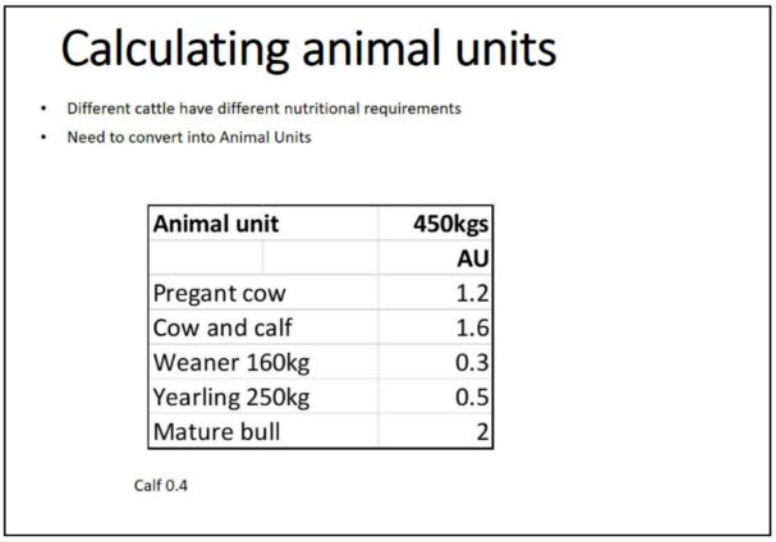
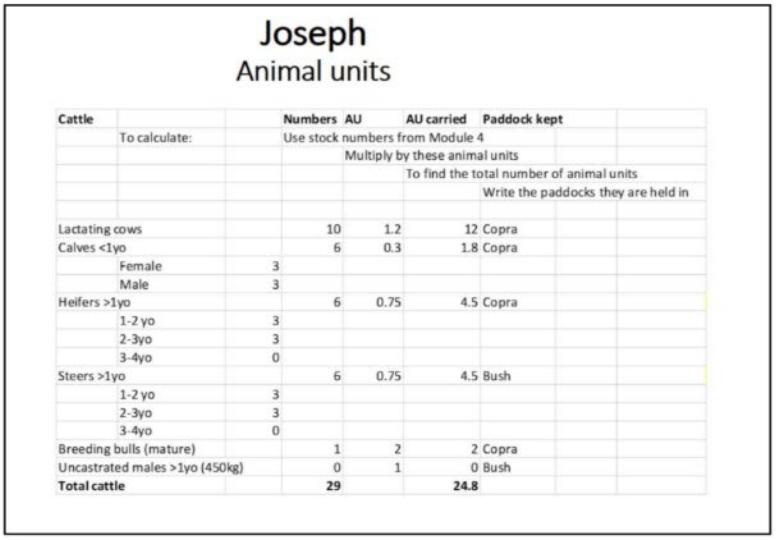

Calculating animal units
• Different cattle have different nutritional requirements
• Need to convert into Animal Units
Animal unit 450kgs AU
Pregant cow 1.2
Cow and calf 1.6
Weaner 160kg 0.3
Yearling 250kg 0.5
Mature bull 2
Calf 0.4

21


Joseph
Animal units
Cattle
To calculate:
Numbers
AU
AU carried
Paddock kept
Use stock numbers from Module 4
Multiply by these animal units
To find the total number of animal units
Write the paddocks they are held in
Lactating cows 10 1.2 12 Copra
Calves <1yo 6 0.3 1.8 Copra
Female 3
Male 3
Heifers >1yo 6 0.75 4.5 Copra
1-2 yo 3
2-3yo 3
3-4yo 0
Steers >1yo 6 0.75 4.5 Bush
1-2 yo 3
2-3yo 3
3-4yo 0
Breeding bulls (mature) 1 2 2 Copra
Uncastrated males >1yo (450kg) 0 1 0 Bush
Total cattle 29 24.8

22

Exercise

Your Animal Units

Animal units carried on your farm in different paddocks					
Cattle		**Numbers**	**AU**	**AU carried**	**Paddock kept**
	To calculate:	Use stock numbers from Module 4			
			Multiply by these animal units		
				To find the total number of animal units	
					Write the paddocks they are held in
Cows (lactating)			1.2		
Calves <1yo			0.4		
	Female				
	Male				
Heifers >1yo (250kg)			0.5		
	1-2 yo				
	2-3yo				
	3-4yo				
Steers >1yo (350kg)			0.75		
	1-2 yo				
	2-3yo				
	3-4yo				
Breeding bulls (mature)			2		
Uncastrated males >1yo (450kg)			1		
Total cattle					

23

Calculating under- & over-stocking rates

Animals carried compared to carrying capacity on Joseph's farm			
Copra		**Bush**	
Animal units under copra	15.8	Animal units in bush	9
Total carrying capacity	7.5	Total carrying capacity	13.5
Number over-stocked	8.3	Number under-stocked	-4.5

24

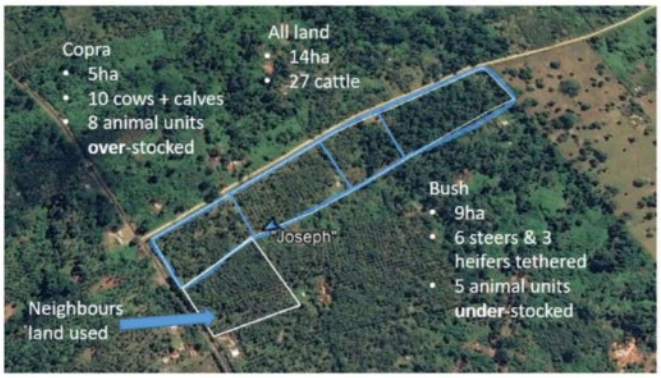
Exercise

Calculate your under- or over-stocking rates

Animals carried compared to carrying capacity on Joseph's farm		
Copra	Bush	Instructions
Animal units under copra	Animal units in bush	Add up the number of animal units raised in each paddock
Total carrying capacity	Total carrying capacity	Multiply carrying capacity per ha by land area (ha) to calculate total carrying capacity
Number over-stocked	Number under-stocked	Subtract the actual number carried from the carrying capacity to calculate how much the land is over-stocked or under-stocked

25

Mapping Joseph's under- & over-stocking rates



What should Joseph do in this case?

26

Module 7.2.
Calculating calving rates

Q. In the example of Joseph, what is the calving rate?

Cattle carried by Joseph (head)			
Lactating cows		10	
Calves <1yo		6	
	Female		3
	Male		3
Heifers >1yo		6	
	1-2 yo		3

A. Joseph has
- 10 cows
- 6 calves (under the age of 1 year old)
- That means 6 cows produced a calf and 4 cows didn't
- 6 calves divided by 10 cows = a calving rate of 60%.

Q. What is a calving interval?

27

Calculating growth rates

- Calculating growth is also important
- Growth important for reproduction, sales, consumption / ceremonies
- Farmers can get growth rate information from measurements or from the literature
-

28

Growth rates in the literature

Carrying capacity on main pasture types.

	Carrying capcity (animal units per ha)	ADWG	Kg/head/year
Open carpet, native legumes	1.5	0.3	117
Buffalo-carpet under old coconuts	1.5	0.3	117
Improved grass, sown legumes	2.5	0.6	210
Tethered in bush (estimate)	~1.5	~0.3	~117
Heavily shaded coconuts & bush	Low		

Source: Macfarlane, David and Shelton, Max (1986) Pastures in Vanuatu. ACIAR Technical Reports Series No 2: Table 1.
Note that in dry season, these carrying capacities should be reduced by about 0.5 AU/ha.

Liveweight production (kg/head/year) from different pasture systems

	50% Shaded Pasture		Open Past. > 70% Light	
Rainfall--> Pasture	<1500mm coralline	>1500mm fertile	<1500mm coralline	>1500mm fertile
50% Wood Infested Native Pasture	40	65	85	115
T-Grass/Legume	70	120	160	225
Buffalo/Legume	100	170	250	325
Signal/Kocosivia/ Legume	na	na	400	500

Source: Mullen, B (1993) "Economics of new pasture establishment and different rehabilitation techniques" in Evans, T.R., Macfarlane, D.C., and Mullen, B.F. (1993) Sustainable beef production from smallholder and plantation and farming systems in the South Pacific: proceedings of a workshop. Port Vila and Luganville, Vanuatu, 2-12 August 1993

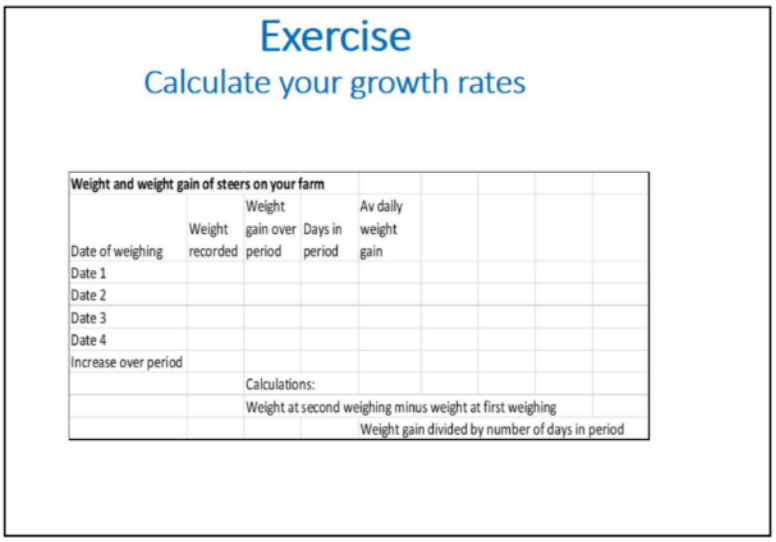
29

Calculating growth rates

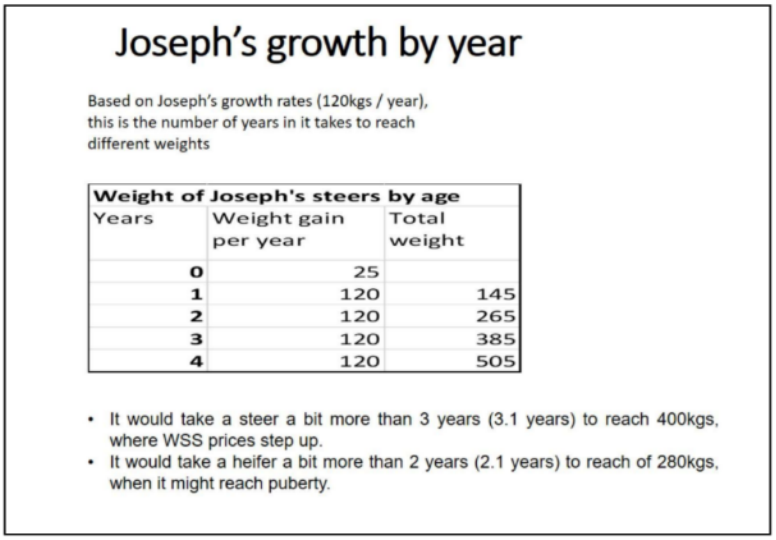
Weight and weight gain of steers on Joseph's farm

Date of weighing	Weight recorded	Weight gain over period	Days in period	Av daily weight gain
Jan 1 2018	300			
July 1 2018	365	65	182	0.36
Dec 31 2018	420	55	183	0.30
Increase over year (2018)		**120**	**365**	**0.33**
		Calculations:		
		Weight at second weighing minus weight at first weighing		
				Weight gain divided by number of days in period

30


Exercise
Calculate your growth rates
Weight and weight gain of steers on your farm
Date of weighing
Weight recorded
Weight gain over period
Days in period
Av daily weight gain
Date 1
Date 2
Date 3
Date 4
Increase over period
Calculations:
Weight at second weighing minus weight at first weighing
Weight gain divided by number of days in period

31


Joseph's growth by year
Based on Joseph's growth rates (120kgs / year), this is the number of years in it takes to reach different weights
Weight of Joseph's steers by age
Years
Weight gain per year
Total weight
0 25
1 120 145
2 120 265
3 120 385
4 120 505
It would take a steer a bit more than 3 years (3.1 years) to reach 400kgs, where WSS prices step up.
It would take a heifer a bit more than 2 years (2.1 years) to reach of 280kgs, when it might reach puberty.

32

Exercise

Calculate your growth rates

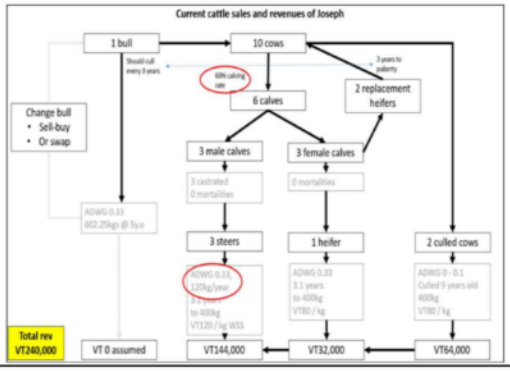
Calculate ages and weights

Weight of your steers or heifers by age		
Years		
0		
1		
2		
3		
4		

33

Use of this data

- To build picture of the cattle herd / system
- To calculate revenues



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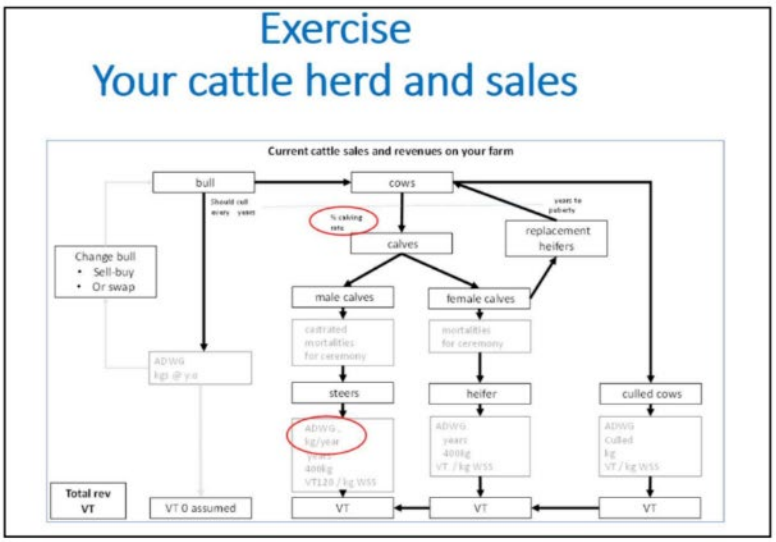
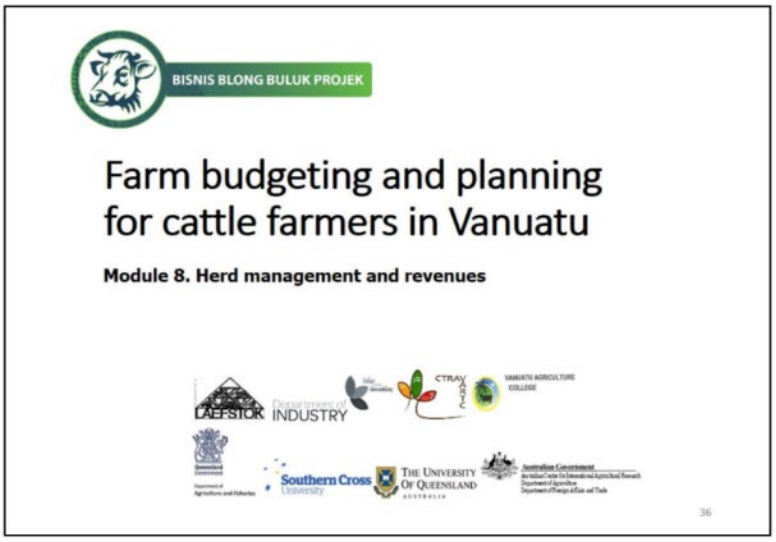

Exercise
Your cattle herd and sales
Current cattle sales and revenues on your farm
bull
cows
% calving rate
calves
replacement heifers
Change bull
• Sell-buy
• Or swap
male calves
female calves
castrated mortalities for ceremony
mortalities for ceremony
ADWG kgs @ y.o
steers
heifer
culled cows
ADWG kg/year
ADWG years 400kg VT / kg WSS
ADWG Culled kg VT / kg WSS
400kg VT120 / kg WSS
Total rev VT
VT 0 assumed
VT
VT
VT

35


BISNIS BLONG BULUK PROJEK
Farm budgeting and planning for cattle farmers in Vanuatu
Module 8. Herd management and revenues
LAEFSTOK
Department of INDUSTRY
CTRAV
VANUATU AGRICULTURE COLLEGE
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THE UNIVERSITY OF QUEENSLAND
Australian Government
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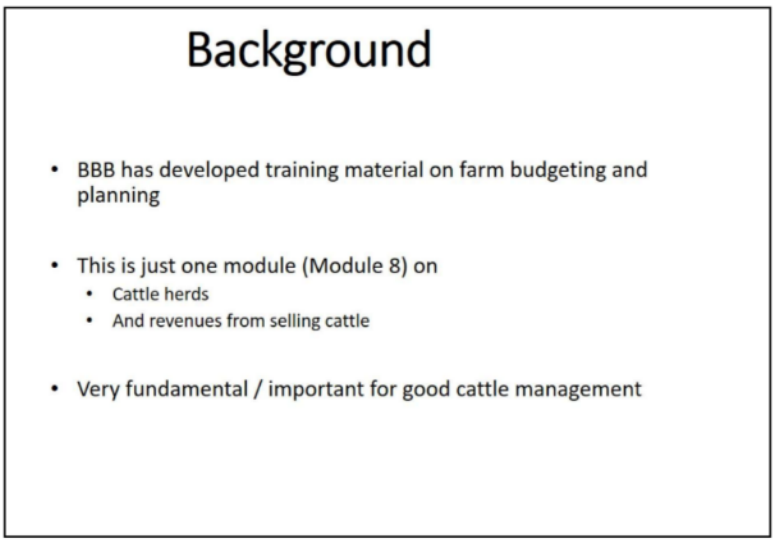
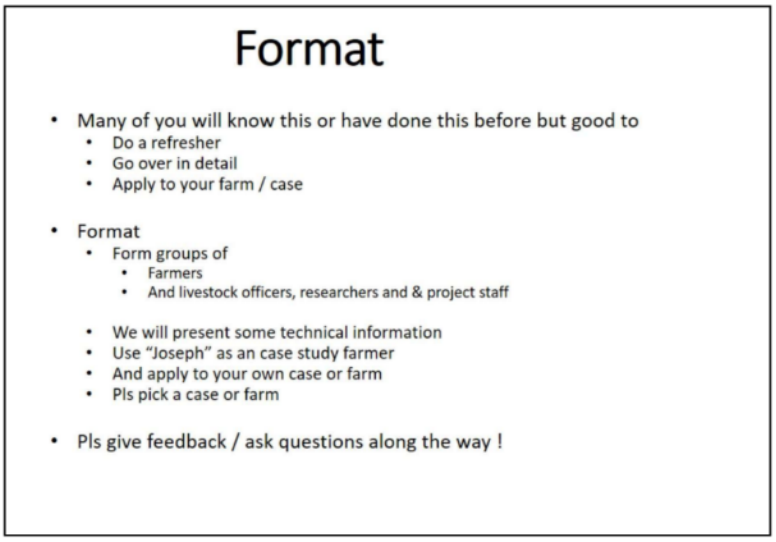
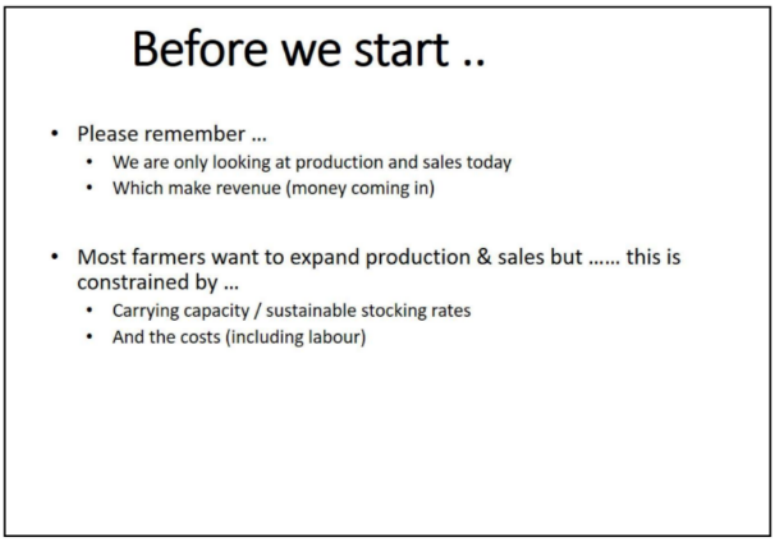

Background
• BBB has developed training material on farm budgeting and planning
• This is just one module (Module 8) on
• Cattle herds
• And revenues from selling cattle
• Very fundamental / important for good cattle management

37


Format
• Many of you will know this or have done this before but good to
• Do a refresher
• Go over in detail
• Apply to your farm / case
• Format
• Form groups of
• Farmers
• And livestock officers, researchers and & project staff
• We will present some technical information
• Use "Joseph" as an case study farmer
• And apply to your own case or farm
• Pls pick a case or farm
• Pls give feedback / ask questions along the way !

38


Before we start ..
• Please remember ...
• We are only looking at production and sales today
• Which make revenue (money coming in)
• Most farmers want to expand production & sales but ..... this is constrained by ...
• Carrying capacity / sustainable stocking rates
• And the costs (including labour)

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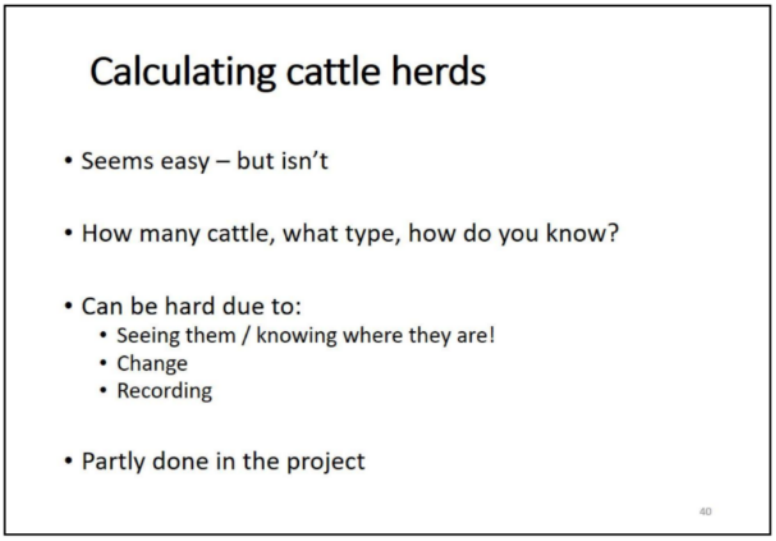
Calculating cattle herds
• Seems easy – but isn't
• How many cattle, what type, how do you know?
• Can be hard due to:
• Seeing them / knowing where they are!
• Change
• Recording
• Partly done in the project
40

40

Counting cattle

This is Joseph's count in monitoring

Cattle carried by Joseph (head)		
Cows	10	
Calves <1yo	6	
Female		3
Male		3
Heifers >1yo	6	
1-2 yo		3
2-3yo		3
3-4yo		0
Steers >1yo	6	
1-2 yo		3
2-3yo		3
3-4yo		0
Breeding bulls (mature)	1	
Uncastrated males >1yo (450	0	
Total cattle	**29**	

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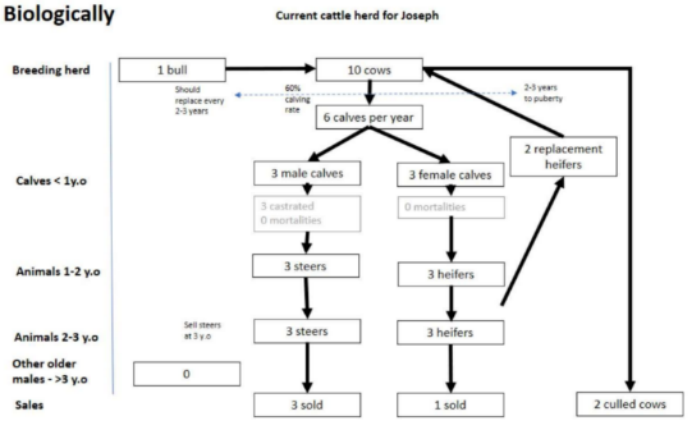
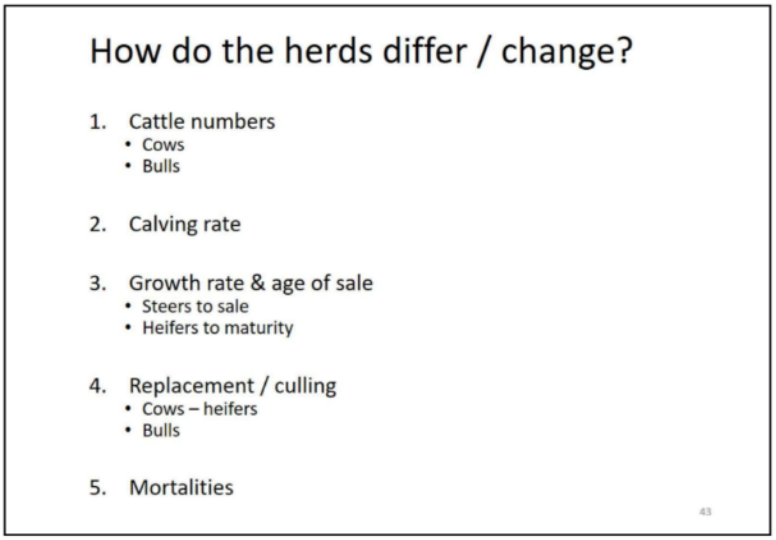
Calculating cattle numbers

Biologically



42


How do the herds differ / change?
1. Cattle numbers
• Cows
• Bulls
2. Calving rate
3. Growth rate & age of sale
• Steers to sale
• Heifers to maturity
4. Replacement / culling
• Cows – heifers
• Bulls
5. Mortalities
43

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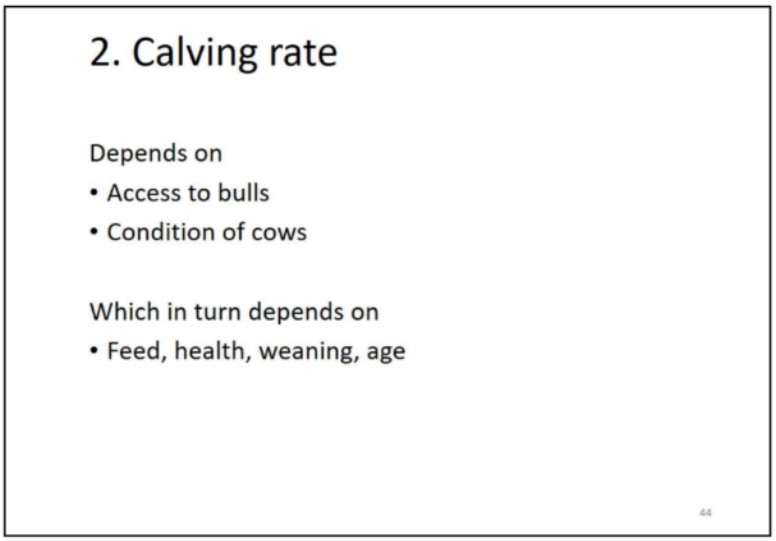
2. Calving rate
Depends on
• Access to bulls
• Condition of cows
Which in turn depends on
• Feed, health, weaning, age
44

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Calculating calving rates

Q. In the example of Joseph, what is the calving rate?

Cattle carried by Joseph (head)		
Lactating cows	10	
Calves <1yo	6	
Female		3
Male		3
Heifers >1yo	6	
1-2 yo		3

A. Joseph has
- 10 cows
- 6 calves (under the age of 1 year old)
- That means 6 cows produced a calf and 4 cows didn't
- 6 calves divided by 10 cows = a calving rate of 60%.

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Exercise

In the next sheet, Joseph has 10 cows and has a calving rate of 60%

Calculate what happens to cattle numbers and revenues if the calving rate changes to:

- 60%
- 40%
- 80%

Write down the answers on the diagram and on this page

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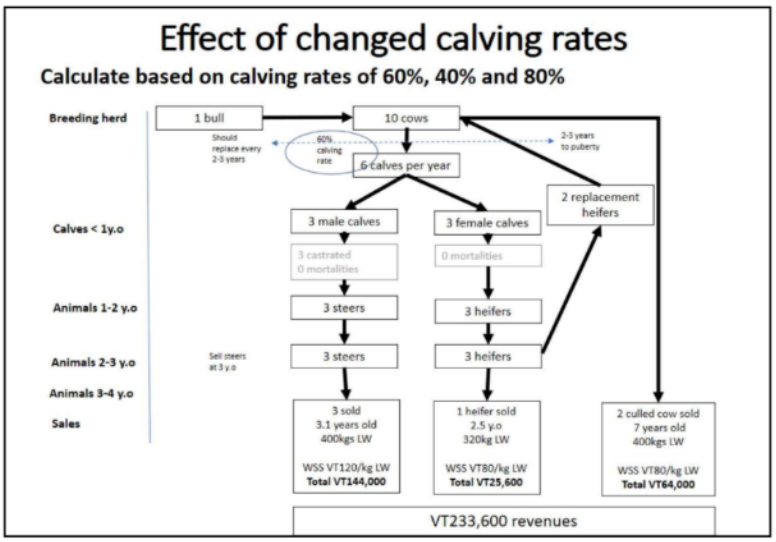

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3. Growth rates & age of sale

- Calculating growth is also important
- Growth important for
  - Reproduction
  - sales, consumption & ceremonies
- Farmers can get growth rate information from
  - measurements
  - or from the literature

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Growth rates in the literature

Carrying capacity on main pasture types.

	Carrying capcity (animal units per ha)	ADWG	Kg/head/year
Open carpet, native legumes	1.5	0.3	117
Buffalo-carpet under old coconuts	1.5	0.3	117
Improved grass, sown legumes	2.5	0.6	210
Tethered in bush (estimate)	~1.5	~0.3	~117
Heavily shaded coconuts & bush		Low	

Source: Macfarlane, David and Shelton, Max (1986) Pastures in Vanuatu, ACIAR Technical Reports Series No 2. Table 1. Note that in dry season, these carrying capacities should be reduced by about 0.5 AU/ha.

Liveweight production (kg/head/year) from different pasture systems

Rainfall--> Pasture	50% Shaded Pasture		Open Past. > 70% Light	
	<1500mm coralline	>1500mm fertile	<1500mm coralline	>1500mm fertile
50% Wood Infested Native Pasture	40	65	85	115
T-Grass/Legume	70	120	160	225
Buffalo/Legume	100	170	250	325
Signal/Kecoeivia/ Legume	na	na	400	500

Source: Mullen, B (1993) "Economics of new pasture establishment and different rehabilitation techniques" in Evans, T.R., Macfarlane, D.C., and Mullen, B.F. (1993) Sustainable beef production from smallholder and plantation and farming systems in the South Pacific: proceedings of a workshop. Port Vila and Luganville, Vanuatu, 2-12 August, 1993

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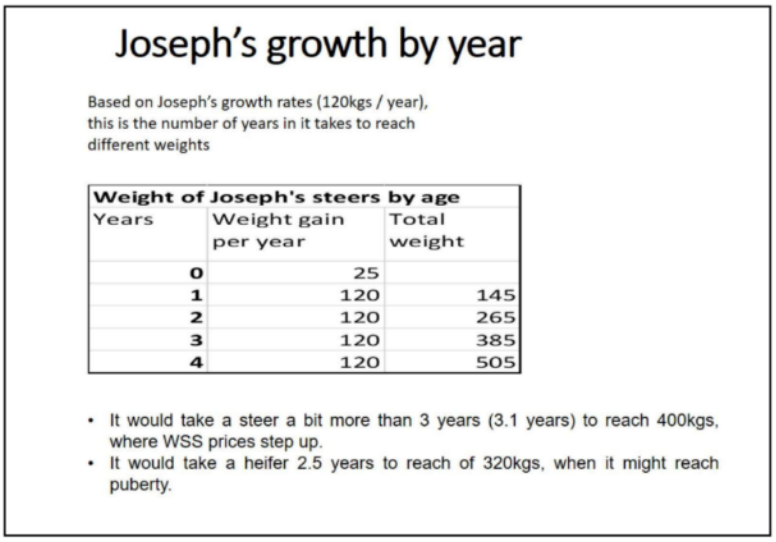
Calculating growth rates

Weight and weight gain of steers on Joseph's farm				
Date of weighing	Weight recorded	Weight gain over period	Days in period	Av daily weight gain
Jan 1 2018	300			
July 1 2018	365	65	182	0.36
Dec 31 2018	420	55	183	0.30
Increase over year (2018)		**120**	**365**	**0.33**
		Calculations:		
		Weight at second weighing minus weight at first weighing		
				Weight gain divided by number of days in period

50



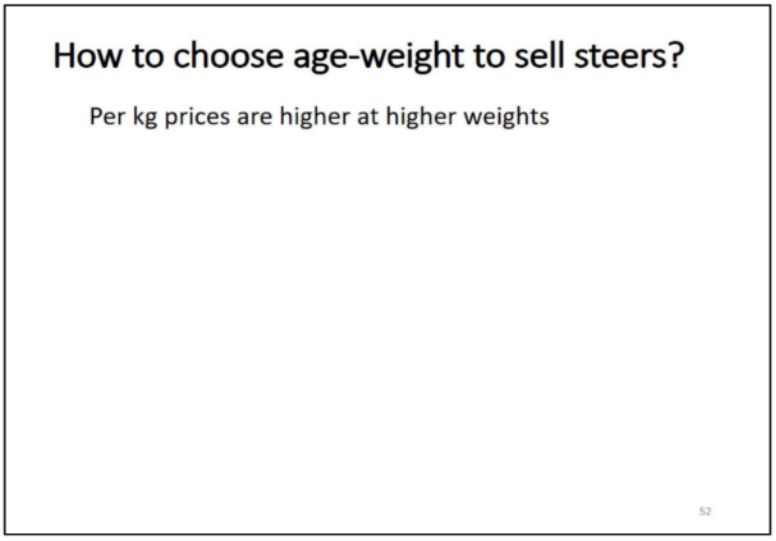
Joseph's growth by year

Based on Joseph's growth rates (120kgs / year), this is the number of years in it takes to reach different weights

Weight of Joseph's steers by age		
Years	Weight gain per year	Total weight
0	25	
1	120	145
2	120	265
3	120	385
4	120	505

- It would take a steer a bit more than 3 years (3.1 years) to reach 400kgs, where WSS prices step up.
- It would take a heifer 2.5 years to reach of 320kgs, when it might reach puberty.

51



How to choose age-weight to sell steers?

Per kg prices are higher at higher weights

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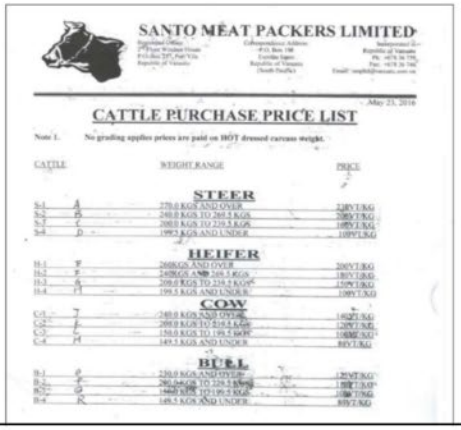
52

Prices schedules

WSS Price schedule April 2018		
VT/kg live weight		
Steers		
	>400kg	120
	<400kg	110
Heifer		80
Cow		80
Bull		
VT/kg carcass weight		
Steers		230

Note, WSS prices have changed

- VT120 for >450 or 500kg?
- VT110 for <450 or ..?
- VT60 for cows
- Doesn't take heifers



SANTO MEAT PACKERS LIMITED

CATTLE PURCHASE PRICE LIST

Note 1. No grading applies prices are paid on HOT dressed carcass weight.

CATTLE		WEIGHT RANGE	PRICE
STEER			
S-1	A	270.0 KGS AND OVER	230VT/KG
S-2	B	240.0 KGS TO 269.5 KGS	200VT/KG
S-3	C	200.0 KGS TO 239.5 KGS	160VT/KG
S-4	D	199.5 KGS AND UNDER	110VT/KG
HEIFER			
H-1	E	260KGS AND OVER	200VT/KG
H-2	F	240KGS AND 259.5 KGS	180VT/KG
H-3	G	200.0 KGS TO 239.5 KGS	150VT/KG
H-4	H	199.5 KGS AND UNDER	110VT/KG
COW			
C-1	I	240.0 KGS AND OVER	140VT/KG
C-2	J	200.0 KGS TO 239.5 KGS	120VT/KG
C-3	K	150.0 KGS TO 199.5 KGS	100VT/KG
C-4	H	149.5 KGS AND UNDER	80VT/KG
BULL			
B-1	O	230.0 KGS AND OVER	230VT/KG
B-2	P	200.0 KGS TO 229.5 KGS	180VT/KG
B-3	Q	150.0 KGS TO 199.5 KGS	150VT/KG
B-4	R	149.5 KGS AND UNDER	80VT/KG

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How to choose age & weight to sell steers?

In Santos, per kg prices are higher at higher weights. So good to

- Have high growth rates
- Or to keep steers longer

But also depends

- When you need money
- The carrying capacity of the land
- The costs of holding the animals

- And sometimes buyers (big farmers & Port Vila butchers) pay good prices for weaners

So it **may** be better to sell at a younger age

Deciding when to sell – and then organising production around this – Is much of the skill of being a cattle producer

We can calculate some scenarios

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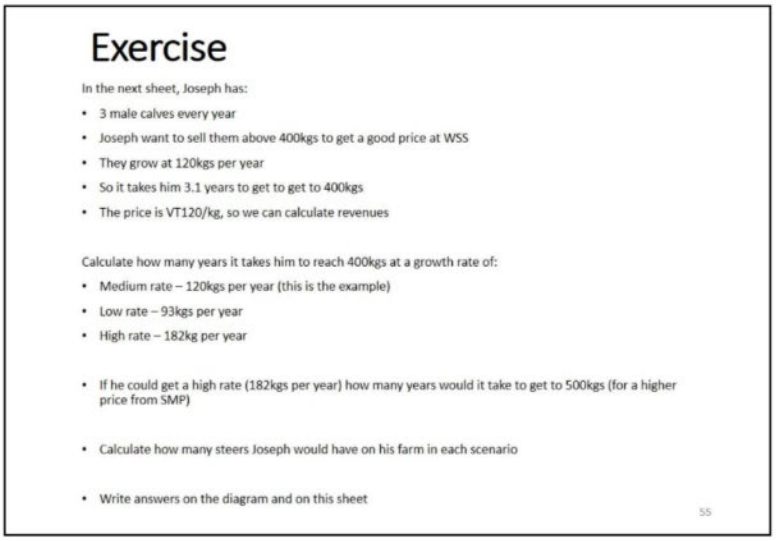
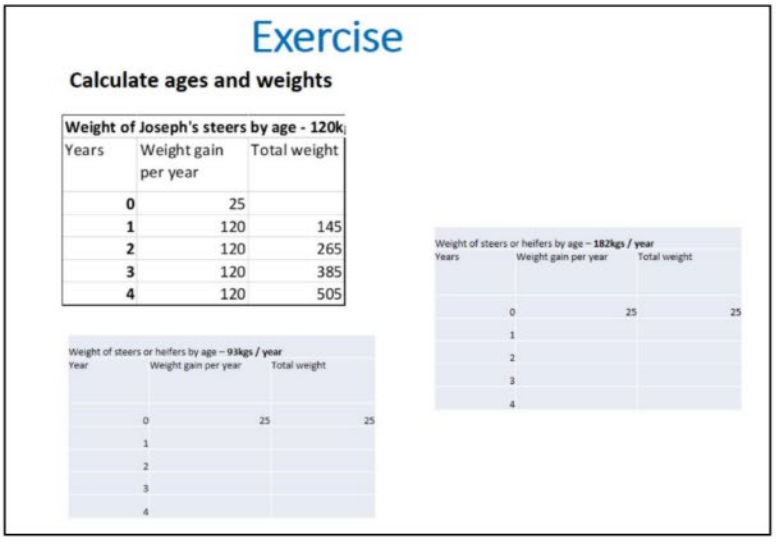

Exercise
In the next sheet, Joseph has:
• 3 male calves every year
• Joseph want to sell them above 400kgs to get a good price at WSS
• They grow at 120kgs per year
• So it takes him 3.1 years to get to get to 400kgs
• The price is VT120/kg, so we can calculate revenues
Calculate how many years it takes him to reach 400kgs at a growth rate of:
• Medium rate – 120kgs per year (this is the example)
• Low rate – 93kgs per year
• High rate – 182kg per year
• If he could get a high rate (182kgs per year) how many years would it take to get to 500kgs (for a higher price from SMP)
• Calculate how many steers Joseph would have on his farm in each scenario
• Write answers on the diagram and on this sheet
55

55


Exercise
Calculate ages and weights
Weight of Joseph's steers by age - 120k
Years
Weight gain per year
Total weight
0 25
1 120 145
2 120 265
3 120 385
4 120 505
Weight of steers or heifers by age – 182kgs / year
Years
Weight gain per year
Total weight
0 25 25
1
2
3
4
Weight of steers or heifers by age – 93kgs / year
Year
Weight gain per year
Total weight
0 25 25
1
2
3
4

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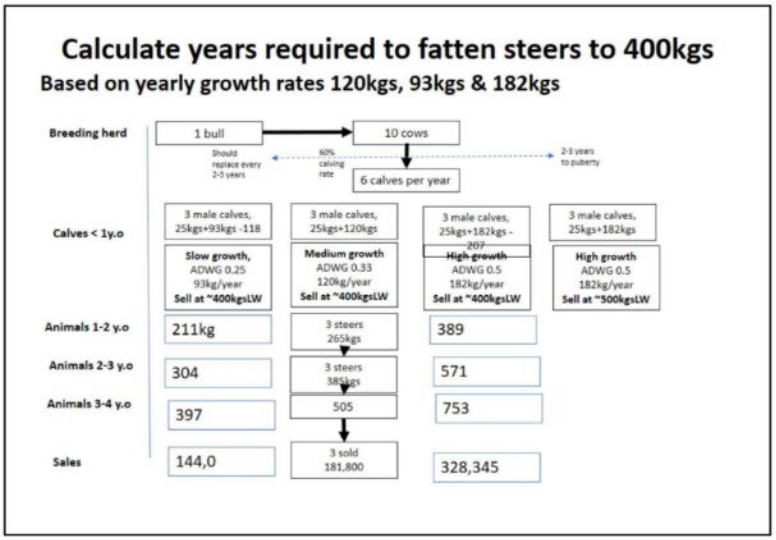
Calculate years required to fatten steers to 400kgs
Based on yearly growth rates 120kgs, 93kgs & 182kgs
Breeding herd
1 bull
10 cows
Should replace every 2-3 years
60% calving rate
2-3 years to puberty
6 calves per year
Calves < 1y.o
3 male calves, 25kgs+93kgs -118
3 male calves, 25kgs+120kgs
3 male calves, 25kgs+182kgs - 207
3 male calves, 25kgs+182kgs
Slow growth, ADWG 0.25 93kg/year Sell at ~400kgsLW
Medium growth ADWG 0.33 120kg/year Sell at ~400kgsLW
High growth ADWG 0.5 182kg/year Sell at ~400kgsLW
High growth ADWG 0.5 182kg/year Sell at ~500kgsLW
Animals 1-2 y.o
211kg
3 steers 265kgs
389
Animals 2-3 y.o
304
3 steers 385kgs
571
Animals 3-4 y.o
397
505
753
Sales
144,0
3 sold 181,800
328,345

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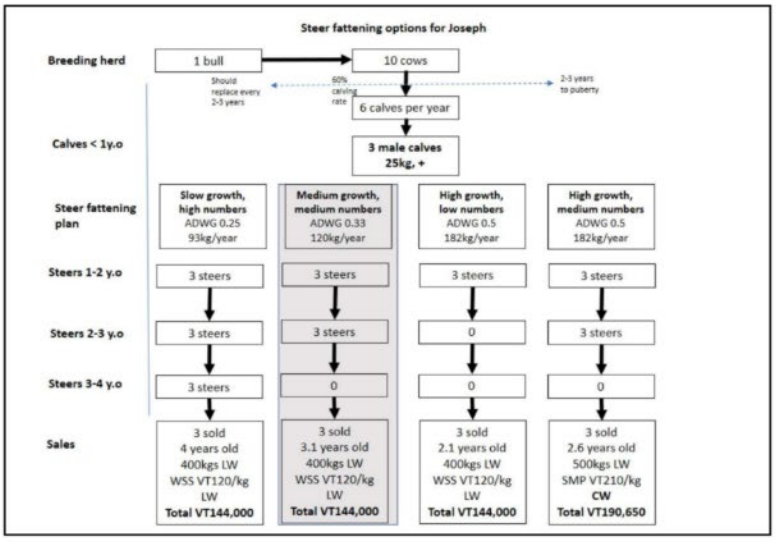
Steer fattening options for Joseph
Breeding herd
1 bull
10 cows
Should replace every 2-3 years
60% calving rate
2-3 years to puberty
6 calves per year
Calves < 1y.o
3 male calves 25kg, +
Steer fattening plan
Slow growth, high numbers ADWG 0.25 93kg/year
Medium growth, medium numbers ADWG 0.33 120kg/year
High growth, low numbers ADWG 0.5 182kg/year
High growth, medium numbers ADWG 0.5 182kg/year
Steers 1-2 y.o
3 steers
3 steers
3 steers
3 steers
Steers 2-3 y.o
3 steers
3 steers
0
3 steers
Steers 3-4 y.o
3 steers
0
0
0
Sales
3 sold 4 years old 400kgs LW WSS VT120/kg LW Total VT144,000
3 sold 3.1 years old 400kgs LW WSS VT120/kg LW Total VT144,000
3 sold 2.1 years old 400kgs LW WSS VT120/kg LW Total VT144,000
3 sold 2.6 years old 500kgs LW SMP VT210/kg CW Total VT190,650

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4. Replacement / culling

When to cull cows

After productivity declines
- Missed a calf
  - Not getting pregnant or miscarriage
- Not producing good calves
- Not keeping up milk to calves or poor mothers

Or before productivity declines
- Body condition
- Age
- Or set number or percentage per year
  - E.g 10%
  - Or 20%

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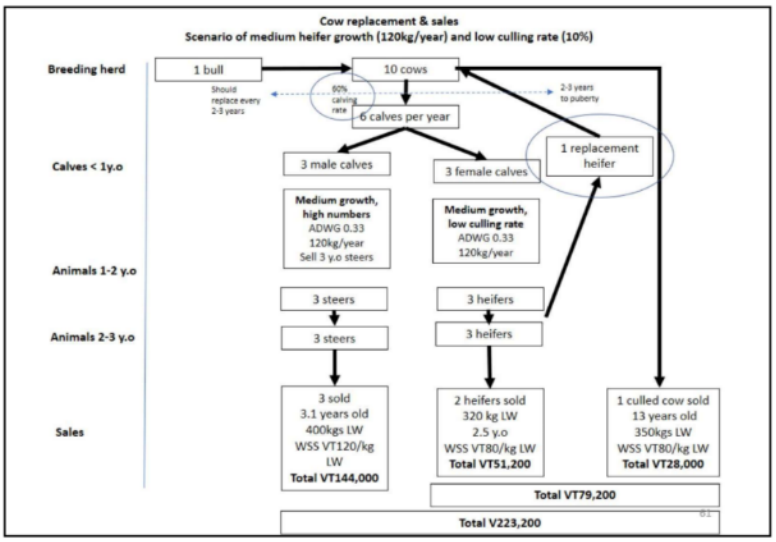
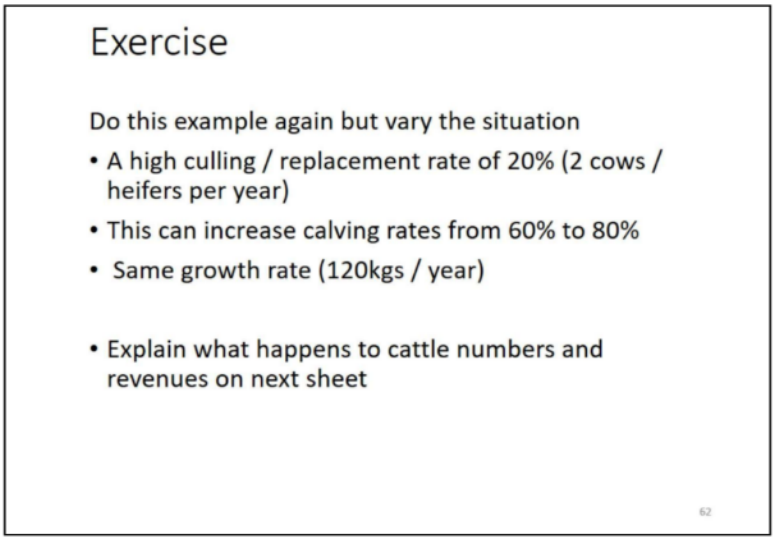
Culling options

Calf 25 kgs															
Heifer growth	93 kgs/year				120kgs/year				93 kgs/year				120kgs/year			
	Heifers		Cows		Heifers		Cows		Heifers		Cows		Heifers		Cows	
Age of female																
1	3				3				3				3			
2	3				3				3				3			
3	3				Sell 2 @ 2.5y.o		1		3				Sell 1 @ 2.5y.o		2	
4	Sell 2 @ 3 y.o		1				1		Sell 1 @ 3 y.o		2				2	
5			1				1				2				2	
6			1				1				2				2	
7			1				1				2				2	
8			1				1				2				Sell 2 @ 7y.o	
9			1				1				Sell 2 @ 8y.o					
10			1				1									
11			1				1									
12			1				1									
13			1				Sell 1 @ 12 y.o									
			Sell 1 @ 13y.o													
Numbers	9		10		6		10		9		10		6		10	
	19				16				19				16			

60


Cow replacement & sales
Scenario of medium heifer growth (120kg/year) and low culling rate (10%)
Breeding herd
1 bull
Should replace every 2-3 years
10 cows
90% calving rate
2-3 years to puberty
6 calves per year
Calves < 1y.o
3 male calves
3 female calves
1 replacement heifer
Medium growth, high numbers
ADWG 0.33
120kg/year
Sell 3 y.o steers
Medium growth, low culling rate
ADWG 0.33
120kg/year
Animals 1-2 y.o
3 steers
3 heifers
Animals 2-3 y.o
3 steers
3 heifers
Sales
3 sold
3.1 years old
400kgs LW
WSS VT120/kg LW
Total VT144,000
2 heifers sold
320 kg LW
2.5 y.o
WSS VT80/kg LW
Total VT51,200
1 culled cow sold
13 years old
350kgs LW
WSS VT80/kg LW
Total VT28,000
Total VT79,200
Total V223,200
61

61


Exercise
Do this example again but vary the situation
• A high culling / replacement rate of 20% (2 cows / heifers per year)
• This can increase calving rates from 60% to 80%
• Same growth rate (120kgs / year)
• Explain what happens to cattle numbers and revenues on next sheet
62

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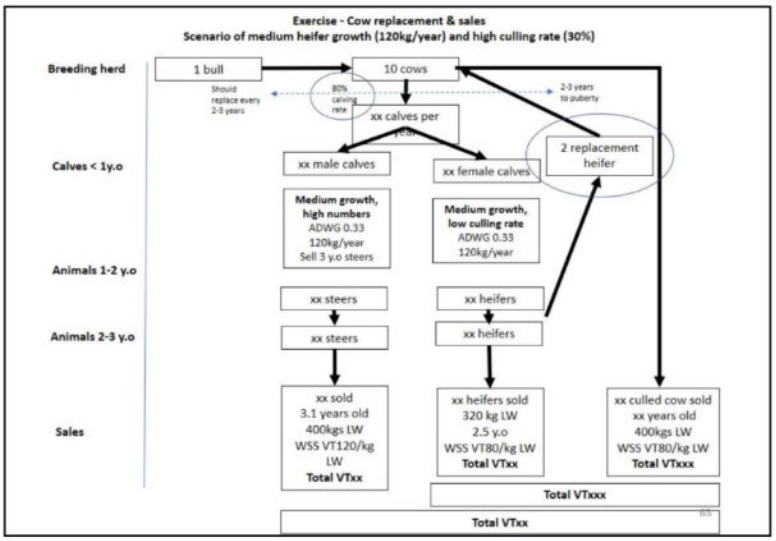
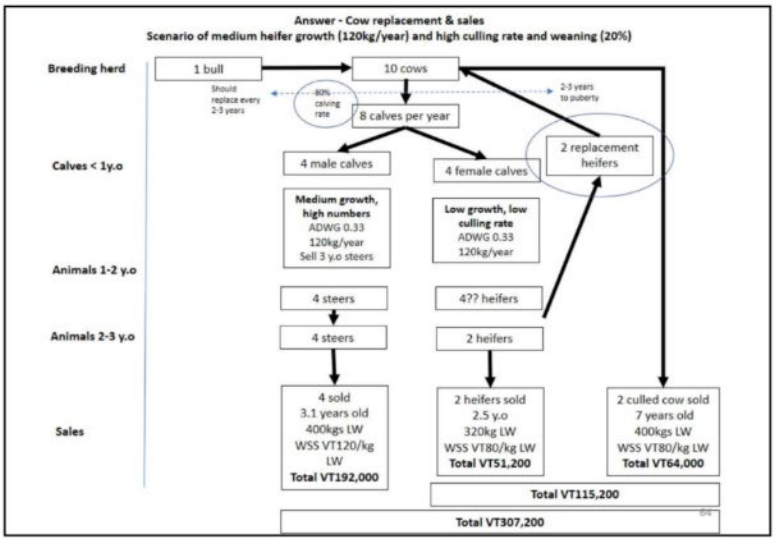

Exercise - Cow replacement & sales
Scenario of medium heifer growth (120kg/year) and high culling rate (30%)
Breeding herd
1 bull
10 cows
Should replace every 2-3 years
80% calving rate
2-3 years to puberty
xx calves per year
Calves < 1y.o
xx male calves
xx female calves
2 replacement heifer
Medium growth, high numbers
ADWG 0.33
120kg/year
Sell 3 y.o steers
Medium growth, low culling rate
ADWG 0.33
120kg/year
Animals 1-2 y.o
xx steers
xx heifers
Animals 2-3 y.o
xx steers
xx heifers
Sales
xx sold
3.1 years old
400kgs LW
WSS VT120/kg LW
Total VTxx
xx heifers sold
320 kg LW
2.5 y.o
WSS VT80/kg LW
Total VTxx
xx culled cow sold
xx years old
400kgs LW
WSS VT80/kg LW
Total VTxxx
Total VTxxx
Total VTxx

63


Answer - Cow replacement & sales
Scenario of medium heifer growth (120kg/year) and high culling rate and weaning (20%)
Breeding herd
1 bull
10 cows
Should replace every 2-3 years
80% calving rate
2-3 years to puberty
8 calves per year
Calves < 1y.o
4 male calves
4 female calves
2 replacement heifers
Medium growth, high numbers
ADWG 0.33
120kg/year
Sell 3 y.o steers
Low growth, low culling rate
ADWG 0.33
120kg/year
Animals 1-2 y.o
4 steers
4?? heifers
Animals 2-3 y.o
4 steers
2 heifers
Sales
4 sold
3.1 years old
400kgs LW
WSS VT120/kg LW
Total VT192,000
2 heifers sold
2.5 y.o
320kg LW
WSS VT80/kg LW
Total VT51,200
2 culled cow sold
7 years old
400kgs LW
WSS VT80/kg LW
Total VT64,000
Total VT115,200
Total VT307,200

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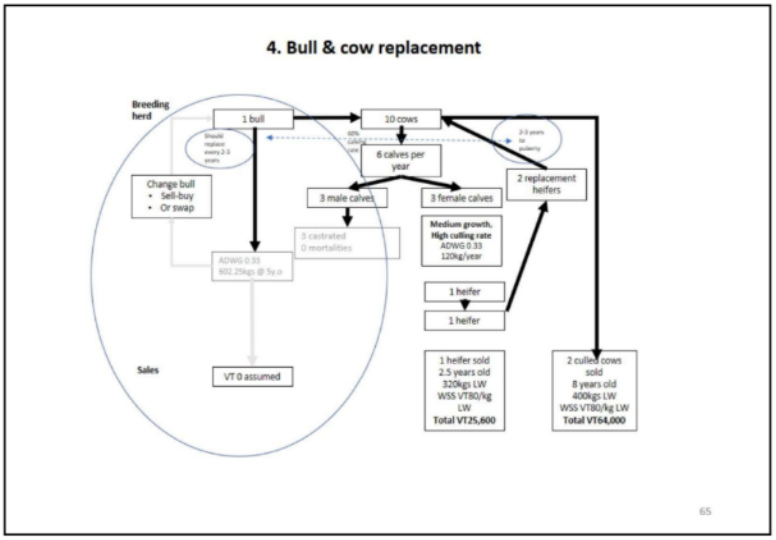
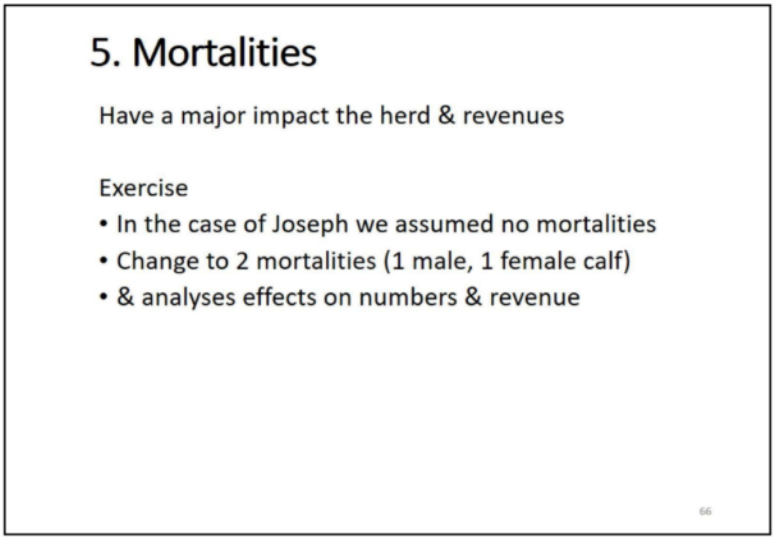
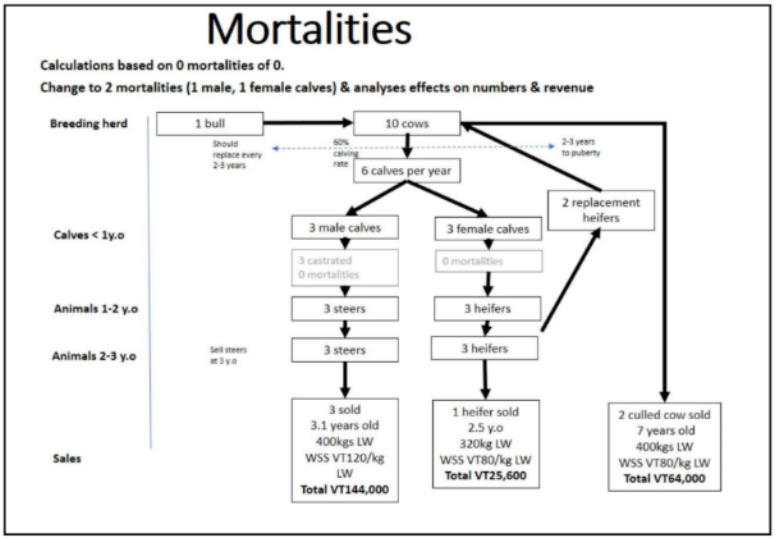

4. Bull & cow replacement
Breeding herd
1 bull
10 cows
6 calves per year
2 replacement heifers
Change bull
• Sell-buy
• Or swap
3 male calves
3 female calves
3 castrated
0 mortalities
Medium growth, High culling rate
ADWG 0.33
120kg/year
1 heifer
1 heifer
ADWG 0.33
602.25kgs @ 5y.o
Sales
VT 0 assumed
1 heifer sold
2.5 years old
320kgs LW
WSS VT80/kg LW
Total VT25,600
2 culled cows sold
8 years old
400kgs LW
WSS VT80/kg LW
Total VT64,000
65

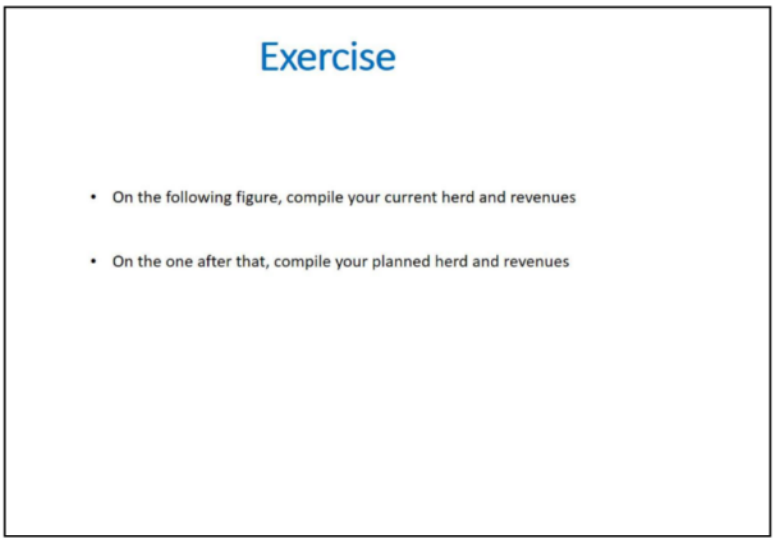
65


5. Mortalities
Have a major impact the herd & revenues
Exercise
• In the case of Joseph we assumed no mortalities
• Change to 2 mortalities (1 male, 1 female calf)
• & analyses effects on numbers & revenue
66

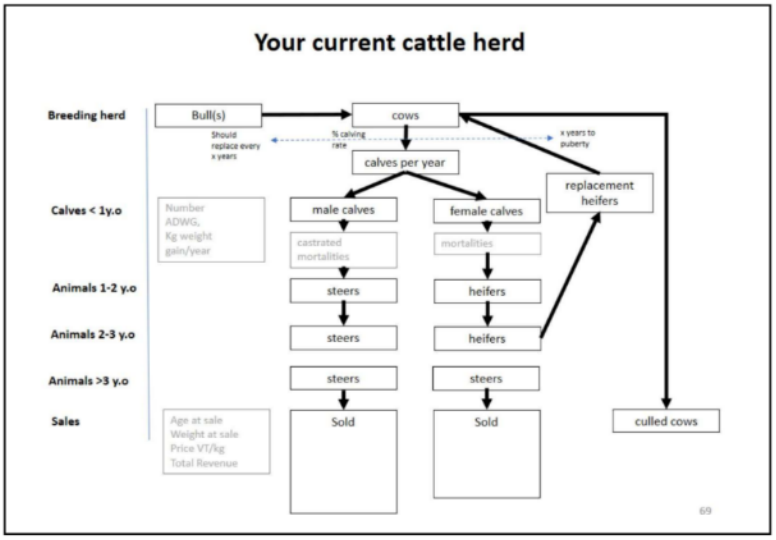
66


Mortalities
Calculations based on 0 mortalities of 0.
Change to 2 mortalities (1 male, 1 female calves) & analyses effects on numbers & revenue
Breeding herd
1 bull
10 cows
Should replace every 2-3 years
60% calving rate
2-3 years to puberty
6 calves per year
2 replacement heifers
Calves < 1y.o
3 male calves
3 female calves
3 castrated
0 mortalities
0 mortalities
Animals 1-2 y.o
3 steers
3 heifers
Animals 2-3 y.o
Sell steers at 3 y.o
3 steers
3 heifers
Sales
3 sold
3.1 years old
400kgs LW
WSS VT120/kg LW
Total VT144,000
1 heifer sold
2.5 y.o
320kg LW
WSS VT80/kg LW
Total VT25,600
2 culled cow sold
7 years old
400kgs LW
WSS VT80/kg LW
Total VT64,000

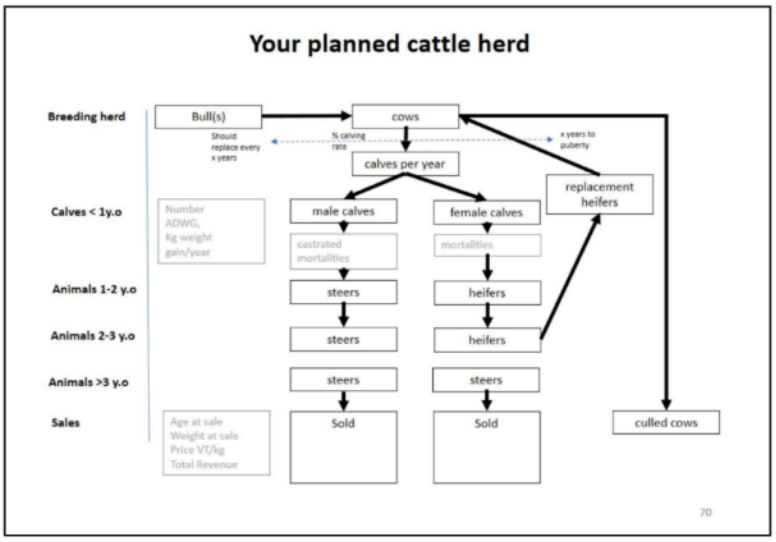
67


Exercise
• On the following figure, compile your current herd and revenues
• On the one after that, compile your planned herd and revenues

68


Your current cattle herd
Breeding herd
Bull(s)
cows
Should replace every x years
% calving rate
x years to puberty
calves per year
replacement heifers
Calves < 1y.o
Number
ADWG,
Kg weight gain/year
male calves
female calves
castrated
mortalities
mortalities
Animals 1-2 y.o
steers
heifers
Animals 2-3 y.o
steers
heifers
Animals >3 y.o
steers
steers
Sales
Age at sale
Weight at sale
Price VT/kg
Total Revenue
Sold
Sold
culled cows
69

69


Your planned cattle herd
Breeding herd
Bull(s)
cows
Should replace every x years
% calving rate
x years to puberty
calves per year
replacement heifers
Calves < 1y.o
Number
ADWG,
Kg weight gain/year
male calves
female calves
castrated
mortalities
mortalities
Animals 1-2 y.o
steers
heifers
Animals 2-3 y.o
steers
heifers
Animals >3 y.o
steers
steers
Sales
Age at sale
Weight at sale
Price VT/kg
Total Revenue
Sold
Sold
culled cows
70

70

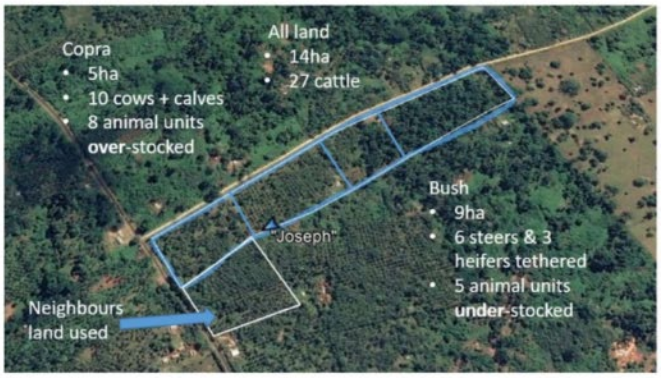
Constraints on production

- Stocking rates
- Costs

71

71

Joseph's under- & over-stocking rates



What should Joseph do in this case?

72

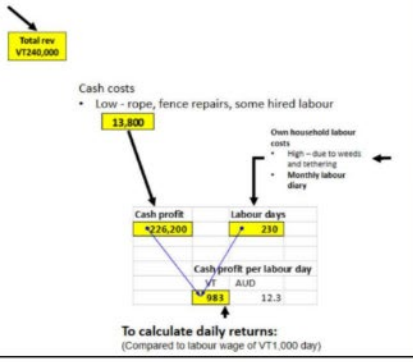
Calculating costs

- Training done in 2018
- But will be done in more detail this year

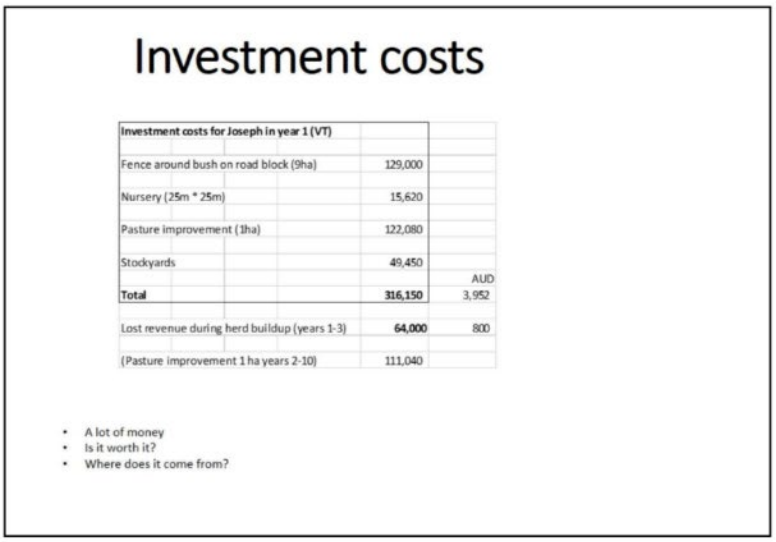
- Costs
  - Variable & operating costs
  - Investment costs

73

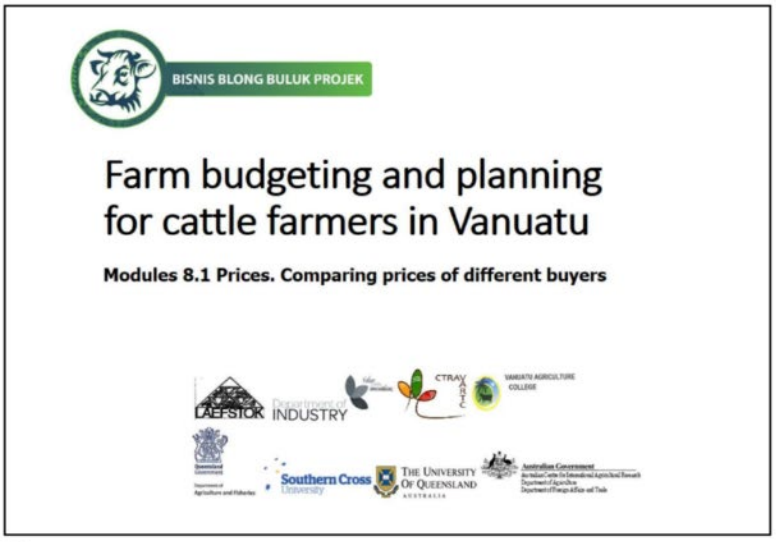
Variable & operating costs



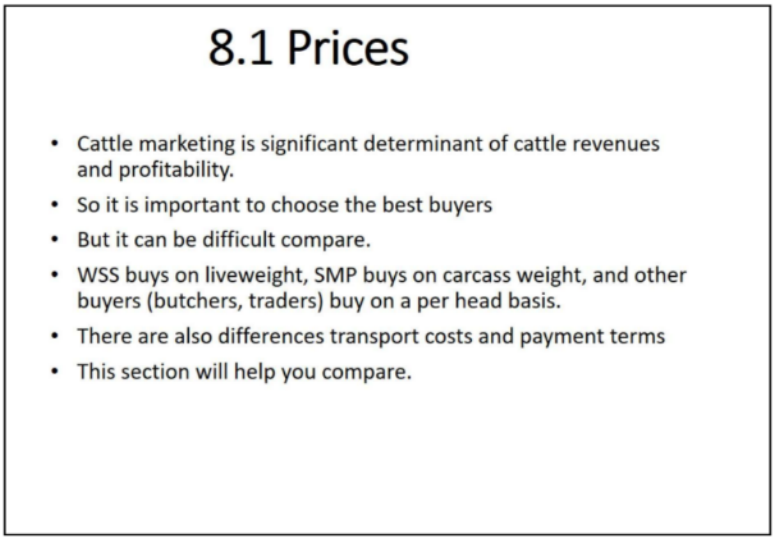
74


Investment costs
Investment costs for Joseph in year 1 (VT)
Fence around bush on road block (9ha) 129,000
Nursery (25m * 25m) 15,620
Pasture improvement (1ha) 122,080
Stockyards 49,450
AUD
Total 316,150 3,952
Lost revenue during herd buildup (years 1-3) 64,000 800
(Pasture improvement 1 ha years 2-10) 111,040
A lot of money
Is it worth it?
Where does it come from?

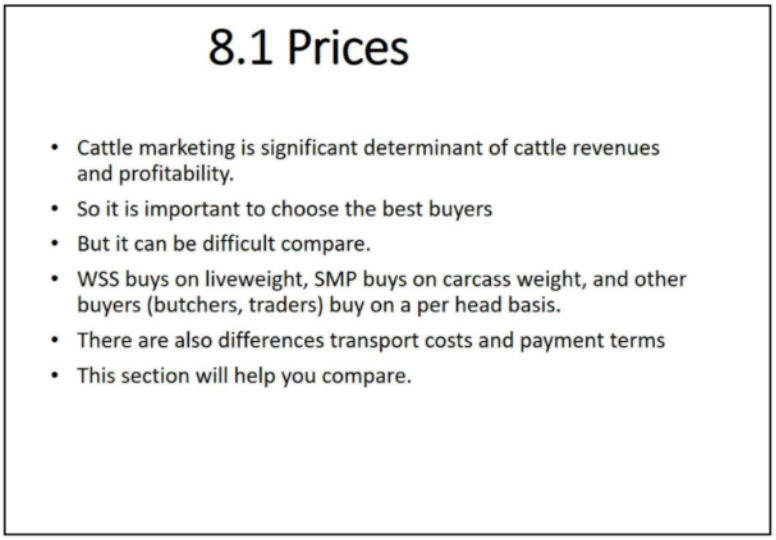
75


BISNIS BLONG BULUK PROJEK
Farm budgeting and planning for cattle farmers in Vanuatu
Modules 8.1 Prices. Comparing prices of different buyers
LAEFSTOK
Department of INDUSTRY
CTRAV
VANUATU AGRICULTURE COLLEGE
Southern Cross University
THE UNIVERSITY OF QUEENSLAND
Australian Government

76


8.1 Prices
• Cattle marketing is significant determinant of cattle revenues and profitability.
• So it is important to choose the best buyers
• But it can be difficult compare.
• WSS buys on liveweight, SMP buys on carcass weight, and other buyers (butchers, traders) buy on a per head basis.
• There are also differences transport costs and payment terms
• This section will help you compare.

77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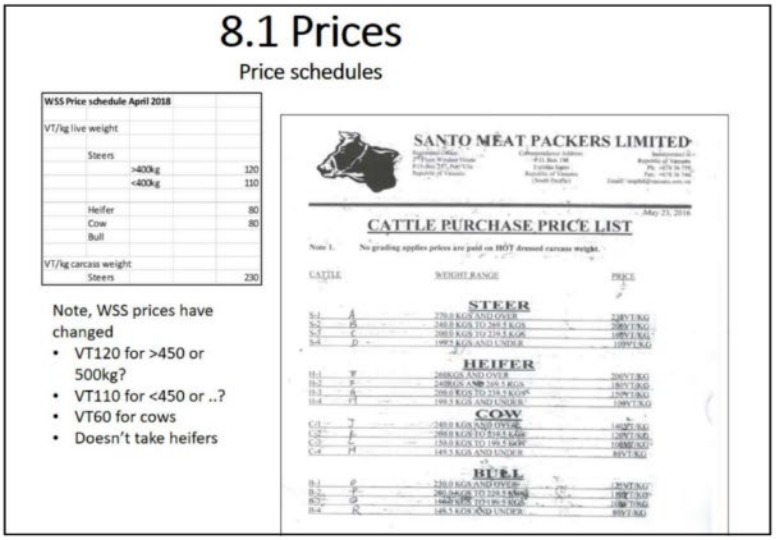
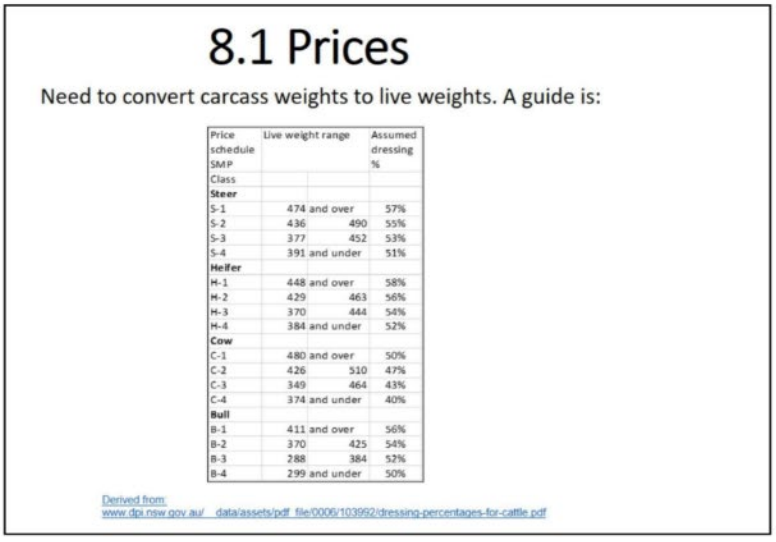
78

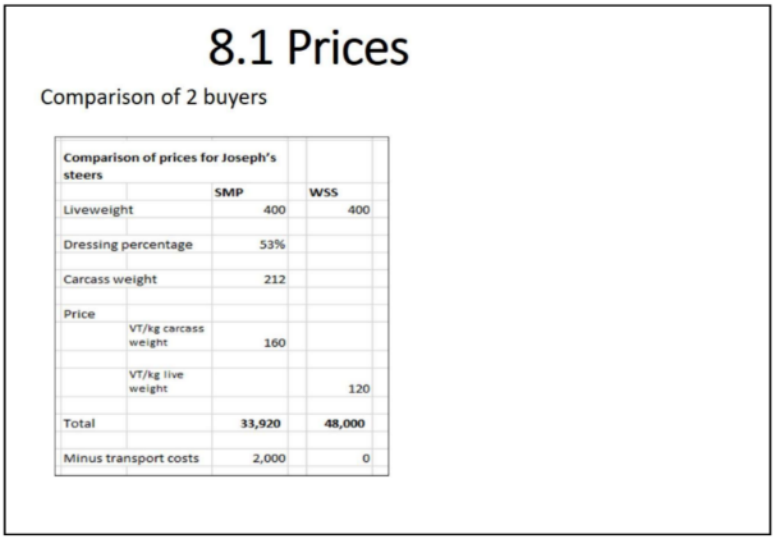


79

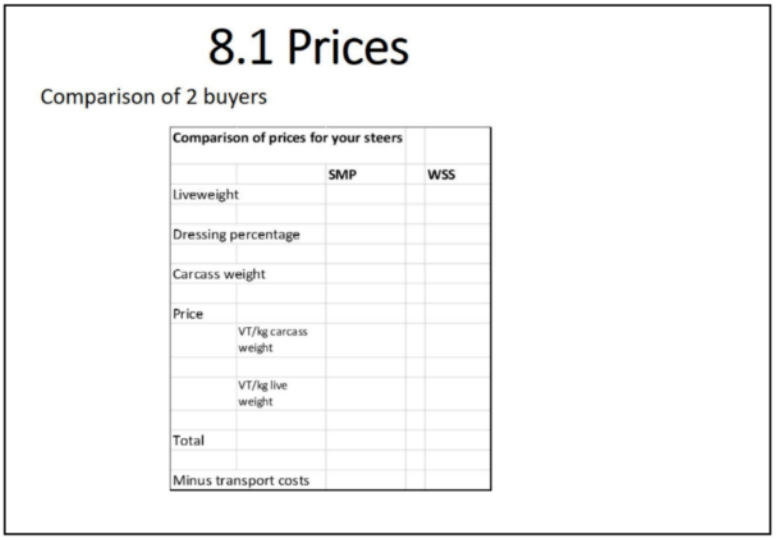


Price schedule SMP	Live weight range		Assumed dressing %
Class			
Steer			
S-1	474	and over	57%
S-2	436	490	55%
S-3	377	452	53%
S-4	391	and under	51%
Heifer			
H-1	448	and over	58%
H-2	429	463	56%
H-3	370	444	54%
H-4	384	and under	52%
Cow			
C-1	480	and over	50%
C-2	426	510	47%
C-3	349	464	43%
C-4	374	and under	40%
Bull			
B-1	411	and over	56%
B-2	370	425	54%
B-3	288	384	52%
B-4	299	and under	50%

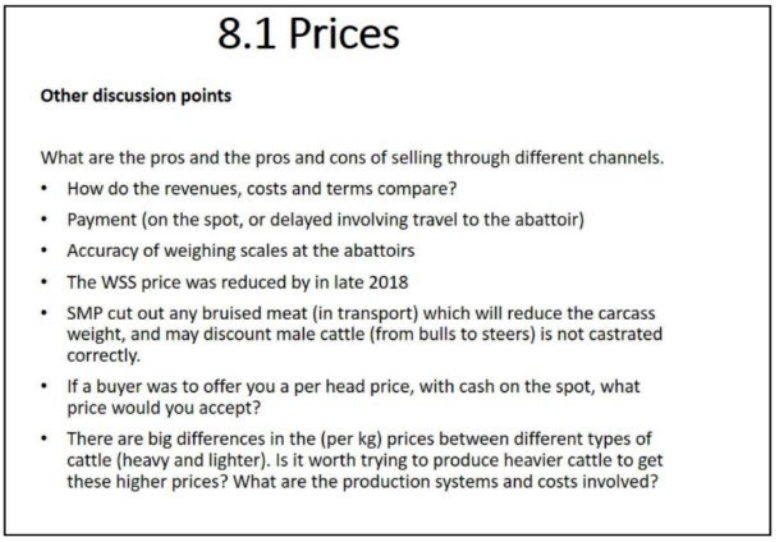
80


8.1 Prices
Comparison of 2 buyers
Comparison of prices for Joseph's steers
SMP
WSS
Liveweight
400
400
Dressing percentage
53%
Carcass weight
212
Price
VT/kg carcass weight
160
VT/kg live weight
120
Total
33,920
48,000
Minus transport costs
2,000
0

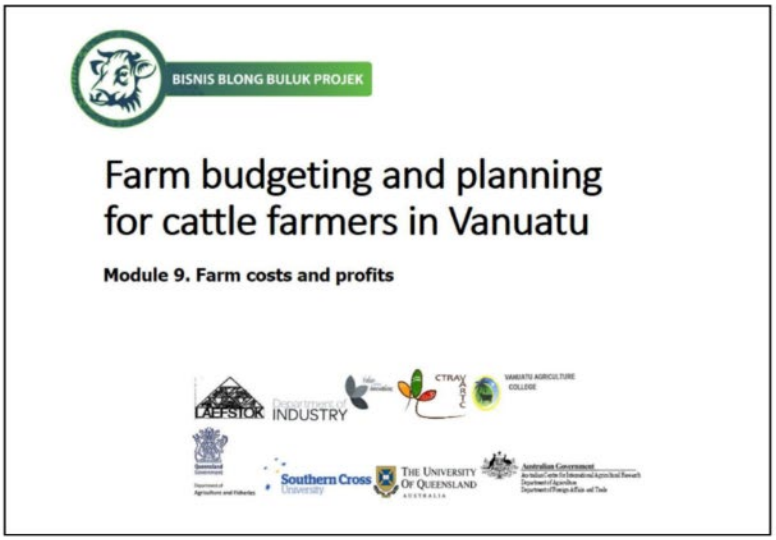
81


8.1 Prices
Comparison of 2 buyers
Comparison of prices for your steers
SMP
WSS
Liveweight
Dressing percentage
Carcass weight
Price
VT/kg carcass weight
VT/kg live weight
Total
Minus transport costs

82


8.1 Prices
Other discussion points
What are the pros and the pros and cons of selling through different channels.
• How do the revenues, costs and terms compare?
• Payment (on the spot, or delayed involving travel to the abattoir)
• Accuracy of weighing scales at the abattoirs
• The WSS price was reduced by in late 2018
• SMP cut out any bruised meat (in transport) which will reduce the carcass weight, and may discount male cattle (from bulls to steers) is not castrated correctly.
• If a buyer was to offer you a per head price, with cash on the spot, what price would you accept?
• There are big differences in the (per kg) prices between different types of cattle (heavy and lighter). Is it worth trying to produce heavier cattle to get these higher prices? What are the production systems and costs involved?

83


BISNIS BLONG BULUK PROJEK
Farm budgeting and planning for cattle farmers in Vanuatu
Module 9. Farm costs and profits
LAEFSTOK
INDUSTRY
CTRAV
Southern Cross University
The University Of Queensland

84

Calculating profits

What do we mean by "profits"?

- Gross profits
- Net profits
- **"Returns to labour"**

To calculate "gross profits":

- Take revenues
- Subtract cash costs

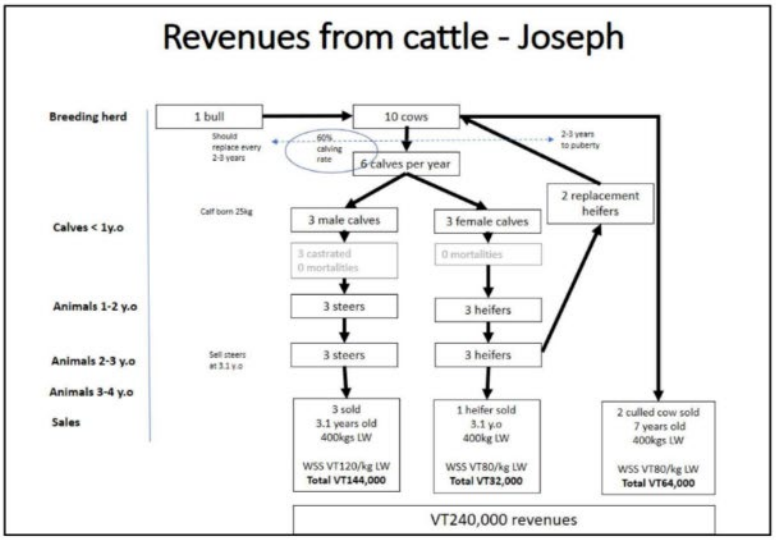
To calculate **"returns to labour"**

- Take "gross profits"
- Divide by labour days

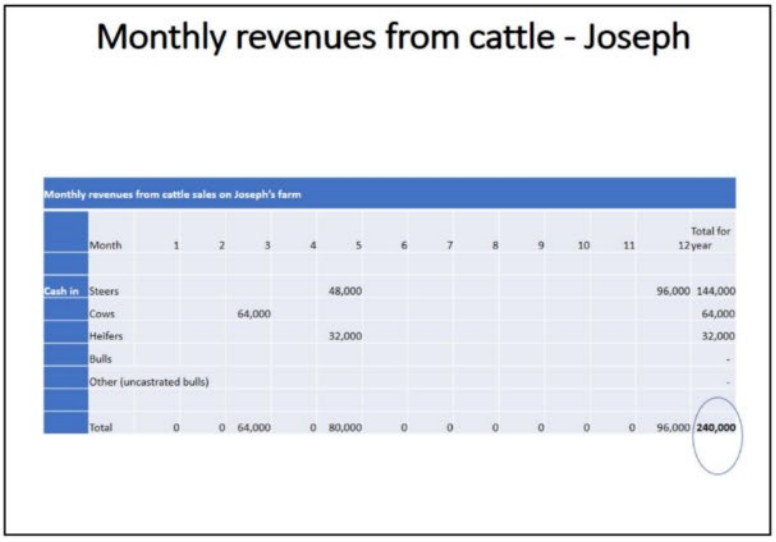
85

"Joseph's" current farm

86



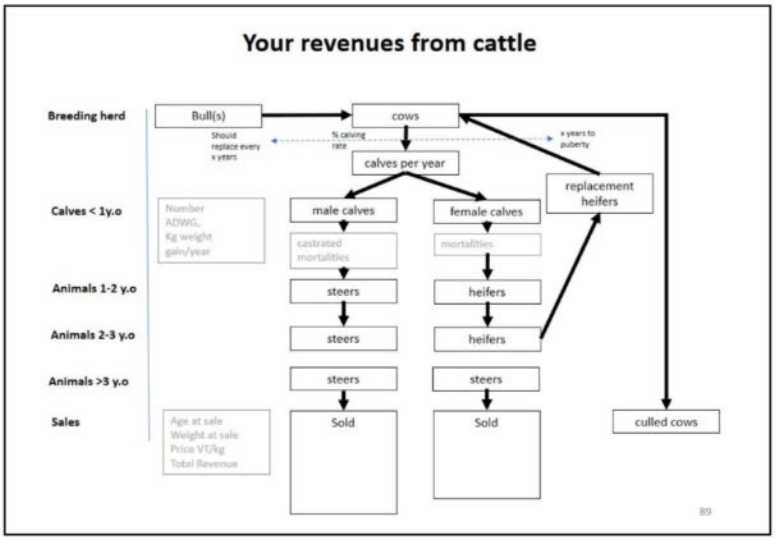
87



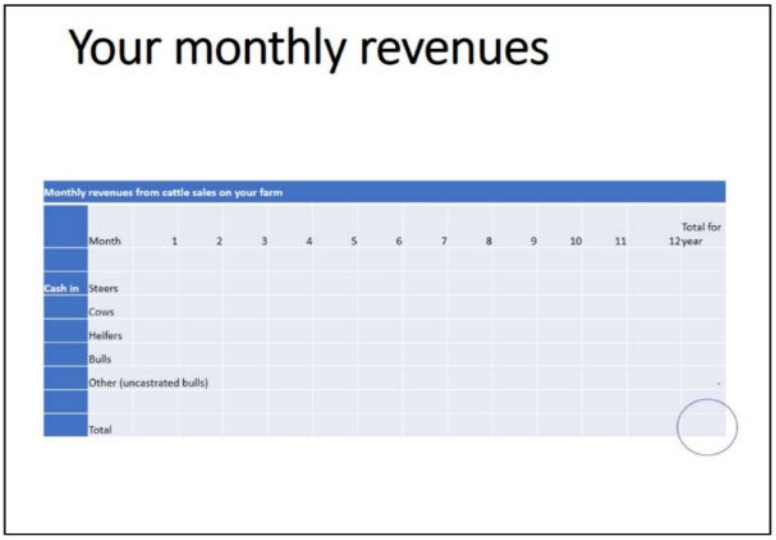
Monthly revenues from cattle sales on Joseph's farm

	Month	1	2	3	4	5	6	7	8	9	10	11	12	Total for year
Cash in	Steers					48,000							96,000	144,000
	Cows			64,000										64,000
	Heifers					32,000								32,000
	Bulls													-
	Other (uncastrated bulls)													-
	Total	0	0	64,000	0	80,000	0	0	0	0	0	0	96,000	**240,000**

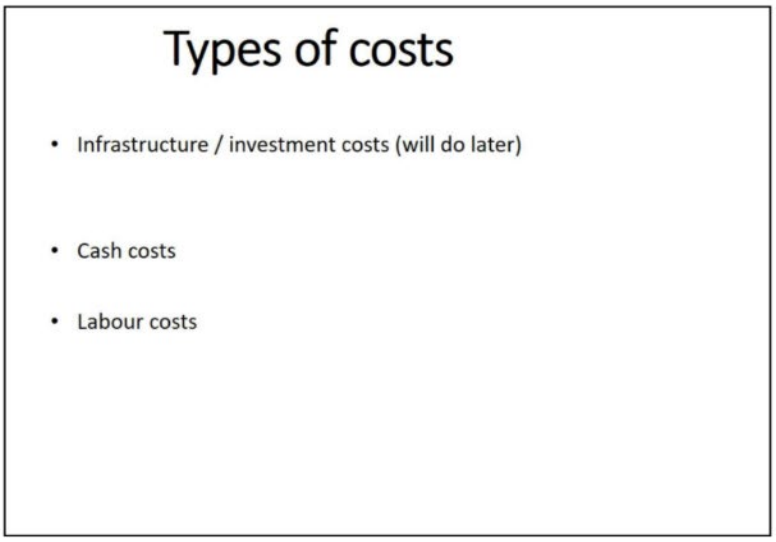
88


Your revenues from cattle
Breeding herd
Bull(s)
cows
Should replace every x years
% calving rate
x years to puberty
calves per year
replacement heifers
Calves < 1y.o
Number
ADWG,
Kg weight gain/year
male calves
female calves
castrated mortalities
mortalities
Animals 1-2 y.o
steers
heifers
Animals 2-3 y.o
steers
heifers
Animals >3 y.o
steers
steers
Sales
Age at sale
Weight at sale
Price VT/kg
Total Revenue
Sold
Sold
culled cows
89

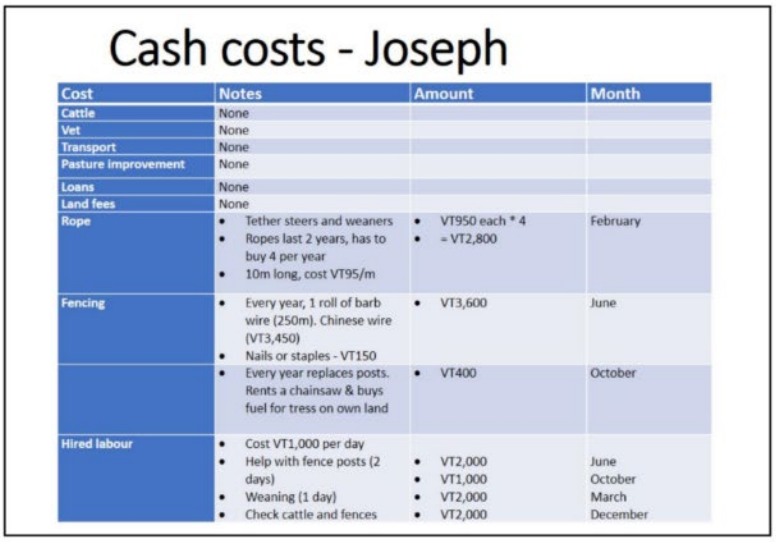
89


Your monthly revenues
Monthly revenues from cattle sales on your farm
Month
1
2
3
4
5
6
7
8
9
10
11
Total for 12year
Cash in
Steers
Cows
Heifers
Bulls
Other (uncastrated bulls)
-
Total

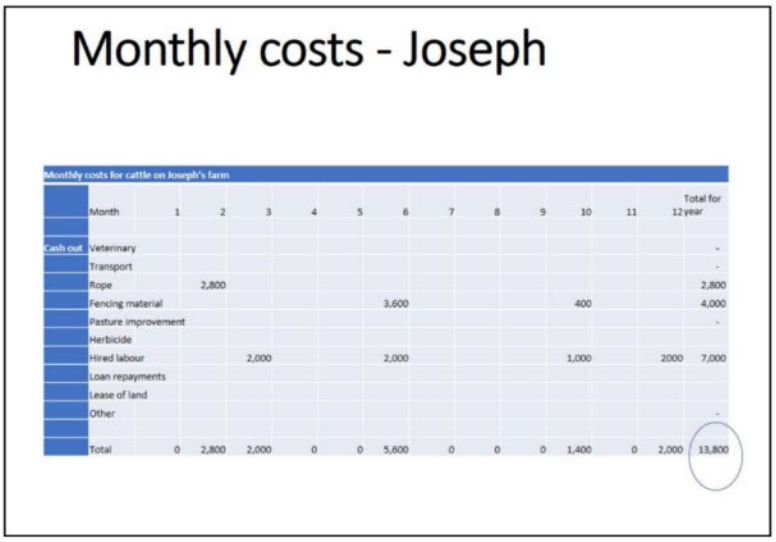
90


Types of costs
• Infrastructure / investment costs (will do later)
• Cash costs
• Labour costs

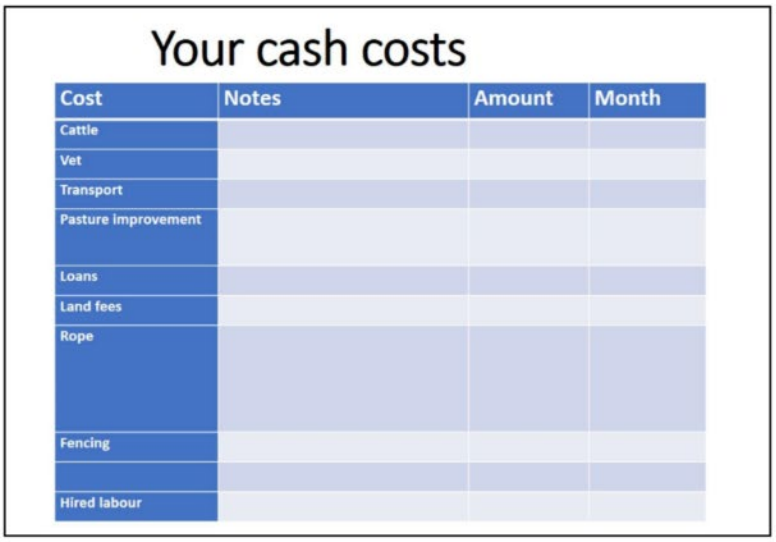
91


Cash costs - Joseph
Cost
Notes
Amount
Month
Cattle
None
Vet
None
Transport
None
Pasture improvement
None
Loans
None
Land fees
None
Rope
Tether steers and weaners
Ropes last 2 years, has to buy 4 per year
10m long, cost VT95/m
VT950 each * 4
= VT2,800
February
Fencing
Every year, 1 roll of barb wire (250m). Chinese wire (VT3,450)
Nails or staples - VT150
VT3,600
June
Every year replaces posts. Rents a chainsaw & buys fuel for tress on own land
VT400
October
Hired labour
Cost VT1,000 per day
Help with fence posts (2 days)
Weaning (1 day)
Check cattle and fences
VT2,000
VT1,000
VT2,000
VT2,000
June
October
March
December

92


Monthly costs - Joseph
Monthly costs for cattle on Joseph's farm
Month 1 2 3 4 5 6 7 8 9 10 11 12 Total for year
Cash out Veterinary -
Transport -
Rope 2,800 2,800
Fencing material 3,600 400 4,000
Pasture improvement -
Herbicide
Hired labour 2,000 2,000 1,000 2000 7,000
Loan repayments
Lease of land
Other -
Total 0 2,800 2,000 0 0 5,600 0 0 0 1,400 0 2,000 13,800

93


Your cash costs
Cost
Notes
Amount
Month
Cattle
Vet
Transport
Pasture improvement
Loans
Land fees
Rope
Fencing
Hired labour

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Your monthly cash costs

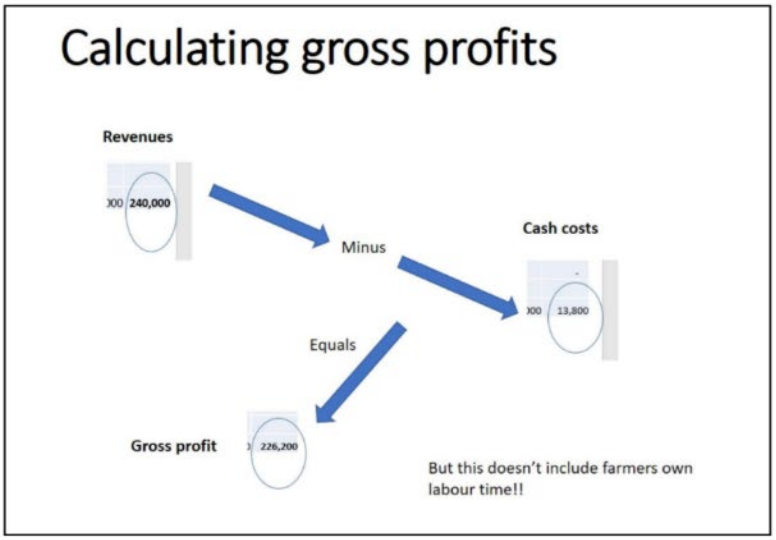
Monthly costs for cattle on your farm													
	Month	1	2	3	4	5	6	7	8	9	10	11	12 Total for year
Cash out	Veterinary												
	Transport												
	Rope												
	Fencing material												
	Pasture improvement												
	Herbicide												
	Hired labour												
	Loan repayments												
	Lease of land												
	Other												
	Total												

95

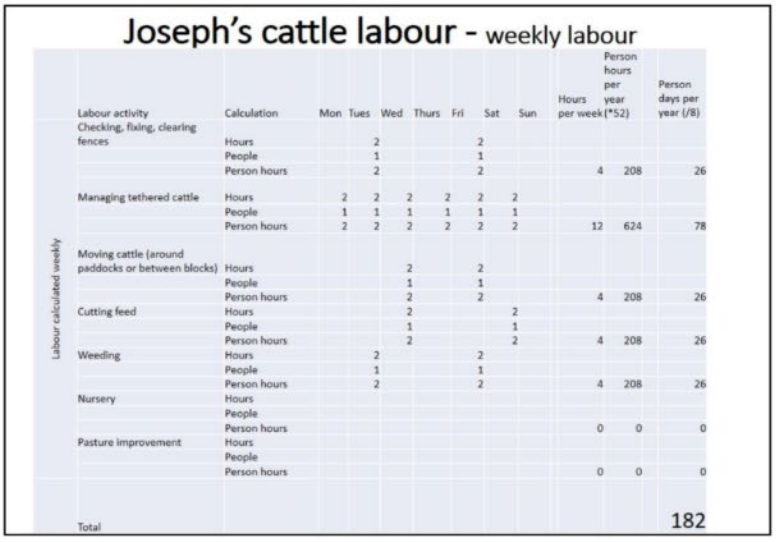
Questions on costs

- Are the cash costs high, medium or low?
- What are the major costs?
- Are there ways to reduce costs?

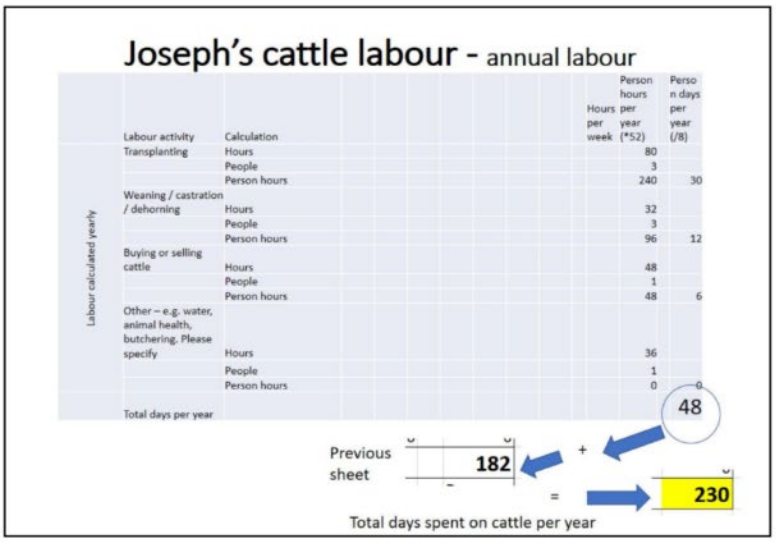
96


Calculating gross profits
Revenues
240,000
Minus
Cash costs
13,800
Equals
Gross profit
226,200
But this doesn't include farmers own labour time!!

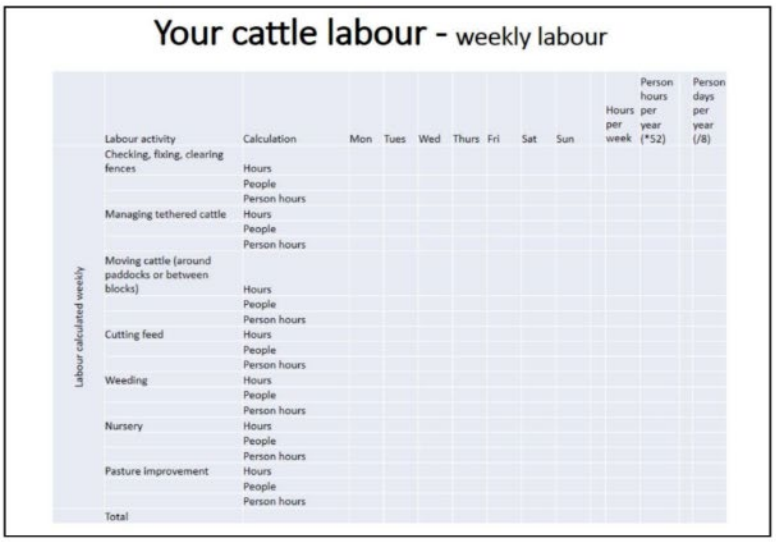
97


Joseph's cattle labour - weekly labour
Labour calculated weekly
Labour activity | Calculation | Mon | Tues | Wed | Thurs | Fri | Sat | Sun | Hours per week | Person hours per year (*52) | Person days per year (/8)
Checking, fixing, clearing fences | Hours | | | 2 | | | 2 | | | | |
People | | | 1 | | | 1 | | | | |
Person hours | | | 2 | | | 2 | | | 4 | 208 | 26
Managing tethered cattle | Hours | 2 | 2 | 2 | 2 | 2 | 2 | | | | |
People | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
Person hours | 2 | 2 | 2 | 2 | 2 | 2 | | 12 | 624 | 78
Moving cattle (around paddocks or between blocks) | Hours | | | 2 | | 2 | | | | | |
People | | | 1 | | 1 | | | | | |
Person hours | | | 2 | | 2 | | | 4 | 208 | 26
Cutting feed | Hours | | | 2 | | | 2 | | | | |
People | | | 1 | | | 1 | | | | |
Person hours | | | 2 | | | 2 | | 4 | 208 | 26
Weeding | Hours | | 2 | | | 2 | | | | | |
People | | 1 | | | 1 | | | | | |
Person hours | | 2 | | | 2 | | | 4 | 208 | 26
Nursery | Hours | | | | | | | | | | |
People | | | | | | | | | | |
Person hours | | | | | | | | 0 | 0 | 0
Pasture improvement | Hours | | | | | | | | | | |
People | | | | | | | | | | |
Person hours | | | | | | | | 0 | 0 | 0
Total
182

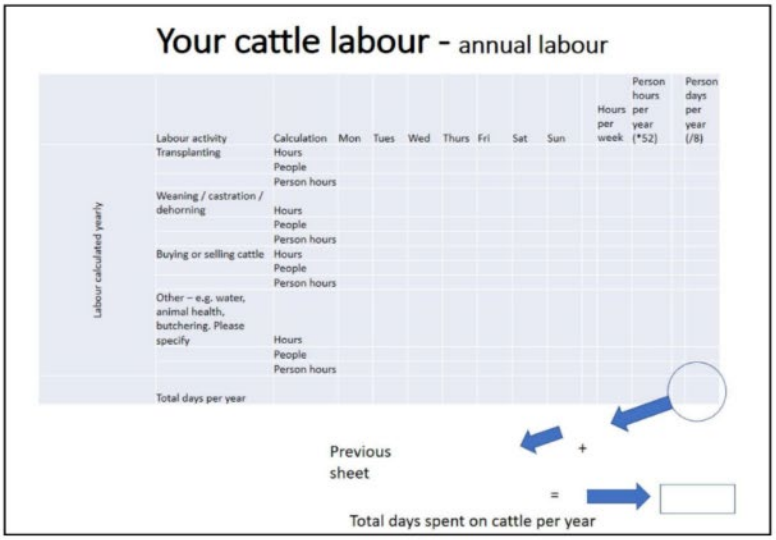
98


Joseph's cattle labour - annual labour
Labour calculated yearly
Labour activity
Calculation
Hours per week
Person hours per year (*52)
Person days per year (/8)
Transplanting
Hours
People
Person hours
240
30
Weaning / castration / dehorning
Hours
People
Person hours
96
12
Buying or selling cattle
Hours
People
Person hours
48
6
Other – e.g. water, animal health, butchering. Please specify
Hours
People
Person hours
Total days per year
48
Previous sheet
182
+
=
230
Total days spent on cattle per year

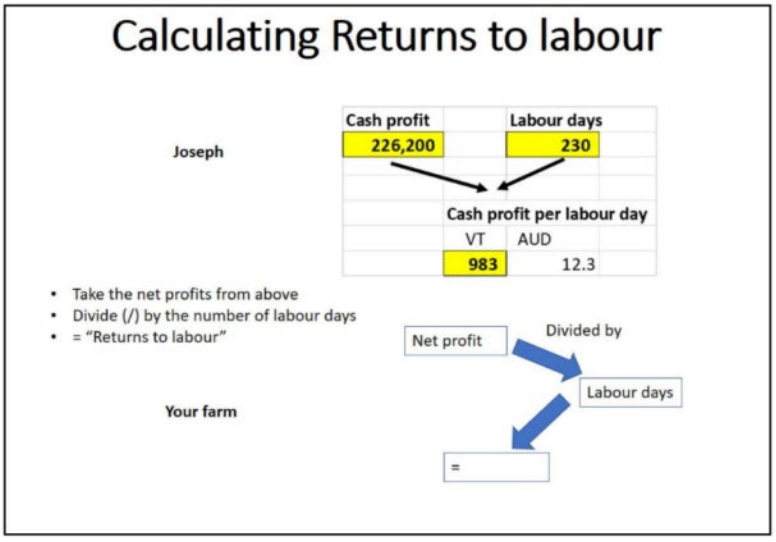
99


Your cattle labour - weekly labour
Labour calculated weekly
Labour activity
Calculation
Mon
Tues
Wed
Thurs
Fri
Sat
Sun
Hours per week
Person hours per year (*52)
Person days per year (/8)
Checking, fixing, clearing fences
Hours
People
Person hours
Managing tethered cattle
Hours
People
Person hours
Moving cattle (around paddocks or between blocks)
Hours
People
Person hours
Cutting feed
Hours
People
Person hours
Weeding
Hours
People
Person hours
Nursery
Hours
People
Person hours
Pasture improvement
Hours
People
Person hours
Total

100


Your cattle labour - annual labour
Labour activity
Calculation
Mon
Tues
Wed
Thurs
Fri
Sat
Sun
Hours per week
Person hours per year (*52)
Person days per year (/8)
Labour calculated yearly
Transplanting
Hours
People
Person hours
Weaning / castration / dehorning
Hours
People
Person hours
Buying or selling cattle
Hours
People
Person hours
Other – e.g. water, animal health, butchering. Please specify
Hours
People
Person hours
Total days per year
Previous sheet
+
=
Total days spent on cattle per year

101


Calculating Returns to labour
Joseph
Cash profit
Labour days
226,200
230
Cash profit per labour day
VT
AUD
983
12.3
Take the net profits from above
Divide (/) by the number of labour days
= "Returns to labour"
Your farm
Net profit
Divided by
Labour days
=

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Your returns to labour

- Is this a lot or not much?
- Were you surprised with the answer?
- How does this compare with other activities? You have to compare the returns, but also how consistent the incomes is
  - The basic wage of off-farm labour is about VT1,000 per day
  - Compared to other activities (e.g. coconuts)
- Do you think there is potential to increase or change these returns?

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Returns to labour - copra

Copra (dry)	Calculations	Sub-totals	Totals
Background information			
Area (ha)	5		
Number of harvests per year	4		
Revenue			
Yield (kg/ha/year dry)	1,700		
Price per kg	40		
Revenue over year			340,000
Variable costs (per harvest over whole area)			
Bags		3,400	
Drying		8,000	
Transport		136,000	
Hired labour (for harvest, dryer, transport)		12,000	
Total costs over year			159,400
Household labour (family, exteneded fmaily, reciprocal) per harvest			
Harvest		80	
Bagging, transport etc.		16	
Other		24	
Total household labour over year			120
Gross returns			180,600
Returns to own labour			1,505

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Infrastructure costs

- In economics, there are usually costed and spread out over the life span of the asset.
- However, here we will just regard these as "upfront" investments.
- That need to be made, especially to upgrade the activity (e.g. cattle).
- Examples include:
  - Fencing
  - Pasture improvement
  - Stock yards
- It is v useful to be able to budget the costs of these on paper
  - To save up
  - To work out if it is worth investing in these

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Fencing

Cash costs to fence 1 hectare square paddock. 100m*100m*100m*100m

Wire		
	Perimeter	400
	Number of wires	4
	Wires required (m)	1,600
	Metres per roll	500
	Number of rolls requ	3.2
	Type	Chinese
	Cost per roll	6,900
Other fence items		
	Posts	0
	Staples	500
	Tie wire	500
	Transport	
	Total cost	**22,080**

Questions:

- If the fence with Chinese wire lasts 8 years, how much does it cost per year?
- If Fijian wire lasts 12 years, and Australian wire lasts 16 years, which is cheap over the long term?
- What is labour is included?

Barbed wire prices - Santo Hardware Mar 2017						
	Chinese wire		Fijian wire		Australian wire	
Metres in roll	250	500	250	500	250	500
Cost	3,450	6,900		14,880		18,300

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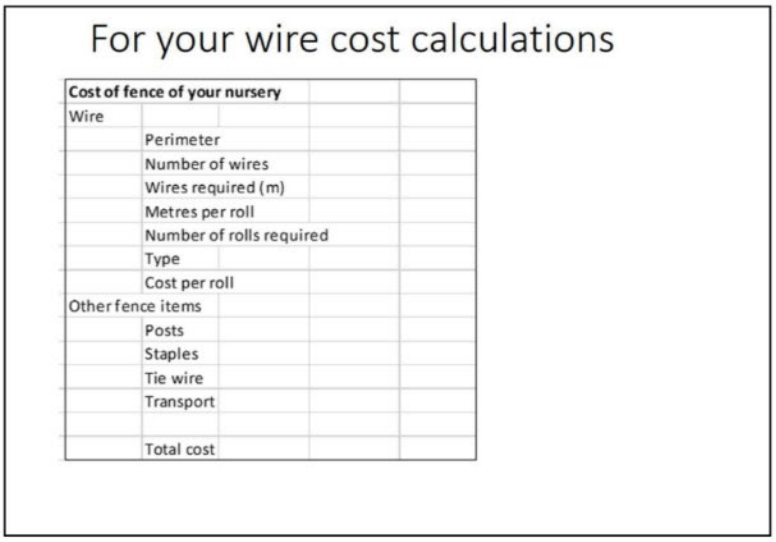
For your wire cost calculations
Cost of fence of your nursery
Wire
Perimeter
Number of wires
Wires required (m)
Metres per roll
Number of rolls required
Type
Cost per roll
Other fence items
Posts
Staples
Tie wire
Transport
Total cost

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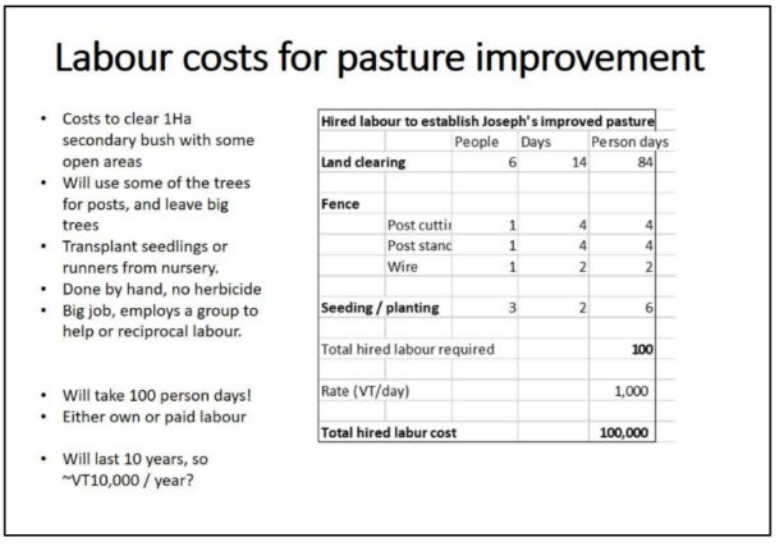
Labour costs for pasture improvement
Costs to clear 1Ha secondary bush with some open areas
Will use some of the trees for posts, and leave big trees
Transplant seedlings or runners from nursery.
Done by hand, no herbicide
Big job, employs a group to help or reciprocal labour.
Will take 100 person days!
Either own or paid labour
Will last 10 years, so ~VT10,000 / year?
Hired labour to establish Joseph's improved pasture
People
Days
Person days
Land clearing 6 14 84
Fence
Post cuttir 1 4 4
Post stanc 1 4 4
Wire 1 2 2
Seeding / planting 3 2 6
Total hired labour required 100
Rate (VT/day) 1,000
Total hired labur cost 100,000

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Labour costs for pasture improvement
- your calculations

Hired labour to establish your improved pasture				
		People	Days	Person da
Land clearing				
Fence				
	Post cutting			
	Post standing			
	Wire			
Seeding / planting				
Total hired labour required				
Rate (VT/day)				
Total hired labur cost				

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Is the investment worth it?

Assume that 1Ha pasture improvement costs **per year** (depreciated)
- VT10,000 in labour
- VT2,000 wire
- Total VT12,000

How much will this 1Ha pasture improvement increase revenues?
- If it increases the stocking rate from 1.5AU/Ha to 2AU/Ha (and extra 0.5AU/Ha).
- Assume weight gain 120kg/year, price VT120/k liveweight

- If weight gain increases from 120 to 170kgs/year (an extra 50kgs)
- If weight gain increases from 120 to 200kgs/year (and extra 80kgs)
- Assume price of VT130/kg (SMP)

Days	365			
	Annual weight gain	Price / kg LW	Revs over year (VT)	Addition over previous
	120	120	14,400.00	
	170	130	22,100.00	7,700.00
	200	130	26,000.00	11,600.00

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Stockyards

Yard budget for Joseph		Sub-total	Totals	Notes
Materials			39,450	
	Posts	-		Cut from own land
	Rails	-		Share arrangement with miller
	Concrete	23,000		Used for race
	Bolts	1,450		
	Transport	10,000		Transport from paddock to yard
	Chainsaw	5,000		Cut timber again in yards
	Other	-		
Labour bought in			10,000	
	Person days	5		
	Rate	2,000		
Total cost			49,450	

Yard budget for your farm		Sub-total	Totals	Notes
Materials			-	
	Posts	-		
	Rails	-		
	Concrete			
	Bolts			
	Transport			
	Chainsaw			
	Other	-		
Labour bought in				
	Person days			
	Rate			
Total cost				

- May last 10 years = just VT5,000 /year
- Hard to put numbers on benefits but include improved management (weaning), transport (injury), reduced time (labour)

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Questions

- Is it worth investing?
  - Return on investment
  - Compared to other investments
- Resources
  - Where would the money come from? (savings, other work)
  - Who would do the work?
  - What would you have to do or give up?
- Will help in planning for the future (next module)

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Appendix 3.4. Agribusiness aspects of the Santo cattle industry

Prepared by: Noel Kalo

A detailed description of the cattle value chain on Santo has been prepared by Noel Kalo. This description is contained within a draft chapter of a thesis for the award of Master of Philosophy at The University of Queensland, supervised by Scott Waldron and Simon Quigley. Due to COVID-19 related impacts on the completion of the research and preparation of the thesis this work will not be completed before July-2021.

Due to copyright issues we are unable to publish the thesis or any sections contained within in the public domain until after the thesis has been examined and approved. The relevant information will be submitted as an Addendum to this Appendix when the thesis has been accepted by The University of Queensland and the award of M. Phil. conferred to Noel Kalo.

Appendix 3.5. Evaluation of BBB farm management training

Prepared by: Noel Kalo and Antoinette Nasse

Four major training sessions on farm management were run over 1-2 days each, with numerous additional and informal sessions. Evaluations were undertaken by participants in two sessions, presented below. The questions are listed in bold type and the answers appear below.

	Business and economic model meeting 26th April 2018: Participants evaluation
Number	**Question 1 Please describe your involvement in today's meeting?**
1	Project Partner Organisation team
2	Government representative
3	Project Partner Organisation team
4	Government representative
5	Government representative
6	Cattle Farmer & Government representative
7	Government representative
8	Bisnis Blong Buluk Project Team
9	Government representative
10	Project Partner Organisation team
	Question 2 What did you like most about business Blong Buluk meeting today
1	I am interested in how we talk about how the stocking rate is going about and how to work on work plan for a long period of time before you are achieving your goal.
2	Getting to know the Project and what work the Project is doing in Vanuatu and what is its purpose or goal.
3	The training today is a sort of refresher and helps us to understand more about helping farmers on well managing their business.
4	Discussion on strategy participant appeared engaged in planning also the discussion on herd expansion
5	Learning more on how to prepare for restocking in a land
6	Very important and good to develop farmer plan on their farms
7	Case Studies and interactions between everyone
8	I like the explanation of the Plot hector planning on board giving more clear understanding on how to develop land
9	Setting the basis for smallholders to start considering cattle farming as a visible Business -Money-making activity
10	Simple calculation plans examples help us understood
	Question 3 What did you like least abou the Bisnis Blong Buluk Meeting Today?
1	I'm like the least of the farm principle of a farm management.
2	I learn many different works inside the Project ie calculating stock rate, Animal unit, Business plan to help improve cattle business industry also small cattle farmer.
3	
4	The plan. How do make a plan before to improve
5	Planning to increase G.33 to G.44 Unit per day for 1 cattle
6	Too limited discussion on each topic

	Business and economic model meeting 26th April 2018: Participants evaluation
7	All good for timing purpose
8	All good
9	Study plan for each day of the training
10	Less practice being done
	Question 4 What would you do differently to improve the business blong Buluk Meeting in the future?
1	Work plans & record keeping monthly bases and see if I am making money or not making money
2	Practicals
3	Having different scenarios & Situation
4	Proper Planning
5	Incorporate Agriculture Activities & livestock Activities in terms of everything short term income and invest in the long-term farming to gain more income.
6	Wider consultation with Stakeholders
7	Presentation of different scenarios, solve common problems on farms, Adding way forward for success
8	Invite small holder farmers as they have real experience in the field
9	
10	Understand the module well and put in simple language to transfer to farmers
	Question 5 After today's meeting & hearing about the Bisnis Blong Buluk Project, do you have any suggestions regarding the approach & implementation of the Bisnis Blong Buluk research Project?
1	All is good
2	To apply more work, help, or training to farmers and also government workers to help building new ideas & knowledge extend through out Vanuatu Islands
3	
4	Maybe a focus farm in 1 or 2 Village implementing some of the strategies discussed
5	my suggestion is to work collaterally with DARD or Agriculture Department to ensure a future planning for clearing a new establish plot for cattle farming is efficiently in terms of income generated from the farm, before cattle can be settle in with pasture improvement.
6	This training has developed proper approach to cattle farmers that will grow sustainability on cattle farming in the rural farmers.
7	All is good, any possibilities for extension to trial out case study for evidence of message to pass to farmers
8	All good am happy with the meeting
9	Planning well taken into structure, each day topics to others
10	All good just more practice on farm business management

	Business Training BBB.11 December 2019
N#	**Q1. Please Describe your involvement in today's meeting?**
1	Project Partner organization team
2	Government Rep
3	Women Farmer
4	Project Partner organizations team
5	BBB Project team
6	Government Representative
7	Cattle farmer & Gov representative
8	Government representatives
9	BBB Project team
10	Project partner organizations
11	BBB Team member
12	Government representative
13	Government representative
	Q2 What did you like most about business blong buluk meeting today?
1	Learn a lot today calculation the gross profits and labour cost
	Gain better understanding and knowledge in helping future farmers calculate their incomes
	and return cost during a sale period. For instance, help farmer understand how much time they spend in the farm to better improve in the future
2	Really help me give me information to manage my farm, learn new things as calculating time (value) spending time
3	I enjoyed the activity today on calculating revenue & calculations on returns to labour activities & liked every session today
4	I like BBB meeting today because I learn something do improve my future farm eg. how to calculate farm lost & profits
5	Farm budgeting and planning for farms
6	Farm budgeting & planning for farms
7	Study sessions all good -really like it
8	Introducing farm budgeting and farm planning for cattle farmers is a new frontier where most efforts and resources needs to go to increase the significance of farm budgeting and planning to farm productivities.
9	What I like most is I have learned new things such as gaining returns to labour
10	learning about how to do calculations in terms of revenue, cash and returns to labour
11	I Like the details and explanation about cost and expenses. I think that it will help me in my personal project not only cattle but other activities. I prefer the way to give us a couple of reading sheets
12	BBB always bring livestock field officer closer to farmers meeting farmers with different farming system that helps improving one another.
13	Farm management process and knowing overall outcome of a farm progress
14	Learn how to work out revenue
15	Calculating profits and revenue
	Q3 What did you like least about the BBB Meeting today?

	Business Training BBB.11 December 2019
1	Informs farmers 1 or 2 weeks earlier before meeting, so all can make it to the meeting venue in time. Thus, no delay dates.
2	
3	All is good all the information was clear it will assist as in our farm management.
4	Profit & income
5	How to calculate profits & revenue & types of cost
6	How to calculate profits & cost
7	Am good everything ok
8	Uncoordinated efforts to organize farmers to attend the training
9	Getting informed about the training on time
10	I like some PowerPoint slide should be in Bislama for more knowledge to farmers
11	All good
12	Budgeting topic. Templet provided
13	Nothing, all is good
14	Training documents are in English and prefer Bislama
15	Make awareness to the farmers and assist them
	Q4 What would you do differently to improve the BBB meeting in the future?
1	Inform farmers earlier before meeting before meeting dates, start meeting in time.
2	Learn to value my time, Labour and planning farm budgeting
3	No comment all is good today study, food & venue ok
4	Nothing
5	To improve I have to improve labour activities that are carried out through the year
6	To improve to have the weekly labour like labour activity
7	I would also dramatize main points in the sessions so farmers can get the idea
8	Improve communications network to deliver smooth meeting workshops chain/process
9	Bring my folder to such training in the future
10	More discussions exchanges in between farmers and everyone
11	I think we need to increase the number of participants in the future in order to produce big quantity of beef in the market according to high demand
12	Having a case study
13	Always good to maintain the kind of working in pairs to resolve problems (farm) and calculations
14	Explanations simple enough in Bislama
15	None
	Q 5 After today's meeting, do you have any suggestions regarding the approach & implementation of the BBB Project?
1	All members should at the training site time as stated in the program. Admin BBB officer should provide registration farm earlier before meeting starts (Attendance)
2	I would like to thank & appreciate what the BBB Research project had done for me as a farmer I gained more experience and knowledge of managing my cattle especially. calculating profits
3	No comment all is good all the information learnt today will assist me in my future farm management.
4	Ok

	Business Training BBB.11 December 2019
5	After today's meeting what I suggested & very helpful to me on how to work out the types of cost, like cash cost, mainly cost and how to returns to labour cost.
6	After today's meeting I suggest is a type of cash and returns cost.
7	No suggestions all is good.
8	A need to complete the beef cattle business training package, Rally resource and efforts to deliver full-funded training on cattle beef business in SANMA and Vanuatu
9	Maybe plan or deliver full training on farm budgeting & planning once pilot phase is over.
10	Nope
11	It's good to convince other farmers in Santo to take part in the BBB Project, translate all notes into Bislama to make easy communications to participants delivery meeting.
12	No all good.
13	All good
14	All good
15	Refresher workshops-improve pasture more awareness assist interested farmers improve breeding stocks

Appendix 3.6. Analysis on the role of cattle in ceremonies in East Santo, Vanuatu

Prepared by: Fynn De Daunton

An Agricultural Science (Honours) student at The University of Queensland, Fynn De Daunton, conducted her major research assignment on the role of cattle in ceremonies in East Santo. The study incorporated fieldwork, surveys, and statistical analysis. The study drew on BBB staff and resources in Santo and was supervised by Scott Waldron and Cherise Addinsall.

Appendix 3.6 presents the thesis in the form it was submitted to the University of Queensland (original without changes or edits).

Undergraduate Thesis 2017

Fynn De Daunton

Primary supervision by Dr Scott Waldron

Secondary supervision by Dr Cherise Addinsall

Case study: The impact of ceremonial cattle use on commercial cattle production in East Santo, Vanuatu

Submitted to the School of Agriculture and Food Sciences for the Bachelor of Agricultural Sciences degree (Honours)

Submitted on the 27th of October 2017

Declaration of originality

The following thesis is the original work of the author, except where it is acknowledged. The work that is presented in this thesis has not been submitted previously for this degree, at this or any other institutions.

Acknowledgements

I wish to acknowledge and sincerely thank the following people for their contributions. Dr Scott Waldron for his principal supervision, support and guidance. Dr Cherise Addinsall for her secondary supervision and support during my interview process in Vanuatu. The Crawford Fund for financially supporting this project. Antoinette Nasse and the project team from *LPS-2014-037* for taking care of me and helping to organise interviews during my trip to Vanuatu. Friends and family for their support, especially during the last few months of writing.

Abstract

In Vanuatu, ceremonial activities involve major contributions from community members. In East Santo, cattle are a major economic activity and feature in all ceremonies. While it is known that cattle play an important role in ceremonies, in addition to their economic significance, the details of these ceremonies and the impact of this on the commercial market remained largely unknown. As a first step in filling this knowledge gap, this study aims to provide insights into the use of cattle in ceremonies in rural and urban areas of North East Espiritu Santo, Vanuatu. Six key research questions were developed to achieve this. This project used a mixed methods approach over two key sections and involves both qualitative and quantitative data collection and analysis.

The first section summarises the findings of semi-structured interviews conducted in Vanuatu using a semi-structured interview format. These interviews focused on detailing ceremonial activities and the motivations and attitudes of community members. These interviews revealed several key findings regarding ceremonial activities in East Santo. Firstly, it was revealed that funerals and weddings are the most important ceremonies, with the number and type of cattle used for both highly variable depending on region and circumstance. Secondly, that the proportion of cattle used for ceremonial activities is highly variable. When it comes to community involvement, younger generations are generally less involved in ceremonial activities than older generations, with this often attributed to an increased emphasis on commercial production. Interview responses also indicated that in some areas, the nature of ceremonies will change in the future, due in part to increased focus on the market.

The second stage of data analysis estimates the magnitudes of how many cattle are entering the ceremonial market, the rough proportions of the total herd and sales, and consider how this will change in the future with population growth and the changing nature of ceremonies. This model ultimately showed that even with conservative estimates for cattle use in ceremonies, a large number and proportion of cattle are entering the ceremonial channel. This research project highlights ceremonial cattle use in East Santo has an impact on the commercial market to some extent. While this perceived impact varies depending on region and circumstance, increasing population and the changing nature of ceremonies will likely further impact on this relationship.

Introduction

Background

Ceremonies are an important part of social and economic life in many developing countries. The celebration of personal, community, national and religious occasion creates and maintains social bonds and can play a role in the distribution of commodities. Ceremonies require a significant input from the community, particularly in terms of time but also materials, especially food giving, cooking, and eating which is central to all ceremonies.

These factors play out in Vanuatu, where traditional and introduced ceremonies involve major contributions from all members of clans and communities. Food inputs include root crops, kava and pigs. In Northeast Santo, where this study is conducted, cattle are a major economic activity interwoven into household life, and cattle feature in all ceremonies in the region.

The use of cattle in ceremonies is therefore likely to have a significant impact on a range of social and policy issues, including rural livelihoods, cattle production systems, the national herd and food security/price considerations, the availability of cattle on the non-ceremonial (commercial) market and therefore industry. However, the nature and extent of this impact is largely unknown. Most discussions on these issues are based on assumptions and anecdotes, and not documented.

A recent study (NZMFAT, 2017), surveyed households on cattle production and turnoff, including for ceremonies, but little detail on the ceremonies was provided. As a first step in filling this knowledge gap, this study aims to provide insights into the use of cattle in ceremonies in rural and urban areas of North East Espiritu Santo, Vanuatu. The island of Espiritu Santo is commonly shortened to Santo, and will be referred to as Santo throughout this thesis report.

Research objectives and questions

The overall aim of the research project is to improve understanding of the use of cattle for ceremonies in East Santo Area Council, Vanuatu. The following research questions were developed to achieve this:

- What are the cattle holdings of households in the region and what is the role of cattle in household livelihoods?
- What are the ceremonies celebrated in the region and what inputs are used?
- What are the numbers, types and sources of cattle used in these ceremonies?
- What proportions of overall turnoff are used for ceremonies, and what is the impact / diversion from non-ceremony (market) sales?
- What are attitudes to ceremonies in the community, by younger generations, and how might they change into the future?
- What is the perspective of policy makers on the use of cattle in ceremonies?

These key research questions were used to guide the development of more specific interview questions for interviewees (see Appendix 1).

Method overview

This research used a mixed methods approach, with two key sections of data collection and analysis. This report summarises the findings of semi-structured interviews conducted in Vanuatu using a semi-structured interview format. It also uses demographic information to model the number and proportions of total cattle and annual turn off entering the ceremonial market. This model also extrapolates data to estimate figures for 2030.

Literature Review

Introduction

The demand for livestock products is predicted to double by 2050, with livestock production a key aspect of global food security (Rojas-Downing, 2017). Climate change and population growth both place significant stress on livestock production systems (Rojas-Downing, 2017). Despite conducive market conditions, cattle production in Vanuatu has decreased over the last 10 years, especially in the smallholder sector (Quigley & Waldron 2015). In response to this, the project *Increasing the productivity and market options of smallholder beef cattle farmers in Vanuatu (LPS-2014-037)* has been developed. The collaborative project is funded by the Australian Centre for International Agricultural Research (ACIAR) and involves the government of Vanuatu (Department of Industry and Department of Livestock), agricultural research and training units in Vanuatu (Vanuatu Agricultural College and the Vanuatu Agricultural Research and Training Centre) and Australian universities (the University of Queensland and Southern Cross University and the ACIAR.

This research project falls under this much larger project, with the primary research question of "what is the impact of ceremonial processes on the beef cattle market in Vanuatu?" While it is understood that traditional ceremonies and rituals have a significant impact on the production and sale of beef, the full extent and impacts are not well known.

This literature review collates and analyses information from various sources. It is worth highlighting from the outset that this review found limited relevant literature on the use of commodities for ceremonies. As a result, this literature review mainly provides a context on Vanuatu including the economy, agricultural production, cattle production, food security, the religious context, environmental vulnerability and gender roles. However, two case studies on ceremonial activities are overviewed for Timor-Leste and Ambrym Island in Vanuatu, which are relevant to the ceremonial processes analysed in this research project.

This research project will involve a trip to Santo, Vanuatu in June 2017 for primary data collection. This data collection will be in the form of semi-structured interviews. These interviews will focus on ceremonial cattle use in different communities, with participants primarily farmers from villages throughout Santo. Members of the government and the ACIAR project LPS-2014-037 project staff will also be interviewed.

Background on Vanuatu

Climate

Vanuatu is situated in the southwest Pacific, approximately 800km west of Fiji. Mean temperature, rainfall and humidity generally decreases between the northern and southern areas of the country (FAO 2003).

Vanuatu has two distinct seasons. A warm, wet season from November to April, and a cool, dry season from May to October (VMGHD 2011). Vanuatu's climatic conditions are generally highly variable (VMGHD 2011). Rainfall in Vanuatu is largely dependent on the South Pacific Convergence Zone (SPCZ) (VMGHD 2011; Cai et al 2012). The SPCZ is the most expansive persistent rain band in the Southern Hemisphere, stretching from the western Pacific Ocean to French Polynesia (Cai et al 2012). As the SPCZ intensifies and moves south, it brings higher levels of rainfall to Vanuatu.

Tropical cyclones are common in Vanuatu, affecting the country between November and April. Between 1969 and 2010 (a 41 year period), 94 cyclones have passed within 400 km of Port Vila. This averages as two or three cyclones annually, however, this generally varies greatly (VMGHD 2011).

Background information

The nation of Vanuatu is comprised of 83 islands, 65 of which are inhabited (Craven, 2015). Land area of the country is approximately 12 190 km^2 (FAO 2015) with the country divided into the six administrative providences of: Torba, SANMA, Penama, Malampa, Shefa and

Tafea (Census Report 2009). Santo is the largest of these islands, and is located in SANMA province (Census Report 2009). The total population of the country is approximately 240,000 – 270,000 (US Department of State 2015) and is distributed unevenly between inhabited islands, with a majority living in rural communities. Approximately 50% of the population live on three islands. (FAO 2003; Aregheore, Steglar & Ng'ambi 2006). The population of Santo was approximately 40 000 as of 2009, with population growth of 2.4% annually (2009 Census).

Most islands have mountainous terrain, and a majority of the country's population reside in coastal regions. Humans have been settled in Vanuatu for thousands of years, with migration from many surrounding areas creating one of the most culturally diverse countries in the world (Vanuatu Cultural Centre 2017). This diversity is evident in the 113 languages spoken, with the dominant language being Bislama (Vanuatu Cultural Centre 2017).

Due to the isolation of different islands, many populations have evolved unique social structures and customs. This poses a difficulty when considering significant ceremonial processes affecting cattle production in the country, as ceremonial processes are highly varied in different regions on and within different islands. Despite this variation, one consistency across all regions within Vanuatu is the prominence of ritual events that characterise the life of an individual. Milestones are commonly celebrated with family and friends, including births, marriages, deaths and personal achievements (Vanuatu Cultural Centre 2017).

The country gained independence in 1980 from joint French and British rule (Richmond & Sovacool, 2012). In comparison to other Pacific Island nations, the constitution of Vanuatu focuses more on customary land ownership, with all freehold land ownership abolished in 1980 after the country became independent (Ward et al. 1995). Vanuatu is the only Melanesian country that "dissolved the colonial dualism of customary and alienated lands" (Richmond & Sovacool, 2012), with all land ownership right's returned to custom owners. In this case, custom owners are defined as 'indigenous individuals or groups whose ownership claims are based on customary principles and practices' (Ward et al 1995). This affected both European landholders and community leaders as there were cases where both had gained control of land that did not traditionally belong to them (Anderson & Lee 2010). Vanuatu has one of the lowest social indicator rankings in the Pacific (Bowan et al. 2009). 80% of the population do not have access to electricity, and as of 2006, approximately half of the population live below the poverty line (Henckel 2006).

Economy

The largest contributor to Gross Domestic Product (GDP) is tourism, followed by agriculture (Richmond & Sovacool 2012). Agriculture represents 20% of GDP, with small-scale agriculture responsible for the livelihood of 80% of the population (Richmond & Sovacool 2012; Vanuatu Financial Services Commission 2016). Vanuatu is one of few remaining countries in the world where the traditional economy provides for livelihoods more than the cash economy does (Regenvanu 2010). Nearly 100% of exports are agricultural commodities such as copra and beef (Richmond & Sovacool 2012). A majority of government efforts to stimulate the economy focus on the private sector (Bowan et al 2009). The formal economy is primarily located in Port Vila, Vanuatu's capital city.

Many islands are isolated from major markets, particularly agricultural markets. Access to credit and financial support is also very limited, particularly in rural areas (Connell 2010). These are significant barriers to development in many cases, often characterised as 'poverty of opportunity' (Craven 2015). However, many of these communities have achieved 'subsistence affluence', which doesn't fit into many Western models of development, but is not necessarily a state of under development (Bowan et al 2009).

There are many limitations and challenges associated with running a small business in Vanuatu, four of which will be elaborated upon in this section (Mitchell 2014). The first is the remoteness and isolation, both of the islands from global markets, and islands from one another (Bowan et al. 2009). The second is vulnerability to global markets and the

fluctuations that come with this (Bowan et al. 2009). The third is vulnerability to environmental events and natural disasters that occur relatively frequently in the region (Bowan et al. 2009). The fourth is the small size of domestic markets and the limited diversification that comes with this (Bowan et al. 2015).

The gradual shift towards a market-based economy has increased migration between islands, as on-island employment opportunities are limited for many communities (Craven 2015). This can be a damaging trend when migration is not coupled with economic diversification, as it does not create on-island jobs and can be a short-term solution to a larger issue of economic limitations (Craven 2015). As a result of these forces, the ceremonies, traditions and beliefs of a culture have a significant impact on the livelihood of communities in Vanuatu (Tao et al 2010).

Understanding the economic context of Vanuatu was important prior to conducting fieldwork for this research project, as this is the system in which these ceremonial processes are operating within. In many cases, the cattle used for ceremonies are being channelled out of the formal market economy.

Agricultural production

Soil fertility in Vanuatu is high, with one third of cultivatable land currently utilised and a high potential for agricultural expansion (IMF 2013). Production of major commodities has significantly declined in recent years, with this attributed to a combination of external and internal factors (Craven 2015). Subsistence agriculture is the most prominent form of production (Ratuva 2010). Approximately 80% of the Ni-Vanuatu population of working age cultivate land (Aregheore, Steglar & Ng'ambi, 2006).

Vanuatu joined the Food and Agriculture Organisation (FAO) in 1983 (FAO 2015), with cooperation focusing primarily on collecting data, increasing local food production capacity, strengthening market linkages and increasing resistance to climate change (FAO, 2015). A significant contribution from the FAO comes in the form of aid work and response to natural disasters. After cyclone Pam in 2015, the FAO provided technical assistance and supplies to help 48 000 people resume agricultural activities (FAO 2015).

There are multiple frameworks and projects in place targeting the agricultural sector of the country, generally with the aim of increasing production and food security. Examples of these projects include the *2013-2017 Country Programming Framework (CPF) for the Pacific Subregion* and the *Overarching Productivity Sector Policy 2012-2017.* Research focus areas are currently improving pastures to be more adaptable and resilient to the impending impacts of climate change (FAO 2015).

Rural agricultural development has been largely neglected, even though rural farmers have been identified as a vulnerable group. Many rural extension services had been discontinued, with a recent push for increasing the prominence of these services in rural areas once again (FAO 2015). Access to credit is again a significant limitation. Similarly to many other issues, legislation review has been identified as a key factor in improving this situation.

The agricultural sector is already being heavily influenced by climate change, and the severity of this influence will increase in the future (Mitchell 2014). In terms of research and development, livestock species that are resilient to these changes are critical, as is the preservation of indigenous animal genetics.

Cattle production

The livestock sector is dominated by beef cattle, which equates to approximately 12% of GDP and 22% of total exports for the country. Livestock production is an important agricultural sector, as it provides meat, milk and other products (Aregheore, Steglar & Ng'ambi, 2006; Vanuatu Financial Services Commission, 2016). Domestic demand for beef cattle is increasing. This is attributed to population increase, increasing levels of urbanisation and increasing tourism levels. In 1999, 46% of households in Vanuatu owned

cattle and as of 2009, 39% of private households within the Samna province raise cattle (Census Report 2009).

The island of Santo has been selected for this research project, as it is one of the most important areas of cattle production. Santo is one of two islands with a high concentration of larger cattle holdings, and one of three islands with a high concentration of smallholder cattle farmers (FAO 2015). The average ni-Vanuatu household in Santo owns 13 cattle, higher than the country's average of nine (FAO 2015).

Between 2006 and 2007, the agricultural census showed an increase in the total number of cattle, however the growth rate had decreased from 73% to 22% (Vanuatu National Statistics Office 2007). The environment of Vanuatu is one of the most conducive in the world for raising cattle (Vanuatu Financial Services Commission 2016). Limitations for the cattle sector are primarily poor transport, lack of access to credit for rural producers and limited extension programs (Vanuatu Financial Services Commission 2016).

The dominant form of production is free grazing, and is thus dependent on forages. With concentrates and supplements not commonly used (FAO 2015), production is highly dependent on pasture quality and quantity (Evans et al 1999). Many tropical species native to the area have a low dry matter digestibility quantity (Evans et al 1999). This issue is particularly prominent in the dry season, and can result in animals not gaining or maintaining weight.

The Vanuatu Pasture Improvement Project (VPIP) introduced improved grass and legume species, which led to the average carrying capacity increasing to 2.5animals per hectare. For small-scale producers, approximately half continue to use native species, while the other half use improved and introduced species.

Vanuatu is internationally recognised as being free of major animal disease, and is not limited by this when it comes to international trades (FAO 2003). Nitrogen deficiency is a common limiting factor of crop and pasture production. Other major limiting nutrients are sodium, copper and phosphorus (FAO 2003). Water can also be a limitation for production, as only 30% of smallholder farmers have access to suitable drinking water for their livestock. The significance of this is dependent on the climatic zone in question, and is most prominent in regions with low rainfall.

Food security

Vanuatu is currently highly dependent on food imports to meet demand (FAO 2015). The country has seen a significant shift in consumption patterns over the last 30 years (FAO 2015). Processed and packaged food have become much more prominent, and the consumption of local, fresh food per capita has decreased (FAO 2015). Coupled with factors such as decreased levels of physical activity, this has contributed to the increased prominence of nutrition related health issues, such as rates of diabetes and obesity. Over 20% of the adult population suffer from diabetes (International Diabetes Federation 2017).

It is difficult to gather and analyse data for a population that is distributed unevenly in many isolated regions. One initiative that has been relatively successful at achieving data collection that is representative of the whole population has been the Department of Agricultural and Rural Development's *national market information system*. This project involves market surveying, focusing on key agricultural products (FAO 2015). As a result of this project, data for the key markets of Luganville and Port Vila are now produced and disseminated regularly.

Religious context

A majority of Vanuatu's population identify as Christian, 82% as of the 2009 census (US Department of State 2015). In the 1970s, traditional *kastom* was used to unite non-European national identities, and was a significant contributor to the independence movement (US Depament of State 2015).

Environmental vulnerability

Vanuatu is considered very vulnerable to climate change and natural disasters. Vanuatu ranks highly in international rankings for vulnerability and faces an increasing risk of impacts from both human and natural stressors (Craven 2015). The country is located in the 'ring of fire' and the 'cyclone belt'. 81% of landmass and 76% of population is considered vulnerable to hazards such as volcanic eruptions, cyclones and droughts (Richmond & Sovacool, 2012). Many Pacific Island nations are heavily dependent on international support when it comes to natural disaster response (Mitchell 2014). In 2015 Cyclone Pam, a level five tropical storm, hit Vanuatu. This resulted in eleven fatalities and the displacement of 25% of the country's population. The resulting damage was estimated to be worth more than 60% of Vanuatu's GDP (IMF 2013). The most prominent risk Vanuatu faces as a result of climate change is the increasing frequency and severity of natural disasters (Lebot & Simeoni 2015). When interviewed about their country's vulnerability to climate change, respondents identified three main issues; coastal erosion, a supply of potable water and flooding events (Richmond & Sovacool, 2012).

As a result of the country's recognition as a region vulnerable to the impacts of climate change, there are many projects and mitigation programs in place. Generally, attempts at a community level have proven more successful than the top-down government projects. Migration and climate change have a circular, dependent relationship (Craven 2015).

Gender roles

While it is recognised that women within society are generally 'disadvantaged' in terms of their economic involvement, this is not an issue that is treated as a priority. Health, education and political participation are the gendered issues that are generally identified as key. Female representation in parliament and senior leadership is very low (Bowan et al 2009). Another significant issue is that many traditional laws that are recognised by the Vanuatu Constitution discriminate against women (Bowan et al. 2009). These include laws relating to matrimonial property ownership, inheritance and citizenship. 97% of land is owned under customary tenure, meaning that women have limited rights and access (Mitchell 2014). In many cases, women using this land cannot have their ownership formalised and registered (Bowan et al. 2009). Of the 30 000 cases of land registry in the country, only 20 are in the sole name of a woman (Bowan et al. 2009). This is a serious contributor to women having limited access to financial services and loans, as they do not have land assets to put up as collateral (Bowan et al. 2009). In addition, domestic violence is a serious problem in many cases (Bowan et al. 2009). While it is a difficult issue to measure, there is speculation that in some cases, Western attempts to address financial gender inequalities by empowering women have contributed to instances of domestic violence (Bowan et al. 2009).

Census data in 1999 revealed that up to 30% of businesses were owned by women, with women being increasingly involved in the private sector (Bowan et al 2009). However, in many cases, women in Vanuatu are effectively operating their businesses within a framework that discriminates against them (Bowan et al. 2009). While the country's constitution outlaws discrimination, enforcement of this when it intersects with custom law is unclear (Bowan et al. 2009). Reforms of the legal frameworks in place are needed to achieve and uphold gender equality, with a key distinction needed between customary and formal law (Bowan et al 2009).

There are programs in place that aim to address gender issues with respect to economic involvement. Increasing the involvement of women in the economic sector has been identified as a matter of importance for economic growth and development across Asia and the Pacific (ESCAP 2007). In 2007, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) estimated that $40 billion annually is lost due to the limited access of women to appropriate employment opportunity throughout Asia and the Pacific (ESCAP 2007). In addition to this, it was estimated that between US$16 billion and $30 billion is lost because of gender gaps in education (ESCAP 2007). Females are much less

likely to continue on to tertiary education, and less likely to receive a government scholarship. The National Plan of Action for Women 2007-2011 was established to increase employment rates and access to economic resources, as well as monitor working conditions (Bowan et al 2009).

It is important to understand the role of women within Vanuatu society, and the inequalities that exist. Gender is an important component of any social study, as the impacts are often complex and significant. It is important to note that cattle production, marketing and proceeds are generally considered as men's business in Vanuatu. This can deprive women from this important source of cash income, including that required for household necessities such as school fees, health and clothing. Women generally make cash income from other activities, especially market garden. However the broader ACIAR project and interviews for this research project uncovered cases of women that were responsible for the management and proceeds of cattle and coconuts.

Ceremony case studies

Timor Leste

When considering previous case studies and examples of similar incidents, it is necessary to look at examples other than Vanuatu. One relevant case study can be seen in Timor-Leste, where comparable cultural and social factors have a significant impact on the beef cattle market. The population of Timor-Leste is 1.2 million people, with agriculture being a very important sector of the country's economic activities (Jones 2014). Agriculture comprises approximately one third of the country's GDP and nearly two thirds of the population are engaged in the agricultural industry. Animal husbandry is the most common activity to generate income (Choudhury et al, 2014). Similarly to Vanuatu, a large proportion of the population (70%) are based rurally (National Statistics Directorate 2010).

While personal food consumption has increased steadily in Timor-Leste since 1996, the country still experiences high rates of poverty and malnutrition rates much higher than both the global average and neighbouring countries. In 2015, the Global Hunger Index scored Timor-Leste as the fourth lowest country. Timor-Leste ranks very low in many health and development indicators, such as 50% of children under five suffering from chronic malnutrition (conference). While malnutrition is a more prevalent issue in rural areas, it is recognised by The World Health Organisation (2010) as a public health problem across the country.

Similarly to Vanuatu, Timor-Leste relies on food importation to meet demand, especially when production is limited by climatic conditions. The country is regarded as having poor food security, with many people experiencing a 'hungry season', which may last up to four months each year. Food insecurity sits at 64-70% (Molyneux et al. 2012). A key contributor to this food insecurity is the very low productivity of staple crops. In addition to food security issues, there are social issues that can result from the "excessive financial pressures" associated with these events, such as conflict within families (Browne et al 2016).

The religious history of Timor-Leste is complex and has been heavily influenced by political and social conditions. Between 1975 and 1999 the region was ruled by Indonesia, and this was a period of widespread religious and cultural oppression (REF). Many communities were forced to resettle, and many sacred and culturally significant structures were destroyed. Timor-Leste achieved independence in 2002, after which the prevalence of traditional ceremonies and expressions of religious freedom increased. Traditional ceremonies and rituals were encouraged by the government to promote unity and independence from Indonesia (McWilliam & Traube 2011). "Timorese farming practices are simultaneously deeply cultural practices that inform and guide the rhythm of agriculture and help reproduce fundamental exchange relationships and social safety nets" (McWilliam et al 2015).

A 2016 study of Timor-Leste (Browne et al 2016) asked the question "do rituals serve as a brake on innovation in staple food cropping in Timor-Leste?" The four ceremonial categories

considered were; related to agriculture, traditional ceremonies for life, traditional ceremonies surrounding death and ceremonies related to the church. Most rituals, regardless of the focus, were closely interlinked and tied together by the belief system of the community. Of these events, agricultural based ceremonies on average required less time and money than those involving life and death – particularly those involving death. Many ceremonies involve sacrificing a goat, pig or chicken as a symbol of gratitude to the to the ancestors.

Two sets of interviews were conducted in 2006-2007 and 2015 that focused on ritual practices from the perspective of food security. The results of these interviews found that the time and resources dedicated to ritual practices varied between different communities. However, across all communities, contribution of both time and resources was significant. This was despite "extensive" rural poverty (Browne et al 2016). The study focused primarily on crop production, and less on the involvement of livestock in these processes. In particular, these studies focused on rice and maize cultivation to test this hypothesis. The study concluded that while the monthly per capita income in rural areas was approximately US $50, a significant amount of money (up to $1000 annually in some areas) is expended on traditional ceremonies and rituals, in addition to extensive time resources.

Other cultural considerations and the use of cattle in ceremonies in Timor Leste are overviewed in Waldron et al. (2016, pp53-55).

Ambrym island

A study conducted on the island of Ambrym in Vanuatu looked at the significance of ceremonial exchange and sacrifice. This study found that people "orient a large portion of their productive attention towards ceremonies", such as deaths, marriage, circumcisions and births (Rio 2007). In many cases, the primary purpose of raising pigs and maintaining gardens was for ceremony and/or church events (Rio 2007). A majority of food, including the best produce, was dedicated to exchange and not for personal use. There were also several examples of customary exchanges observed. For example, when a marriage ceremony occurs, it is customary for the uncle of the bride to gift cows, rice, green food and money. Additionally, all attendees at a marriage ceremony are socially obligated to bring food (Rio 2007).

Conclusion

There is a limited amount of published literature relevant to the impact of ceremonial processes on beef cattle production in Vanuatu. As the researcher will be travelling to Vanuatu to interview locals about the ceremonial use of cattle, this literature review provides a foundation for this research. It achieves this by analysing the research environment and relevant case studies in other comparable regions.

Methodology

This research project takes a mixed method approach. Mixed method research uses both quantitative and qualitative data in one study, or multiple studies focusing on one underlying phenomenon (Leech & Onwuegbuzie, 2008). It involves philosophical assumptions that guide the collection and analysis of data, and the mixture of quantitative and qualitative data within a study (Cresswell & Plano Clark 2007). There are two data analysis chapters for this research report. Chapter 4 analyses interview data, while chapter 5 is a model focusing on the number and proportion of cattle entering the ceremonial cattle market, and how this will change in the future.

Interview data on the use of cattle in ceremonies

The method used for the qualitative data collection stage of this research project was face to face, semi-structured interviews. Semi-structured interviews are commonly used as a method of collecting qualitative data, and were selected as the most appropriate method for this project. Selecting an appropriate and efficient method of data collection enhances the validity, accuracy and reliability of research.

Selection

The location of Eastern Santo was selected due to the ACIAR project *LPS-2014-037* operating in this region. Similarly, interview participants were selected because of their involvement with this project, or their connection with project members. It was not possible to randomly select participants, as not all members of the population were accessible or willing to participate. Thus selection involved finding willing, available participants while ensuring that the surrounding areas of Luganville, Port Orly and Sara were all represented in this sample. It was usually a case of conducting interviews wherever the project was travelling that day, as the interviewer did not have easy access to transport around the island, and was primarily relying on the project truck.

Interview process

The semi-structured interview method includes a base of structured questions, with the potential for the interview to also include unplanned themes and ideas based on what the interviewee reveals over the course of the interview. This method includes pre-defined questions (such as would be used in a structured interview) as well as the open-ended characteristic of an unstructured interview. Semi-structured interviews are generally considered most useful when an interviewer has some idea about the focus topic, but is looking for interviewees to raise new issues (Wilson, 2014).

In this case, the researcher was interested in the ceremonial processes involving cattle, but the scope of interviews was very wide, to allow for flexibility. There are limited published studies on this research area, and using a structured, inflexible interview style would cut off potential avenues of valuable information.

The length of semi-structured interviews can vary from several minutes to hours. This is dependent on the amount of questions set out by interviewers, as well as the answers to open ended questions that are provided by the interviewee. Interviews that are too long run the risk of reducing the pool of participants that are wiling to give up work time, while interviews that are too short may not result in adequate rapport being built, and the interview may not be able to cover the topic in sufficient depth (Robson 2002). In this case, the aim for interviews was between 10 and 15 minutes, depending on the individual circumstances of each. Most of the people participating in this research project were interviewed in their home village. Some interviews were conducted with minimal time constraints, and participants were able to give longer, more detailed answers. For example, after women's meetings, or when it was possible to organise to meet interviewees at their homes when they had set time aside. In other cases, the interviews were conducted in a rushed environment.

Interview sample

Interviews were conducted with 14 interviewees over 13 days of fieldwork. In addition to this, Scott Waldron and Cherise Addinsall conducted two interviews, with notes made available to the author. Data was organised into the geographical regions of Luganville, Sara, Port Orly, Khole and Ladi village. Luganville is the urban centre of Santo, while the other four villages are rural regions. The sample is as follows:

Table 1. Details of interviewees

Interview No.	Individual or Group?	Village	Farm Category	Association with project
Interview 1	Group	Port Orly	NA	Farmers
Interview 2	Individual	Port Orly	Medium-holder	Lead farmer
Interview 3	Individual	Khole	Small-holder	Farmer
Interview 4	Individual	Port Orly	Commercial	Farmer
Interview 5	Individual	Sara	Medium-holder	Farmer
Interview 6	Group	Sara	NA	Primarily farmers
Interview 7	Individual	Luganville	Small-holder	Project team member
Interview 8	Individual	Port Orly	Commercial	Farmer
Interview 9	Individual	Luganville	Small-holder	Department of Livestock
Interview 10	Individual	Sara	Medium-holder	Project team member
Interview 11	Individual	Makira island (not Santo)	Small-holder	Project team member
Interview 12	Individual	Ladi village	Small-holder	Farmer
Interview 13	Individual	Luganville	Small-holder	Project team member
Interview 14	Individual	Luganville	Small-holder	Farmer
Interview 15	Group	Khole	NA	Farmers
Interview 16	Group	Khole	NA	Farmers

Source: provided from surveys through the ACIAR project *LPS-2014-037*

The names of interviewees have been omitted from this document for the purpose of anonymity. Farmers have been classified into four categories based on the number of cattle in their herd. Less than 20 cows was classified as a small holder, between 21 and 50 a medium holder, 51-100 is a large holder, while more than 100 cows is a commercial holder.

Table 1 shows that a majority of interviewees are smallholders, followed by medium-holders and commercial holders. Most interviewees are farmers involved with the project, while some are project team members who have family with cattle. An additional point of note is that the 11th interview was from another island, so may not be fully aware of practices in Santo, but his interview is included because he has daily contact with farmers in this region. While the sample size is small, the range of interviewees provides a reasonable representation of the broader farmer population of East Santo and is expected to provide a robust picture of the attitudes and practices of this region.

There are however several limitations in the veracity of the interview data. While interviewees include both farmers and project team members, many industries are not represented, as only interviewees associated with the ACIAR project *LPS-2014-037* were available. Despite these limitations, this cross-section of people was as diverse as was possible within the parameters of this research project.

Limitations of interview data

Sample size

Due to limited time of 13 days and the confines of this study, the overall sample size of 16 for this research project is not statistically significant given household numbers on the East Coast. While this already poses a limitation, the sample size for individual questions was often more restricted, as many interviews did not cover all pre-determined questions. There were several contributing factors to this, especially time pressure.

Cultural differences

One significant factor in the context of this research is the cultural differences between Santo (Vanuatu) and the researcher's home in Brisbane (Australia). In preparation for this undertaking, the researcher undertook a literature review and attempted to familiarise herself with the environment that she was going to be entering. However, the researcher entered an almost entirely foreign environment, and there were inevitably many influential cultural factors. In addition to these cultural factors, there are noticeable physical features that identify the researcher as an outsider, as well as the fact that she does not speak the Bislama language.

Interruptions and time constraints

The interviews conducted occurred in the field, and in many cases, there were interruptions and constraints that were not controllable. For example, one participant was interviewed in the hospital, as he was unwell. Although happy to participate in the interview, he had a coughing fit approximately five minutes into his interview, and it was decided by the interviewer to end the interview then, and not further question him. Another interview was conducted on the side of the road, with approximately 20 people, in addition to the interviewer and interviewee, standing around, waiting for the interview to conclude, so that they could continue to take their cattle into town. As a result of this clear imposition, there was a time pressure in place, and the interview was not as detailed as it could have been in a more relaxed environment.

Language barrier

Most of the interviews were conducted with an interpreter present. This sometimes interrupted the flow between questions and answers. Additionally, although some interviewees spoke fluent English and an interpreter was not required, there were still occasions of misunderstanding.

Quantitative methods to calculate regional use of cattle in ceremonies

Interview methods were used to understand the ceremonial use of cattle in Santo from a household perspective. However, extrapolation of the data is required to provide a broader regional picture.

The analysis draws on various primary and secondary data to parameterise calculations. Primary data was drawn from interview material (above) especially to establish the major ceremonies and average number of cattle used in different locations. Secondary data – especially national censuses conducted in 2009 and 2016 – were used to derive demographics statistics and indicators (including populations, population growth, urbanisation, age profiles, marriage rates, death rates). To estimate proportions of cattle used in ceremonies, data was drawn from the ACIAR project LPS-2014-037 on cattle numbers and growth.

These data were used to estimate the magnitude of cattle from major ceremonies (funerals and weddings). Calculations were done through formulas in a spreadsheet model. Numerous assumptions have been made which are made explicit in the step-by-step analysis.

Results and discussion

Questions providing basic interviewee information and the role of cattle in livelihoods

The first group of questions provides basic information on the interviewees and the role of cattle in their livelihoods (number of cattle, primary form of livelihoods, school fees). This group of questions provide a context for more detailed questions to follow, and highlights key features of this sample group. For example, that school fees are commonly paid with cattle in some areas, and that this group is comprised of smallholder, medium-holder and commercial farmers.

Number of cattle

Interview question: How many cows do you/your family own?

This question was asked to establish the herd sizes of the respondents, which may be relevant to other variable. For example, it was hypothesised that large cattle farms may give or sell a larger number of cattle for ceremonial use than smallholders. There may also be relationships between herd sizes and the value that they received from the contribution to the ceremony.

Eight respondents were asked about the number of cattle they personally own. Two respondents were from Port Orly, two from Sara, one from Luganville, one from Khole and one from Ladi. The two respondents from Sara had approximately 25 and 30 cattle. The two respondents from Port Orly had 20 cows and 262 cows. The respondent from Luganville owned 200 cows. The respondent from Khole had 30 head, and the respondent from Ladi has 15 cows.

An important point of note for this question is that the number of cattle belonging to project farmers has already been recorded for the ACIAR Project LPS-2014-037. As a result, this question was not asked to all interviewees, with this information collected at a later date and included in chapter 3.

Primary form of livelihood

Table 2. Interview question: Is cattle production your primary form of livelihood?

Response	No. of respondents	Observation
Yes	3	One respondent from Port Orly added that this is the primary livelihood of the region.
No	0	

Source: author interview questions. N=3

This question has been included because if cattle production is the primary form of livelihood, the use of cattle for ceremonies will have a larger effect on livelihoods, either of individuals or within a region.

It was hypothesised that a majority of interviewees would identify cattle production as their primary form of livelihood. This is because Santo has a high concentration of both small and large holder cattle farmers (FAO 2015). In addition to this, most interviews were conducted with people already participating in the larger ACIAR project, and their involvement with this project is based on cattle farming.

Only a small proportion of interviewees were asked if cattle production was their primary form of livelihood, but all three asked confirmed that cattle production was their primary form of livelihood. This question series did reveal that cattle production is the primary form of livelihood in Port Orly.

School fees

Table 3. Interview question: Are school fees commonly paid with cattle?

Response	No. of Respondents	Observations
Yes	3	Yes responses were recorded in Port Orly (2) and Luganville, with the no response recorded in Sara
No	1	

Source: author interview questions. N=4

This question aimed to further explore the role of cattle in livelihoods. There was anecdotal evidence that one important way that cattle contribute to livelihoods is by providing cash income to pay for school fees. Three respondents from Port Orly and Luganville answered that cattle are commonly used to pay school fees, while the one respondent from Sara answered that paying school fees with cattle is not a common occurrence. It is not possible to draw conclusions from this very limited sample pool, but responses infer that cattle are used to pay school fees on Santo.

Questions outlining the use of cattle and other commodities

The second group of questions outlines the use of cattle and other commodities in ceremonies (most common ceremonies, funerals, weddings, bride prize, church, and other commodities used in ceremonies). This group of questions provides details for ceremonial activities. This section also includes two first hand accounts of ceremonial activities, which provide context for analysis.

Most common ceremonies

It was hypothesised that marriage and death ceremonies would be identified as the most common ceremonies. However, it was expected that a range of other ceremonies would also be identified, such as personal achievements and church events.

Table 4. Interview question: What are the most common ceremonies that occur in this community?

Responses	Respondents who identified the event	Observations
Marriage	13	Engagements, births, birthdays, political celebrations, independence celebrations and Chief's day all identified in the urban area of Luganville
Funerals	13	
Church events	12	
Engagements	1	
Births	1	
Birthdays	1	
Political celebrations	1	
Independence celebrations	1	
Chief's day	1	

Source: author interview questions. N=13

These responses are relatively consistent with the hypothesis, in that all respondents answered that marriage and death ceremonies were the most commonly occurring. Almost all respondents also identified Church events as a common ceremony. The responses from the four regions don't indicate significant differences in the types of ceremonies that involved cattle.

Cattle use in funerals

The numbers of cattle used in ceremonies were unknown before the study but it was expected that numbers would be significant, depending on the number of cattle that the household holds. Ten answers collected across five regions indicate that the number of cattle involved varies greatly across different regions, and even within regions, as can be seen by the spread of responses.

Table 5. Interview question: How many cattle are used in death ceremonies?

No. of cattle	No. of Respondents	Observations
1 to 2	1	Of the three respondents from Luganville, no one responded with a response higher than 6. In terms of where this contribution comes from, all three respondents from Port Orly identified family members as the primary providers. Of the three respondents from Luganville,
A few	1	
4 – 5	1	
6	2	
10 -11	1	
Up to 16	1	
16 to 18	1	
26	1	
A flexible amount	1	

Source: author interview questions. N=10

Results suggest a high variability in the number of cattle used in funerals. However, considering the higher end of the ranges in Port Orly, Ladi and Sara, all were higher than Luganville. This suggests that in general, fewer cows may be used in ceremonies in the more urban Luganville when compared to the more rural Port Orly, Ladi and Sara. One respondent supported this assumption by stating that in Luganville, fewer cattle are used than in the rural areas.

Scott Waldron, was able to attend a funeral ceremony in Khole, and I was able to access the notes from this. In this region, as in all regions considered in this research project, ceremonies occur on both the 10th and 100th days after death. Attendees had come from Port Orly and Sara from Santo, as well as further afield, including from the islands Malakula and Efate. Approximately 150 people were in attendance in the morning, with more expected to arrive for the afternoon. Two cows had been killed for consumption at this point, with the meat being barbequed on sticks and cooked with yam, sweet potato and taro.

Funeral cattle contribution

Table 6. Interview question: Who generally provides the cattle for a death ceremony?

Responses	No. of respondents for ceremonial event
Family of deceased	5
Community members	1
Changing contribution	1

Source: author interview questions. N=7

The most common response for the question ‘who contributes the cattle for funeral ceremonies’ was ‘the family of the deceased’. These responses spread over the four regions of Port Orly, Luganville, Ladi and Sara. As could be expected in an urban area, only one respondent (from Luganville) commented that cattle are often purchased.

Cattle use in wedding ceremonies

Table 7. Interview question: How are cattle used/how many cattle are used in marriage ceremonies?

No. of cattle	No. of respondents	Observations
Variable/unknown	1	Most respondents, regardless of living in an urban or rural area, identified that the number of cattle used in marriage ceremonies is highly variable, depending on factors such as the size of the wedding and the wealth of the respective families.
1 – 3	1	
3 – 4	1	
4	1	
>4	1	
4 - 6	1	

Source: author interview questions. N=6

Based on literature review findings, it was hypothesised that marriages would be a common ceremony involving cattle across the areas studied, but the numbers that might be used are unknown.

In comparison to funerals, these answers suggest that marriage ceremonies generally require fewer cattle, and do not have an extended period of cattle contribution as some funerals do. The respondent from Ladi answered that four steers were being killed, as well as “additional cows”. While it is not known how many additional cows this is referring to, the maximum amount of cows excluding this interview was six, with most interviewees saying that while it depends on size, up to four cows are generally killed. In terms of contributions, responses were varied regarding who was responsible for contributing cattle for a wedding feast. Respondents from Sara and Luganville both stated that the male’s side of the family generally contribute cows. With the exception of Luganville, at least one respondent from each region stated that cows can be contributed from either the male’s or female’s side of the family.

In addition to weddings requiring a smaller cattle contribution than funerals, another factor to consider is the predictability of these events. In contrast to funerals, which can be very unpredictable as is the nature of death and result in unexpected demand, weddings are often planned and those contributing cattle can take this into consideration.

To get an understanding of a wedding ceremony, the author attended the preparation for one in Ladi. Four bulls were killed from Ladi, the home of the bride. Additional cattle were contributed from Hog Harbour, the home of the groom. The cattle contributed from Ladi came from various members of the community. I was able to interview one of these contributors. When his father died earlier in the year, this family had donated cattle for that ceremony, so he was now donating in return. In this instance, all cattle were contributed for free. In this village, wedding preparation is a community effort. There were approximately 100 people involved in set up during my visit in the morning. The entire community were working together throughout the day to prepare the food and decorate the area in preparation for the ceremony.

Cattle as bride prize

Questions about cattle being used as a bride prize were not asked in enough interviews to draw any conclusions or assumptions. Only two interviews covered this topic, one in Luganville and one in Port Orly. Both respondents answered that cattle are not commonly used as a bride prize. The question ‘are cattle used as a bride prize’ was not covered in

many interviews. However these answers suggest that cattle are not commonly used as a bride prize in the two regions of Port Orly and Luganville.

Church related questions

Church events were identified as one of the most common ceremonial events, along with marriages and funerals. However, the nature of church events and their use of cattle is quite different to marriage and funeral ceremonies. While events such as important religious days of celebration and christenings will often involve the use of cattle, the number and contribution is difficult to determine.

Initial interview responses to pre-determined questions suggested that cattle use for church events depends on many variables, and as a result of this, follow up interviews relating to this subject followed a less structured format. One major variable identified was the region in question, as the church often operates different in different villages. As a result of this, responses have been split into village for analysis purpose.

Table 8. Responses to questions involving church ceremonies

Village	No. of Respondents	The nature of church events
Luganville	3	The first respondent confirmed that members of the Luganville community pay a 10% tithe to the church and that this is a common practice across all surrounding areas. The second respondent confirmed that community members pay a tithe, as well as stating that the church does not have a herd of cows. The church will purchase cows if need be, although community members will generally contribute cows. The third respondent explained that when it comes to using cows for church events, it is very flexible, and much less structured than in rural villages.
Port Orly	1 (group)	In Port Orly, the women's group indicated that the church have their own herd, and these cows can be used to feed the community at church functions.
Sara	2	The first interviewee stated that community members will often sell cows to the church at a discounted price, or exchange cows for other commodities. The second respondent explained that similarly to Luganville, community members pay a 10% tithe, and that the church will often provide for church events.

Source: author interview questions. N=6

It was hypothesised that church events would be common ceremonies involving the use of cattle. There were respondents for this question from the three regions of Port Orly, Luganville and Sara. In Port Orly, the use of cattle in church events is separate to weddings and funerals, because the church has their own herd. In Luganville and Sara, responses suggest that the church's contribution of cattle to church events is flexible. Sometimes the church will purchase from members of the community, and this will often be at a discounted price. Sometimes, community members will contribute cows for free.

This question revealed that in different areas, the nature of cattle use in church events is different. While it is difficult to draw conclusions from six interviews, these results suggest that the use of cattle in church events is relatively variable, and potentially dependent on additional factors not uncovered in this case study.

Additional commodities

Table 9. Interview question: that other commodities are commonly used in ceremonies?

Response	No. of Respondents
Kava	2
Copra	2
Taro	1
Yam	1
Pigs	2
Chicken	2

Source: author interview questions. N= 3

This question was included to try and gauge what other commodities play a significant role in ceremonial activities. Results obtained for this line of questioning suggest that cattle are not the primary commodities used in all areas studied.

One respondent from Sara said that kava is the most important ceremonial commodity and more important than cattle. In contrast, cattle were said to be the primary commodities used in ceremonies in Khole. Interviews from other regions didn't rank the proportion of contribution for different ceremonial commodities against each other. However, other important agricultural commodities include kava, yam, taro, pigs, chickens and copra, which were all identified as contributors within different regions.

Questions looking at the type and source of cattle and the diversion of cattle from market sales

This group of questions looks at the [numbers], type and source of cattle used for ceremonies and the diversion of cattle from market sales (type of cattle used, proportion of cattle used for ceremonies, impact on market sales, additional cattle requirements). This shows how the ceremonial market and commercial market interact,

Type of cattle used in ceremonies

Table 10. Interview question: What type of cattle are primarily used in ceremonies?

Response	No. of Respondents	Observations
Steers	3	Although there were only 8 respondents for this question, 12 responses were recorded. There were many respondents who gave multiple answers because the type of cattle used in these ceremonies is flexible. One respondent from Luganville responded that community members contribute money, and the money collected determines the type and quality of cattle purchased.
Heifers	0	
Both male and female	5	
Whatever is available	2	
Best Available	1	
Aggressive / lowest performing	1	

Source: author interview questions. N= 8

One respondent from Sara said that kava is the most important ceremonial commodity and more important than cattle. In contrast, cattle were said to be the primary commodities used in ceremonies in Khole. Interviews from other regions didn't rank the proportion of contribution for different ceremonial commodities against each other. However, other

important agricultural commodities include kava, yam, taro, pigs, chickens and copra, which were all identified as contributors within different regions.

The type of cattle used for ceremonies has potentially significant implications for cattle production systems. For example, the use of breeding females will diminish herd growth potential. Use of culled animals (cows or bulls) can increase herd productivity, and abattoir buyers discount the price for these animals.

While six different responses were recorded, the most common answer was that both male and female cattle are used in ceremonies. These 12 responses from eight respondents suggest that there are many different types of cattle used, with a high level of variability for a large number of reasons.

Proportion of cattle used for market vs ceremony

Table 11. Interview question: What proportion of cattle enters the cash market vs ceremonial use?

% of cattle to market	No. of Responses
30%	1
< 50%	2
50%	1
>50%	2
60-70%	1
70%	2
80-90%	1
A large percentage	1
Highly variable	1

Source: author interview questions. N= 12

When considering the estimates given in these interviews, it's important to acknowledge that the timing of some ceremonies is unpredictable. For example, cattle to be killed for annual Independence Day celebrations can be planned in advance, while funerals will be mostly unpredictable events.

These interviews suggest that the proportion of cattle entering the beef market compared to the proportion of cattle that are used for ceremonial activities is not consistent throughout East Santo and Luganville. This is likely due to different cattle production levels and different ceremonial requirements in different areas. It's also likely that the responses from different interviewees are dependent on their personal cattle herds. For example, cattle farmers with a higher number of animals will likely sell a higher proportion to the market than farmers with only a few animals required for ceremonies. For example, one interviewee sold three cattle in the cash market and used three for ceremonies.

It was difficult for some interviewees to estimate a percentage. It is also important to note that while any did provide an estimate, these are estimates only and not necessarily accurate.

The impact of ceremonies on the market

Table 12. Interview question: Do you think ceremonial cattle use has a negative impact on the beef cattle market?

Response	No. of Respondents	Observations
No	1	One respondent answered that there was not a negative impact, as this was just the way of culture. He added that others, primarily the younger generations, do see ceremonial cattle use as a hindrance to the market. One respondent added that the markets operate separately.
Yes – not significant	1	
Yes - significant	2	

Source: author interview questions. N= 4

One key question for this research is whether the use of cattle for ceremonies impacts on the beef cattle market, especially by diverting significant numbers of cattle away from the market, or by reducing the growth potential of the cattle herd. This question was included with the aim of providing the perspective of community members.

All three respondents from Luganville believe that the ceremonial use of cattle impacts on the beef cattle market. One respondent from a rural community answered that there is no negative impact. The limited sample size precludes broader conclusions.

Importantly, one interviewee said that the impact is often significant when demand is unexpected, such as for a funeral. Additionally, one interview noted that the younger generations often do see ceremonial cattle use as having a negative impact on the beef cattle market. This is consistent with a question regarding the participation of younger generations (4.x), where a majority of respondents answered that the younger generation is generally more commercially minded.

These responses suggest that households in the region believe the use of cattle in cultural ceremonies impacts on cattle production for commercial use, although the perceived extent of this impact varies. Variations in these responses are likely due to a variety of factors. One relevant factor is their personal experience with both the commercial market and ceremonial activities. For example, one respondent is the Head of the Department of Livestock, two respondents are employed through this ACIAR project while the final respondent was a small-holder farmer. The responses of each respondent will be, at least in part, a reflection of their personal knowledge, experience and biases.

Additional cattle requirements

Table 13. Interview question: If additional cattle are required for ceremonial use, where are they sourced?

Response	No. of Respondents
Large-holder farmers	5
Can be provided by the church for free	1
Family and friends within the community	3

Source: author interview questions. N= 8

This question was included in the interviews to determine where additional cattle are sourced [beyond their own herds], and to identify cattle flow entering and exiting different regions. The Port Orly women's group answered that cattle are generally sourced from large-holder farmers, but that the church will sometimes provide cattle for free from their herd. It is likely that cattle are sourced depending on availability and price.

When cattle are bought in from outside the household, an additional factor is the price or non-market value that the cattle are being sold for. If producers are selling cattle for

ceremonial use for below market value, it will result in foregone cash profit (but may be realised in other forms). Five of these interviews discussed the price of these cattle, with three stating that cattle can be sold for below market value. This is at the discretion of the seller and dependent on the relationship between buyer and seller. At least one respondent from Sara, Luganville and Port Orly indicated that cattle could be sold for below market value.

Questions focusing on ceremonial attitudes and motivation

The fourth group of questions provides insights into attitudes to ceremonies and how these vary by generation, areas or into the future (concealing wealth, participation in ceremonies, participation of younger generations, and how ceremonies might change in the future. This group of questions shows generational differences when it comes to participation, with the younger generations generally being more commercially minded. These questions also highlight interesting motivations and behaviours that are shaped by ceremonial obligations.

Concealing wealth

Table 14. Interview question: Do people within this community conceal wealth?

Response	No. of Respondents
No	2
Not common	4
Common	5

Source: author interview questions. N= 11

Another cultural issue in cattle production relates to concealing cattle. There are several reasons why households might conceal wealth. There are social obligations for wealthier households to contribute more to ceremonies. Alternatively better producer might be expected to provide their best cattle, which removes productive and valuable animals.

It is relevant to note that questions regarding concealing wealth are somewhat sensitive. Interviewees who conceal wealth from others within their community may not necessarily want to reveal this information to the interviewer.

There did not appear to be significant differences between urban Luganville to the rural villages. With the exception of one interview from Ladi, at least one respondent from each area acknowledged that concealing wealth did occur to some extent. While answers ranged from the practice being uncommon to being commonplace, geographical differences were not revealed in the interview data. It is also important to note that different responses were received from the same areas. This may be due differences between interviewees, the sensitive nature of this question, or because they didn't know the extent of concealing in the community, but these motivations were not explored further.

Participation in ceremonies

Table 15. Interview question: Does everyone within the community participate in these ceremonies?

Response	No. of Responses	Observations
Yes	2	Both interviewees that responded 'most people' added that only those who are very busy will not participate. The 'no' response referred to willingness to contribute cattle for free, not willingness to physically attend. The women's group stated that participation is a matter of prestige.
No	1	
Most people	2	

Source: author interview questions. N= 5

This question links closely to the questions above about the changing nature of ceremonies as well as the willingness of younger generations to participate. Together these three questions address the way that different communities and different generations within communities participate in ceremonial processes.

When reviewing the answers to this question and attempting to analyse responses, this question is potentially ambiguous, as it does not define what it actually means to 'participate' in ceremonies. Responses cover both the contribution of cattle for ceremonies for free as well as physical attendance at these events. One respondent from Sara answered that not everyone will partake in the same way, and that not everyone will contribute cattle for free. He did not comment on the proportion of the community that will participate in ceremonies overall.

There were five interviews that asked about the community's willingness to participate in ceremonial activities. The Port Orly women's group replied that everyone will participate, and that this is a matter of prestige as well as expectation. The individual respondent from Port Orly answered that only those who are very busy will not partake. Similarly, a respondent from Luganville answered that everyone will participate except for people who are very busy. The two respondents from Sara answered differently. One replied that everyone participates in ceremonies, while the other stated that not everyone will partake in the same way, and some members of the community are not willing to contribute cattle for ceremonial use for free and will always sell them. These two responses are not contradictory, and are answering the question in a different way.

Participation of younger generations in ceremonies

Table 16. Interview question: Do younger generations participate in the same way as older generations?

Response	No. of Respondents	Observations
Participate the same as older generations	3	7 of the 10 respondents answered that the younger generations are more commercially minded than older generations. There were respondents for this question across all five regions.
Participate less than older generations	7	

Source: author interview questions. N= 10

While not all respondents addressed how the participation of younger generations would impact on the nature of ceremonies, one respondent did add that the commercially minded attitude of the younger generations will change the nature of ceremonies (i.e. reduce the prevalence or conduct). Another respondent explained that although they are more commercially minded, younger people will continue to participate and do what they are told. Another respondent answered that many younger people are less interested in cattle production and are moving away from the industry all together.

When it comes to considering responses for this question, it's important to note that this is a potentially sensitive issue. Asking about changes to traditional ceremonies that are deeply rooted in culture may elicit responses that are biased or not completely honest.

Regardless of these biases, the results suggest that the participation of younger generations is decreasing in some areas of Santo [what areas, or is there a difference between urban and rural areas?]. Younger people who are less involved in cattle production overall, or who aren't willing to sell cattle for below market value, will also change the nature of cattle contribution in the future. This trend will have social and economic implications for beef production and the market.

The changing nature of ceremonies

Table 17. Interview question: Do you think the nature of ceremonies will change in the future?

Response	No. of Respondents	Observations
Yes	4	Both 'Yes' and 'No' responses were gathered over both urban (Luganville) and rural regions (Sara, Port Orly, Ladi and Khole)
No	8	

Source: author interview questions. N= 12

It was hypothesised that the increase in prices of beef or cultural change might impact on the use of cattle in ceremonies, although the trends were unknown. Both respondents from Sara answered that the nature of ceremonies will change. They attributed this to decreasing interest in ceremonies from younger generations, as they focus on market production. In both Port Orly and Luganville respondents were split, with one respondent from each region stating that the nature of cattle use in ceremonies would change. However, a majority of respondents from both Luganville and Port Orly answered that the nature of these ceremonies would not change. All respondents from Khole and Ladi answered that the nature of ceremonies will not change, as they are deeply rooted in culture.

An important factor when considering these answers is that ceremonies have already evolved in different ways in different areas. While two of the three respondents from the urban Luganville answered that the nature of ceremonies in this region will not change, responses to previous questions suggest that ceremonial activity is already quite different in Luganville when compared to more regional locations. Considering that responses from Luganville were at the lower number of cattle used for funeral ceremonies, the process of change that other areas may go through in the future may already have occurred in this area.

An important consideration for this line of questioning is the potentially sensitive nature of it. Older community members may not want to admit or discuss the fact that traditional ceremonies may be changing over time, especially with an unknown outsider such as the interviewer.

Policy questions

This section presents interview material from a government and policy perspective. This interviewee was a SANMA livestock officer, with the interview focusing on policy issues. The two policies primarily discussed were the soon to be introduced female kill ban and the distribution of breeding stock. While most interviews conducted followed a semi-structured format, one interview was not prompted by a questionnaire.

The Department of Livestock aims to increase national production from the current number of 275 000 to 500 000 by 2025, to increase industrial activity (including in abattoirs), increase exports and to increase incomes from livestock production. The interviewee outlined how ceremonies detract from these aims. They therefore seek to "educate" livestock officers, chiefs, pastors and farmers to reduce the amount and value of commodities used in ceremonies and to appreciate the commercial value of cattle. They consider that the use of commodities (including cattle) is often excessive, driven by prestige. This detracts from a more profit-driven approach, where herds are managed to increase productivity, growth and cash income used for household necessities (that can include education, health, clothing and accommodation).

Following a similar ban in the 1980s to address diminishing herd numbers , in 2017 government of Vanuatu introduced a ban on the slaughter of productive females (of breeding age). Implementation and enforcement will be challenging, especially given the large numbers of heifers sold into the weaner market in Port Vila and the use of females in ceremonies (as indicated in Section 4.8 above). However, there is also some indication that younger generations or more urbanised areas will decrease the numbers of cattle killed at ceremonies into the future, which the Department of Livestock would be happy about.

A second project discussed is the distribution of cattle as breeding stock. Introduced in 2015, this project distributes females, most originating from Santo, to other islands of Vanuatu. The SANMA Livestock Officer was concerned about the effect on breeding stock in Santo, the logistics and that the cattle are sometimes killed for consumption in destination areas.

Data modelling

The aim of this chapter is to quantify the number and proportion of cattle used for ceremonies. Other studies (NZMFAT, 2017) have attempted to do this from the "supply side" by surveying farmers of their use of cattle for ceremonies and then extrapolating up in scale. This method is of course valid, but is subject to error, especially on farmer recall and representativeness.

This study aims to cross-verify the findings using a different method, namely calculating use of cattle in ceremonies from the "demand side". It does so through a series of analytical steps outlined below, and drawing on various data. Data includes statistical data from national censuses (2009 and 2016), livestock surveys (NZMFAT) and cattle data from ACIAR Project LPS-2014-037. Importantly, the analysis also draws on parameters drawn from interview data presented in Chapter 4.

This chapter does not aim to provide an exact figure on the number of cattle that are used in ceremonies, as there are many unknown variables and incomplete data sets. The purpose is to estimate the magnitudes of how many cattle are entering the ceremonial market, the rough proportions of the total herd and sales, and consider how this will change in the future with population growth and the changing nature of ceremonies. Numerous assumptions have been made which are made explicit in the analysis below.

This data is split into the two regions of Luganville and East Santo, as interview data shows that urban and rural regions have different cattle requirements. The calculations include just funerals and weddings, which were found to be the most important in chapter 4, and where data is most reliable. In calculating the proportions of cattle used in ceremonies into the future (to 2030), it is assumed that cattle herd and numbers held by smallholders will remain stable, and not decline as is widely believed to be happening. As a result of these assumptions, the numbers and proportions of cattle used in ceremonies are conservative (likely to be low).

Even with conservative assumptions, the analysis finds that a large number of cattle are entering the ceremonial channel (753 per year in 2016 based on four head per ceremony). This accounts for 14% of cattle in stock and 39% of total turnoff. These findings are similar to those of NZMFAT for Vanuatu as a whole. With human population growth and a stable cattle herd, ceremonies will account for more than half of turnoff. Even without any non-ceremony sales on the open market, ceremonies will "eat into" (diminish) the cattle herd by 2030, should the number of cattle per ceremony increase, or if breeding cattle are consumed.

Calculation method

This model only takes into consideration cattle use for funerals and marriages, as they were found through the interviews conducted (chapter 4) to be the most common. The occurrence of these ceremonies are also able to be estimated. Due to the highly variable responses received in chapter 4 on the number of cattle used per ceremony, calculations have been repeated for an average of 2, 4, 6, 8 and 10 cattle used per ceremony. When interpreting the data, however, it is important to note that interview data suggests that funerals usually use more cattle than weddings. In some regions, funeral requirements are higher than 20 cows over 100 days.

While significant, other ceremonies are not considered, leading to conservative estimates on the ceremonial use of cattle. Church events have not been accounted for because interviews revealed that in some areas (such as Port Orly), the church has their own herd, and the use of cattle for church events is highly variable. However, as church events were

found to be a very common ceremony within all communities, cattle entering this channel are likely to be significant.

For example, birthdays, births and Independence Day celebrations were all identified during the interview process as ceremonies involving cattle, albeit intermittently and with variable numbers. Most of these ceremonies were discussed in limited detail, with most only identified by one respondent. This does not provide a reliable information base on which to calculate use of cattle for these ceremonies.

Estimating use of cattle in wedding ceremonies

The steps followed for estimating the use of cattle in wedding ceremonies are as follows:

- The total population in the age bracket 16-69 (2517 in East Santos, 9593 in Luganville) was taken from the 2016 census
- This figure was divided by the number of years in the age bracket
- This figure was multiplied by the proportion of people that have been married at some time (30%), taken from the 2009 census. This does not take into account divorces and remarriages
- This was then divided by 2, for both men and women, to derive a total number of weddings per year
- The number of weddings per year was multiplied by the number of cattle used per wedding, expressed as a range (2, 4, 6, 8, 10)
- Data has been extrapolated to 2030 to analyse demand and supply in the future. To determine demand, the population growth rates of 1.8% and 2.7% are used respectively for East Santo and Luganville based on 2009 and 2016 census data. The calculations from 5.1.1 and 5.1.2 are repeated with this new population to calculate an estimated ceremonial cattle use for 2030. This assumes that the herd is static (self- replacing, with surplus sales), and that all parameters remain the same
- The steps above were repeated for both East Santo and Luganville and aggregated

Table 18. Number of cattle used in marriage ceremonies

		Number of cattle				
		2	**4**	**6**	**8**	**10**
2016	East Santo	33	65	98	131	163
	Luganville	124	249	373	497	622
	Total	**157**	**314**	**471**	**628**	**785**
2030	East Santo	41	82	123	164	205
	Luganville	172	343	515	686	858
	Total	**213**	**425**	**638**	**850**	**1063**

Source: data from 2009 and 2016 census

Estimating use of cattle in funeral ceremonies

- The total population (4463 in East Santos, 15865 in Luganville) was multiplied by the crude death rate (5.4 per thousand, 2009 census) to derive total deaths per year
- Multiplied by range of cattle used per funeral (2,4,6,8,10)

Table 19. Number of cattle used in funeral ceremonies

		Number of cattle				
		2	**4**	**6**	**8**	**10**
2016	East Santo	48	96	145	193	241
	Luganville	171	343	514	685	857
	Total	**219**	**439**	**659**	**878**	**1098**
2030	East Santo	61	121	182	243	303
	Luganville	236	473	709	945	1182
	Total	**297**	**594**	**891**	**1188**	**1485**

Source: data from 2009 and 2016 census

Estimating use of cattle in funeral and marriage ceremonies

Table 20. Number of cattle used in marriage and funeral ceremonies

		Number of cattle				
		2	**4**	**6**	**8**	**10**
2016	East Santo	81	162	242	323	404
	Luganville	296	591	887	1,183	1,478
	Total	**377**	**753**	**1,129**	**1,506**	**1,882**
2030	East Santo	102	204	305	407	509
	Luganville	408	816	1224	1632	2039
	Total	**510**	**1,020**	**1,529**	**2,039**	**2,548**

Proportion of cattle used in ceremonies

The next stage of this analysis is to reconcile the ceremonial demand for cattle with supply. The total cattle herd size is taken from the 2016 census and then allocated into types of cattle based on herd model developed in LPS2014-037.

However, only cattle produced by small and medium-holders are assumed to be used for ceremonies, not cattle produced on estates. This reduces the total herd size by 50%. This is conservative compared to the NZMFAT survey which estimates that only 31% of cattle in Vanuatu are produced by smallholders. Using this data, the model calculates the number of cattle that are sold in each class. One important assumption for this section is that the herd is self-sustaining, not building up or drawing down.

Table 21: Total number of cattle used in ceremonies

		Number of cattle				
		2	**4**	**6**	**8**	**10**
2016	% of cattle used for ceremonies	7	14	21	28	35
	% of annual turnoff	19	39	58	77	97
2030	% of cattle used for ceremonies	9	19	28	37	47
	% of annual turnoff	26	52	78	104	129

Conclusions

Research questions and findings

The overall aim of the research project was to improve understanding of the use of cattle for ceremonies in North East Santo, Vanuatu. As outlined throughout this report, the scope and resources available applied numerous limitations to the study, especially in the sample size of the surveys. However, the study did provide some useful data from both household interviews and quantitative methods. This contributed to understanding of the issues, of which there were very limited existing documented studies.

By using a semi-structured format, the author was able to collect responses from a range of interviewees, providing a robust picture of the practices and attitudes of ceremonial cattle use in East Santo. It was found that funerals, weddings and church events are the most common ceremonies with the greatest use of cattle. There is however high variation in the data in the number and type of cattle used for funeral and wedding ceremonies and in the proportion of cattle entering the ceremonial market compared to the cash market. This variation is dependent on region and household circumstance.

Several conclusions were reached regarding the attitudes and beliefs of community members. Some interviewees believe that the use of cattle in cultural ceremonies has a negative impact on the cash market. Younger generations were generally considered to be more commercially minded than older generations. One-third of respondents believed that the nature of ceremonial cattle use would change in the future. However, a majority of interviewees expressed that ceremonial activities are deeply rooted in culture and tradition, and this is a factor that keeps ceremonial activities from changing.

The aim of the data model developed in chapter 5 was to quantify the number and proportions of cattle used for ceremonies. Even with conservative assumptions, the model shows that ceremonial cattle use makes up a high proportion of total cattle and annual cattle turnoff. A large number of cattle are entering the ceremonial channel (753 per year in 2016 based on four head per wedding and funeral). This accounts for 14% of cattle in stock and 39% of total turnoff. These findings are similar to those of NZMFAT (2017) for Vanuatu as a whole. With human population growth and a stable cattle herd, ceremonies will account for more than half of turnoff by 2030. Even without any non-ceremony sales on the open market, ceremonies will diminish the cattle herd by 2030, should the number of cattle per ceremony increase, or if breeding cattle are consumed.

Future research

While the range of interviewees in Chapter 4 gives a reasonable representation of the broader farmer population, the sample size of 16 interviews is very small. Some questions resulting in potentially significant findings have a sample pool that is too small to draw conclusions from. Continuing the interview process to result in a larger sample pool would allow for more accurate assumptions and conclusions to be drawn.

Results from Chapter 5 show that the number and proportion of ceremonial cattle use compared to commercial use in East Santo is high. While this model is appropriate given the constraints of this research project, there are many assumptions involved, and important factors that are not taken into consideration. For example, this model assumes that the herd is self-sustaining, although there is evidence that the herd is actually declining. Incorporating more data into this model and removing assumptions will increase accuracy.

The study was conducted in one particular area of Vanuatu – North East Santos. This covers a fairly homogeneous ethnic and language group, which has a long history of cattle production and consumption. This is likely to differ from other areas that have different cultural backgrounds and livelihoods where, for example, pigs are more valued and prevalent.

Due to the limited scope of the research and inability to generalise findings, no attempt has been made to draw recommendations for policy or industry.

In sum, widening and deepening the study – perhaps with additional or revised research and interview questions – would provide a more robust knowledge base from which to base policy, industry and other decisions. Such a study would require research skills in ethnography, but grounded in understanding of socio-economic aspects of household livestock production and with an appreciation of complex policy issues.

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Appendix 3.7 Bio-economic model of small-holder cattle production systems in Vanuatu

This large model consists of 9 input sheets and 2 outputs sheets (financial statements) shown below. The model reports on herd change and cash flow on a seasonal / monthly basis. The model has been disseminated and available to interested users on request.

Bio-economic model of small-holder cattle production systems in Vanuatu

This workbook models the cattle operations of a representative smallholder in East Santos, Vanuatu

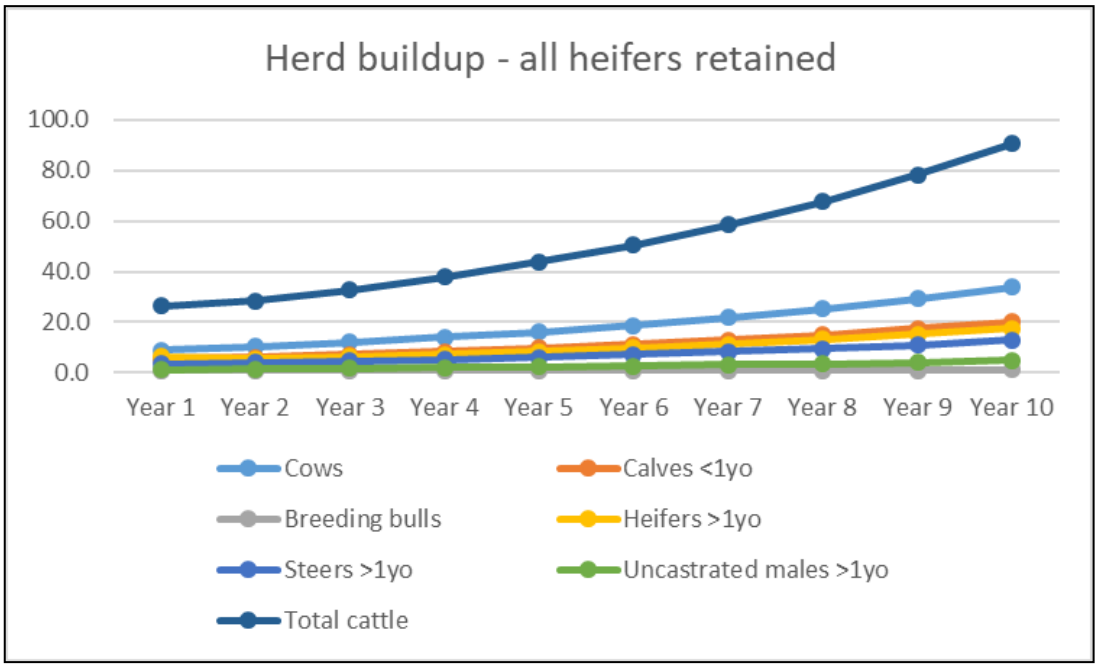
It consists of several sections and worksheets that can be navigated through these links

FRONT PAGE	INPUT SHEETS	OUTPUT SHEETS
	Basic household information	
	Land stocking	Returns to labour
	Herd structures	Cash flow
	Herd change 10 years	
	Monthly cattle calcs	
	Prices	
	Variable Costs	
	Costs capital items	
	Copra	

Use of the model is encouraged, but must be attributed to the following source "Model of small-holder cattle producer in Vanuatu" for ACIAR Project LPS-2014-037 (Scott Waldron and Keith Antfalo, 2020)

One aspect that may be of particular interest to policy makers and funding agencies is a herd model that can capture herd dynamics and growth of various classes of cattle under different production and slaughter policy scenarios. Further explanation of the tool is also available on request.

Cows												
Number beginning of year	9.0	10	12	14	16	19	22	25	29	34		
Mortality rate	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%		
Number of years cow kept	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		
Cow culling age	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0		
Number culled per year	1.0	1.1	1.3	1.5	1.8	2.0	2.4	2.7	3.2	3.7		
Culling rate	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%		
Additional sold (-) or boug	0	0	0	0	0	0	0	0	0	0		
Cows year end	9.0	10.43	12.09	14.01	16.24	18.82	21.81	25.28	29.30	33.96		


Herd buildup - all heifers retained
100.0
80.0
60.0
40.0
20.0
0.0
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
Cows
Calves <1yo
Breeding bulls
Heifers >1yo
Steers >1yo
Uncastrated males >1yo
Total cattle