

**University
Centre
Somerset**

Part of Bridgwater & Taunton College

INVESTMENT APPRAISAL

HOLLY BONNER

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REPORT INTRODUCTION

Total global meat consumption, over the past decade, has increased by around 2% a year ¹, and now provides 11% of global food energy availability and 21% of protein ². The Southwest of England contains nearly one third of the nation's beef animals ³, making beef the second biggest agricultural output value for the region, at £495 million ³, contributing to the third biggest share of agri-revenue in the UK, on a five-year average ⁴, and the 5th largest beef market internationally ⁵. Despite a plethora of opinions on beef, and its future in sustainable models of a futuristic world, emanating from Western cultures, the global protein availability of beef is projected to grow by 5.9% by 2030 ⁶. Therefore (given the challenges of sustainable food production), educating the farmers of tomorrow on effective, efficient, beef systems has, arguably, never been so critical.

Rodway Farm business is unique, belonging to Bridgwater & Taunton College, and therefore being one of the primary agricultural education facilities in the Southwest. As a result, the farm is viewed and utilised by many students each year (nearly 23,000 students enrolled in the college in 2020-21 ⁷) with agricultural students primarily joining the 65,614 farmers employed in the Southwest ³, evidencing the need to provide both a practical (and theoretical) education in beef systems to the college students. Moreover, lecturers note that they have seen a number of prospective college students choose to attend competitor colleges, identifying broader and, potentially more progressive, farm facilities as a reason for this decision, with many competitor colleges comprising beef units (see figure 1), pressurising Bridgwater and Taunton College to expand into this area. At a value to the college of £7,000 per student ⁷, the need to continue to recruit students is both a financial and fundamental need of the college, with student education the primary goal of the organisation. The inclusion of a progressive and well-managed beef enterprise has the potential to serve as an additional educational facility, driving student recruitment, whilst capitalising financially upon their attendance, increasing organisation revenue and industry reputation. Moreover, providing an alternative income source will increase the resilience and income stability of the farm, particularly in times of fluctuating farmgate milk prices.

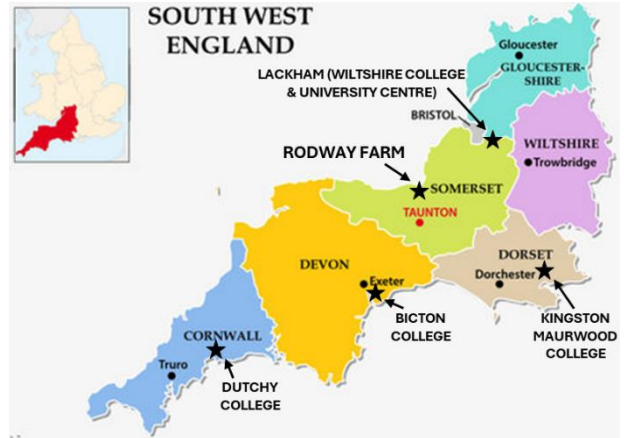


Figure 1: map of competitor colleges that have beef units (authors own)

Rodway farm is a dairy and grazing livestock farm, and education facility, of 151ha, located in Somerset. The commercial farm consists of 220 Holstien dairy cows, and a mixed sheep flock of 160 ewes, with a whole farm stocking rate of 2.14LSU/ha. Farm management has identified a steel-framed, open-sided shed, with half of this building (measuring 27m by 14m) allocated for the new beef enterprise, allowing establishment with little capital investment. However, all financial data was collected purely for farm economics, and do not account for the implications of consequent increases in student numbers (at this stage of the report), as the costs of this are hugely variable and sensitive.

Currently, the dairy herd targets 72 heifer replacement heifers per annum, using sexed semen to breed own replacements, meaning approximately 80 dairy heifer calves are bred each year. Allowing for pre and post-natal mortality, and calving interval, the herd produces 195 calves, of which approximately 115 are dairy beef, providing a readily available source of dairy beef calves for the beef enterprise. These beef calves are currently sold at 10 days, at an average value of £180/head, which is used in the following report.

A business appraisal determines a business' (or in this case an enterprise's) value/worth and endeavours to predict income, expenditure, net profitability, fixed costs, capital investment, and gross profitability. The following report builds on this structure, to create an evaluation of three potential beef systems for introduction onto the studied farm, then the selection of one, which is appraised for its financial and physical requirements and prospects. This evaluation includes a discounted cash flow (DCF), which estimates the value of the investment, based on cashflows it's expected to generate in the future ⁸. Finally, a recommendation is made to farm management, as to the viability and suitability of the potential enterprise, based on the report findings.

ANALYSIS & SELECTION OF A BEEF SYSTEM FOR RODWAY FARM

This report examined three types of beef enterprise for Rodway, in appendix 1, 2 and 3 respectively, with partial budgets depicted here. Gross margins per head for beef systems vary considerably (table 1), however this report is for Rodway Farm, as an educational operation, and business, therefore both the profitability of systems, and their ability to educate future farmers, have been considered. Given this, the author chose the systems which utilised dairy beef cross breeds. With increasing pressure on the minimalization of environmental impacts, it is arguably likely that dairy cross beef will become preferential, due to their lower greenhouse gas emissions to that of the suckler beef industry 9.

Winter finishing was selected for its low land requirement (key in a competitive market), and labour requirement was limited to part-time winter labour, compatible with the college term times. This is a critical point, as labour demand at the farm is stretched, and this simple system would be easily managed and transferable between employees. However, the enterprise is not profitable, with a low GM compared to the fixed costs and capital investment. Contrastingly, rearing dairy cross beef calves (from Rodway's dairy herd) to stores required far more winter labour, and for this labour to be specialised and skilled in calf rearing to achieve the high growth rates demonstrated. However, the manual labour is limited in summer months, when no students are on campus, and crucially the enterprise is substantially profitable, whilst providing a broad education in both calf rearing (a skill replicated across multiple agricultural sub-sectors) and beef breeding and management, hence its inclusion in the analysis. Rearing dairy cross beef calves (again Rodway's own) to finished, on an intensive forage diet, meanwhile, would demonstrate a full beef system to students, from rearing to finishing, with relatively stable labour demand year-round, and therefore was considered a good system for Rodway. However, the

BEEF SYSTEM GROSS MARGINS	Per head
Dairy cross calves reared to 3 months	£ 34
Dairy cross calves reared to 6 months	£ 51
Spring calving suckler cows	£ 20
Autumn calving suckler cows	£ 115
Summer keeping store cattle	£ 235
Winter keeping store cattle	£ 86
Summer finishing dairy cross cattle	£ 137
Winter finishing dairy cross cattle	£ 48
Averages for 2023 (Redman, G, 2022)	

Table 1: average gross margins for some UK beef systems (10)

PARTIAL BUDGET FOR THE WINTER FINISHING SYSTEM			
Reduction in profit		Increase in profit	
GM of enterprise given up	£	GM of new enterprise taken on	£
		Finishing Beef	£ 2,566
Fixed costs of new enterprise	£	Fixed costs saved from enterprise given up	£
Equipment depreciation	£ 958		
Equipment repairs and maintenance	£ 240		
Water and electricity	£ 1,008		
Rent	£ 1,969		
Labour	£ 12,653		
		(Loss)	-£ 3,997
	£ 16,828		£ 16,828

PARTIAL BUDGET FOR RODWAY DAIRY BEEF CALVES SOLD AS STORES			
Reduction in profit		Increase in profit	
GM of enterprise given up	£	GM of new enterprise taken on	£
	0	Own calves to sell as stores	£ 26,744
Fixed costs of new enterprise	£	Fixed costs saved from enterprise given up	£
Equipment depreciation	£ 340		0
Equipment repairs and maintenance	£ 85		
Water and electricity	£ 1,716		
Rent	£ 3,352		
Labour	£ 12,563		
(Profit)	£ 8,689		
	£ 26,744		£ 26,744

PARTIAL BUDGET FOR RODWAY DAIRY BEEF CALVES FINISHED ON INTENSIVE FORAGE			
GM of enterprise given up	£	GM of new enterprise taken on	£
		Own calves to finish intensive forage	£ 13,332
Fixed costs of new enterprise	£	Fixed costs saved from enterprise given up	£
Equipment depreciation	£ 966		
Equipment repairs and maintenance	£ 242		
Water and electricity	£ 1,391		
Rent	£ 2,716		
Labour	£ 7,074		
(Profit)	£ 944		
	£ 13,332		£ 13,332

system has low profitability, making it vulnerable to market disruption.

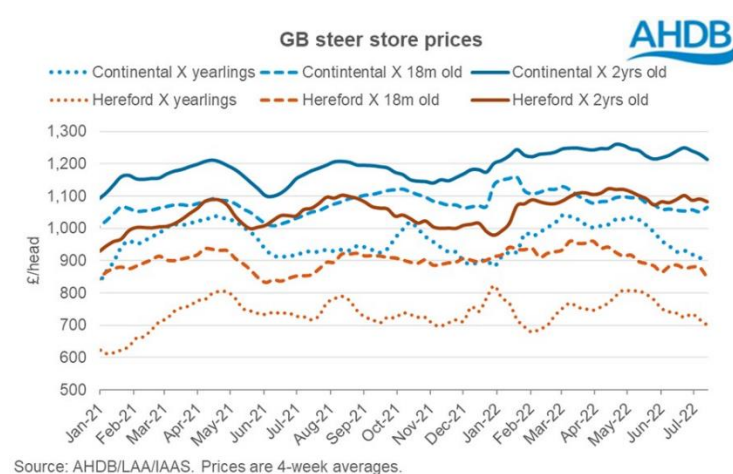
In conclusion, this suggests Rodway adopt the second system. Utilising their own calves gives the farm the opportunity to focus on strong genetic management and good colostrum plans, providing healthy, high-performing cattle for the beef enterprise, and reducing the disease risk of bringing external stock onto the premises. Although the system would not demonstrate finishing cattle to students, it could demonstrate a highly productive, progressive calf rearing programme (particularly if investment was made into new technologies, such as automatic calf feeders (FETF grants may be available 11), and monitored, performance driven, grazing management and productive grass leys, potentially demonstrating to students the utilisation of SFI actions, such as SAM3 or NUM2, within the system. Although labour demand remains the primary issue with the system, it is the most profitable and productive enterprise presented.

LIVESTOCK MARKETING

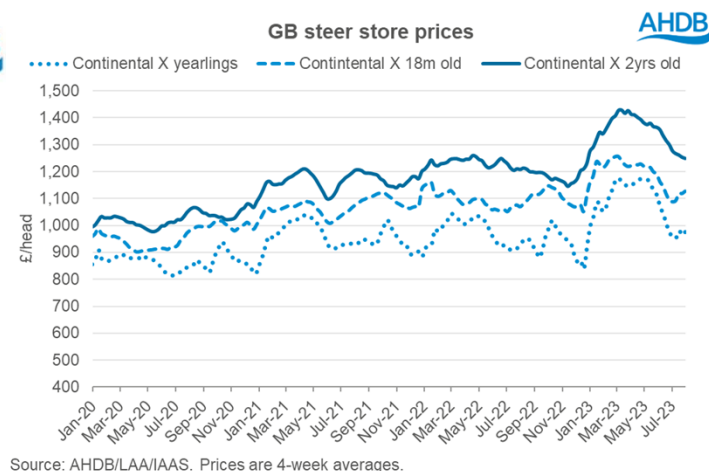
Selling as stores suits some farms, as the system requires less housing and feed than finishing, with farms deciding to sell when it is of best benefit to overall farm production. Output is achieved quicker; thus, payment is received sooner, which can benefit farm cashflow. However, there is only one main outlet for stores – auction markets. Consequently, farms are reliant on a competitive market on the day and must face reductions, through commission and market tolls. Typically, commission is 2-4.5% of sale price ¹², whilst AHDB producer levies are £4.05/head ¹³. The nearest livestock auction market to Rodway is Sedgemoor market, conveniently located just 7 miles from the farm, approximately a 20-minute journey. This is a significant beef cattle market, which Rodway is well-placed to access.

Based on the production system presented, the cattle will be sold at 12 months old, as yearlings, with a target weight of 400kg liveweight, in the Autumn, after a summer at grass. As can be seen in the graphs presented here, prices often peak in the Spring, but are closely followed by the Autumn prices ¹⁴, when finishing units may look for inputs, therefore there should be a reasonable market for the stores to be sold in the Autumn, and output prices generated in the following gross margins reflect this time of selling.

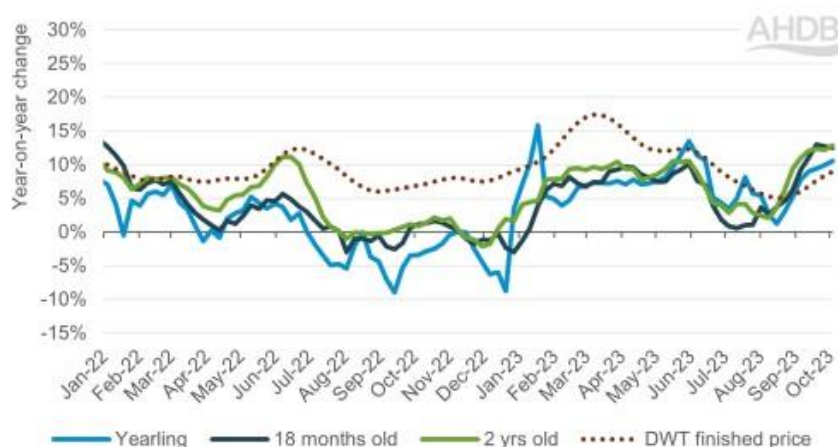
Moreover, as reflected in the data below, Rodway would be best to breed its beef cross calves to a continental beef breed, as these generate greater prices in the store market. For example, the farm could use the British Blue ‘beef impact’ straws from Cogent. This is a mixed sire semen, which can improve conception rates by 6-9% in comparison to conventional semen ¹⁷, and is specifically targeted at producing a profitable beef calf.



(AHDB, 2022) ¹⁴



(AHDB, 2023) ¹⁵



(AHDB, 2023) ¹⁶

THE ENTERPRISE GROSS MARGIN

The gross margins (GM) depicted below demonstrate the enterprise split into two production stages; the first from transfer of calves into the system at 1 or 2 weeks of age up to 6 months old, comprising the indoor calf rearing; the second from 6 months of age up to the point of sale (12 months old), during which period the stock are grazed over the summer. The data has been edited slightly since that of appendix 2, as described in the following analysis.

Stage 1		From 1/2 weeks old to 6 months		
		Per head		X 103
Value of calf		£ 550	£	56,430
Less calf purchase & 5% mortality		£ 190	£	19,494
Output		£ 360	£	36,936
Variable costs:				
	Milk Substitute	£ 74	£	7,555
	Concentrates	£ 169	£	17,339
	Hay	£ 33	£	3,386
	Vet & Med.	£ 24	£	2,462
	Bedding	£ 18	£	1,847
	Misc.	£ 12	£	1,231
Total Variable Costs		£ 330	£	33,821
Gross Margin		£ 30	£	3,115
Stage 2		From 6 months to 12 months		
		Per head		X 101
Store sales		£ 940	£	94,515
Less purchased store (incl. 2% mortality)		£ 561	£	56,407
Output		£ 379	£	38,108
Variable costs:				
	Concentrates	£ 9	£	905
	Vet & Med.	£ 15	£	1,508
	Misc.	£ 14	£	1,408
Variable costs (excl. forage)		£ 38	£	3,821
Forage variable costs		£ 106	£	10,658
Gross margin		£ 235	£	23,629
BEEF GROSS MARGIN		£ 265	£	26,744
ENTERPRISE GROSS MARGIN				
		Per head		X 101
Stage 1				
Output		£ 360	£	36,936
Total variable costs		£ 330	£	33,821
Stage 1: Gross margin		£ 30	£	3,115
Stage 2:				
Output		£ 379	£	38,108
Variable costs		£ 38	£	3,821
Forage variable costs		£ 106	£	10,658
Stage 2: Gross margin		£ 235	£	23,629
Additional student payments		£ 139	£	14,000
ENTERPRISE GROSS MARGIN		£ 403	£	40,744
(Redman.G, 2022) (Appendix 4)				

EXPLANATION OF FIGURES:

- Due to 5% mortality ¹⁰, whilst 108 enter stage 1, only 103 enter stage 2.
- Transfer calf from dairy herd to new enterprise at transfer value of £180/head, but plus £10/head within GM to account for 5% mortality ¹⁰.
- Milk substitute cost is based on the suggested figure of 28kg ¹⁸ based upon average weaning at 49 days.
- Calf concentrates: starter cake is used at a cost of £480/t up to 3 months of age, then transitioned to rearer cake at £385/t ¹⁰; always this is alongside some home-grown grain. Please refer to nutritional guidance in appendix 2.
- Hay is 200kg per calf at £131/t, based on a permanent pasture, 2 cut system ¹⁰.
- Misc. includes ear tags ¹⁰.
- Value of calf at point of transfer from stage 1 to stage 2 is £550, based on 225kg liveweight of individual at £2.44/kg ¹⁰.
- Due to 2% mortality ¹⁰ whilst 103 calves enter stage 2, only 101 are sold as stores.
- The transfer value into stage 2 is allocated as £561 per head to allow for 2% mortality, in this stage ¹⁰.
- The forage variable costs are based on improved permanent pasture at £325/ha GM ¹⁰, given a stocking rate of 1.2 grazing LSU/ha ¹⁰.
- Final sale value is £940/head, given a target liveweight of 400kg at £2.45/kg ¹⁰.
- The enterprise gross margin consists of the gross margins of both stage 1 and stage 2, plus additional student income. This is based on the recruitment of two students at the value of £7,000 each to the college ⁷, consequent of the new beef enterprise.

THE ENTERPRISE PHYSICAL REQUIREMENTS

For full descriptions refer to appendix 4.

BUILDING/HOUSING:

Management allocated an open-sided shed for the beef enterprise. This measures 14m by 27m and is currently empty with earth floors. Consequently, significant changes have been made to achieve suitability for the enterprise structure, providing 6 pens (18 calves per pen), with consideration for space requirements – see the design in appendix 4.

FEED REQUIREMENTS AND STORAGE:

This system will require the storage of hay bales and some home-grown grain, with storage capacity for 90 bales required. This could be facilitated within the second half of the building discussed, or within the yard space beside the building. Meanwhile, storage for 9.3t of grain is required, which can be facilitated in the grain bays, whilst concentrate and milk power storage is likely achievable within the feed path of the shed presented, as it will be purchased by the pallet or by the bag.

MANURE MANAGEMENT:

The predicted actual nitrogen production of the enterprise is 2,200kg/year. The current whole farm N production is 33,851kgN¹⁹ and the farm N limit is 25,670kgN¹⁹. Therefore, 10,382kgN will need to be exported off the farm per annum, equivalent to 2,058m³ of dairy cow slurry.

THE ENTERPRISE CAPITAL REQUIREMENTS

The working capital requirement totals £42,755pa (see fixed costs). This borrowing is required for 12 months and is therefore best financed on a suitable overdraft agreement. The farm should seek an overdraft policy with the lowest possible interest rates, given the volume of overdraft required.

Fixed capital required is £39,156pa, based on the building design suggested in enterprise structural requirements (see appendix 7). Borrowing the main capital will require a long-term source of finance, given the profitability of the enterprise, comprising a mortgage or a loan. However, given that the building is already established, and purely requires further work, a mortgage is likely to be a hard to acquire and bad option, as it would require handing over title deeds, but critically the college cannot obtain a mortgage. Consequently, a business loan is most suitable for this capital purchase. Business loan rates are normally between 3-5% interest, above bank base, therefore the loan would be between 8.25% and 10.25% interest rate, given the current bank base rate of 5.25%²⁰. Appendix 8 demonstrates the total capital cost of the enterprise on two loan terms – 8.25% interest pa and 10.255% interest pa (both true rate). Additionally, there would be a 2% set-up fee, equivalent to £783. The total capital cost is likely to be between £52,540 and £55,595 (see appendix 8). If Rodway Farm uses the whole enterprise profit to repay the capital expenditure, the loan should be repaid, in full, in 7 years.

CAPITAL				
Item	Unit Cost	Quantity	Total Cost	Reference
Building/Structural				
Concreting floor	£48/m ²	378m ²	£ 18,144	(Redman.G, 2022) (Floors.1)
Drainage passageways	£38/m	28m	£ 1,064	(Redman.G, 2022) (Services & Fittings.1)
Lower walls	£115/m ²	126m ²	£ 14,490	(Redman.G, 2022) (Walls & Ceilings.1.4)
Upper wall cladding	£37.50/m ²	55m ²	£ 2,063	(Redman.G, 2022) (Walls & Ceilings.1.3)
15ft gates	£ 146	6	£ 876	(Bateman, 2023)
Feed/water equipment				
Milk feeder (12 teat)	£ 246	1	£ 246	(Abbeydale Direct, 2023)
Milk feeder (6 teat)	£ 145	1	£ 145	(Abbeydale Direct, 2023)
Feed trough	£ 185	6	£ 1,109	(Abbeydale Direct, 2023)
Hay rack	£ 84	6	£ 504	(WBurton&Sons, 2023)
Water trough	£ 86	6	£ 516	(Agridirect, 2023)
Total Capital			£ 39,156	

WORKING CAPITAL	Per head	Total
Livestock Transfer Value	£ 190	£ 19,494
Milk Substitute	£ 74	£ 7,555
Concentrates	£ 178	£ 18,244
Hay	£ 33	£ 3,386
Vet & Med	£ 39	£ 3,971
Bedding	£ 18	£ 1,847
Misc.	£ 26	£ 2,639
Forage Variable Costs	£ 106	£ 10,658
Equipment repairs and maintenance	£ 1	£ 85
Water and electricity	£ 17	£ 1,716
Rent	£ 33	£ 3,352
Labour	£ 125	£ 12,563
	£ 840	£ 85,509
	£ 420	£ 42,755

THE ENTERPRISE FIXED COSTS

Fixed costs total £22,895, and are considerably larger than in appendix 2, due to the inclusion of 'additional' building depreciation, repairs, and maintenance for further work done. For full explanation, see appendix 6.

Furthermore, labour was calculated upon the basis of stage 1 and 2 (each

lasting 6 months), before combining values for the total, to achieve 836 hours per year at total cost of £12,563pa. The hours/head/month were calculated using an early weaning, 0-6 months calf system ²¹ for stage 1, whilst using a 6-12 months summer grazing system ²¹ for stage 2. Labour is charged at £15 per hour, based on total cost to employer for median labour costs, based on the average farm worker earnings and hours ²¹. A contractor's charge accounts for cleaning the shed annually, before each new batch of cattle, was included at £49 – this is for a single hour (which would be realistic to clean out the designated shed) for a telehandler and man ²². This work would be completed when contractors are on site to clean out other farm buildings.

FIXED COSTS					
Additional building depreciation	£ 35,760.50	x	5%	pa	£ 1,788
Additional building repairs and maintance	£ 35,760.50	x	2%	pa	£ 715
Interest	£ 17,880.25	x	8%	pa	£ 1,430
Insurance	£ 35,760.50	x	1%	pa	£ 358
Equiptment depreciation	£ 3,395.80	x	10%	pa	£ 340
Equiptment repairs and maintance	£ 3,395.80	x	2.5%	pa	£ 85
Water and electricity	£ 85.00	per ha	x	20.19	£ 1,716
Rent	£ 166.00	per ha	x	20.19	£ 3,352
Labour	836	hrs pa	x	£ 15.02	£ 12,563
Contractors	£ 49.17	per hr	x	1 hr pa	£ 49
					£ 22,395

INVESTMENT APPRAISAL

Partial budget demonstrates a positive annual profit of £18,348, which is very encouraging, given this is an agricultural investment. The return on capital is 33.7%, over four times the interest rate, which is again reassuring and hard to fault. Moreover, payback is calculated to be 3 years, making for a rapid return on outlay for the college business. For more detailed analysis see appendix 9.

Explanation of partial budget calculations:

- This is a new, additional enterprise, therefore there is no GM of an enterprise given up or fixed costs saved.
- Gross margin of the new enterprise totals £26,744. This is the GM (previously described) generated by the store cattle enterprise. Additionally, the funding the college would receive for two additional students, consequent of the beef enterprise providing an educational facility is £7,000 per student ⁷.
- Fixed costs of the new enterprise total £22,395, as previously examined.

PARTIAL BUDGET			
Reduction in profit		Increase in profit	
GM of enterprise given up	£	GM of new enterprise taken on	£
	0	Own calves to sell as stores	£ 26,744
		Additional student income	£ 14,000
Fixed costs of new enterprise	£	Fixed costs saved from enterprise given up	£
Additional building depreciation	£ 1,788		0
Additional building repairs and maintance	£ 715		
Interest	£ 1,430		
Insurance	£ 358		
Equiptment depreciation	£ 340		
Equiptment repairs and maintance	£ 85		
Water and electricity	£ 1,716		
Rent	£ 3,352		
Labour	£ 12,563		
Contractors	£ 49		
Profit	£ 18,348		
	£ 40,744		£ 40,744

DISCOUNTED CASHFLOW															
YEAR		0	1	2	3	4	5	6	7	8	9	10	11		
INCOME															
Store Cattle			£ 94,515	£ 94,515	£ 94,515	£ 94,515	£ 94,515	£ 94,515	£ 94,515	£ 94,515	£ 94,515	£ 94,515	£ 94,515		
(7% total mortality)															
(400kg liveweight @ £2.45/kg)															
Additional Student Income			£ 14,000	£ 14,000	£ 14,000	£ 14,000	£ 14,000	£ 14,000	£ 14,000	£ 14,000	£ 14,000	£ 14,000	£ 14,000		
Building															
Equipment															£ 17,880
Gates (15ft)															£ 438
Milk Feeders (inc.both)															£ -
Feed trough, hay rack, water trough															£ 213
TOTAL INCOME			£108,515	£ 108,515	£108,515	£108,515	£108,515	£108,515	£108,515	£108,515	£108,515	£ 108,515	£ 108,515		£ 18,531
EXPENDITURE															
Variable Costs															
Milk Substitute (£73.64/hd)			£ 7,555	£ 7,555	£ 7,555	£ 7,555	£ 7,555	£ 7,555	£ 7,555	£ 7,555	£ 7,555	£ 7,555	£ 7,555		
Hay (£33/hd)			£ 3,386	£ 3,386	£ 3,386	£ 3,386	£ 3,386	£ 3,386	£ 3,386	£ 3,386	£ 3,386	£ 3,386	£ 3,386		
Bedding (£18/hd)			£ 1,847	£ 1,847	£ 1,847	£ 1,847	£ 1,847	£ 1,847	£ 1,847	£ 1,847	£ 1,847	£ 1,847	£ 1,847		
Concentrates (£169/hd for stage 1)			£ 17,339	£ 17,339	£ 17,339	£ 17,339	£ 17,339	£ 17,339	£ 17,339	£ 17,339	£ 17,339	£ 17,339	£ 17,339		
Concentrates (£9/hd for stage 2)			£ 905	£ 905	£ 905	£ 905	£ 905	£ 905	£ 905	£ 905	£ 905	£ 905	£ 905		
Vet & Med (£24/hd for stage 1)			£ 2,462	£ 2,462	£ 2,462	£ 2,462	£ 2,462	£ 2,462	£ 2,462	£ 2,462	£ 2,462	£ 2,462	£ 2,462		
Vet & Med (£15/hd for stage 2)			£ 1,508	£ 1,508	£ 1,508	£ 1,508	£ 1,508	£ 1,508	£ 1,508	£ 1,508	£ 1,508	£ 1,508	£ 1,508		
Misc. (£12/hd for stage 1)			£ 1,231	£ 1,231	£ 1,231	£ 1,231	£ 1,231	£ 1,231	£ 1,231	£ 1,231	£ 1,231	£ 1,231	£ 1,231		
Misc. (£14/hd for stage 2)			£ 1,408	£ 1,408	£ 1,408	£ 1,408	£ 1,408	£ 1,408	£ 1,408	£ 1,408	£ 1,408	£ 1,408	£ 1,408		
Forage Variable Costs (£106/hd)			£ 10,658	£ 10,658	£ 10,658	£ 10,658	£ 10,658	£ 10,658	£ 10,658	£ 10,658	£ 10,658	£ 10,658	£ 10,658		
Fixed Costs															
Building repairs & maintenance			£ 715	£ 715	£ 715	£ 715	£ 715	£ 715	£ 715	£ 715	£ 715	£ 715	£ 715		
Equipment repairs & maintenance			£ 85	£ 85	£ 85	£ 85	£ 85	£ 85	£ 85	£ 85	£ 85	£ 85	£ 85		
Interest			£ 1,430	£ 1,430	£ 1,430	£ 1,430	£ 1,430	£ 1,430	£ 1,430	£ 1,430	£ 1,430	£ 1,430	£ 1,430		
Insurance			£ 358	£ 358	£ 358	£ 358	£ 358	£ 358	£ 358	£ 358	£ 358	£ 358	£ 358		
Water & Electricity			£ 1,716	£ 1,716	£ 1,716	£ 1,716	£ 1,716	£ 1,716	£ 1,716	£ 1,716	£ 1,716	£ 1,716	£ 1,716		
Rent			£ 3,352	£ 3,352	£ 3,352	£ 3,352	£ 3,352	£ 3,352	£ 3,352	£ 3,352	£ 3,352	£ 3,352	£ 3,352		
Labour			£ 12,563	£ 12,563	£ 12,563	£ 12,563	£ 12,563	£ 12,563	£ 12,563	£ 12,563	£ 12,563	£ 12,563	£ 12,563		
Contractors			£ 49	£ 49	£ 49	£ 49	£ 49	£ 49	£ 49	£ 49	£ 49	£ 49	£ 49		
Building															
Building			£ 35,761												
Equipment			£ 3,396												
Purchases															
Calf transfer (£180/hd)			£ 19,440	£ 19,440	£ 19,440	£ 19,440	£ 19,440	£ 19,440	£ 19,440	£ 19,440	£ 19,440	£ 19,440	£ 19,440		
TOTAL EXPENDITURE		£ 39,156	£ 88,008	£ 88,008	£ 88,008	£ 88,008	£ 88,008	£ 88,008	£ 88,008	£ 88,008	£ 88,008	£ 88,008	£ 88,008		£ -
NET CASHFLOW															
Discounted Factor at 8 %			0.926	0.857	0.794	0.735	0.681	0.63	0.583	0.54	0.5	0.463	0.429		
Discounted Cashflow			£ 18,990	£ 17,575	£ 16,283	£ 15,073	£ 13,966	£ 12,920	£ 11,956	£ 11,074	£ 10,254	£ 9,495	£ 7,950		
Net Present Value	£ 145,534														
Conclusion	Difference of	£ 106,378	Therefore	This would be a very good investment of capital finance											

Explanation of discounted cash flow analysis calculations:

- Income: store cattle sales of 101 cattle (108 with total system mortality rate of 7%) each sold at 400kg liveweight for £2.45/kg₁₀; the additional student income from two more students (at £7,000 each (BTC, 2023)); building terminal value at 50% (5% depreciation per annum for 10 years); equipment terminal values of gates at 50% (given that they are metal), milk feeders at 0% (these are likely to be in very poor condition after 10 years), and feed troughs, hay racks, and water troughs at 10% (as these are metal and plastic they are likely to retain some value even if not in prime condition).
- Expenditure: variable costs are included each year for stage 1 and stage 2 (as shown in GM) including the first year, as this is a 12-month system, completed within each financial year; fixed costs (excluding depreciation); building and equipment capital costs in year 0 are as previously described in capital explanation; calf transfer value at £180/head₁₀ for 108 calves – note this is a transfer from Rodway dairy herd, not an external purchase.
- Discounted factors at 8% interest rate pa₂₃.
- Net present value of £145,534, giving a difference on investment of £106,378. This is an encouraging figure, predicting the potential for a highly profitable investment.

SENSITIVITY ANALYSIS (SA)

Analysis demonstrated the impact milk powder feeding practice had on profitability, in appendix 10, with large variations in the advised quantities fed, indicating that gross margin of stage one could be significantly impacted by changing the rate of feeding. It was shown that losses were made in the

rearing stage when feed rates were matched to that of dairy heifer rearing systems. Moreover, the second SA was conducted to distinguish the impact on changing mortality rates and store prices on the whole enterprise GM, as mortality rate is considered a critical management measure. This demonstrated that significant increases in output could be achieved through marginal improvements in mortality rate. Moreover, when further examined, the enterprise demonstrated extremely strong resilience to increases in fixed costs, providing reassurance to investors.

However, this also raises the importance of the additional student income generated by the inclusion of beef facilities. This value serves to contribute significantly to enterprise profits, as shown throughout the investment appraisal factors. As the SA below demonstrates, whilst this report has been based on two additional students, increasing numbers would substantially increase profitability. It must be noted that the additional expense, to the college, of more students has not been included, for reasons previously stated. Nonetheless, analysis clearly demonstrates the significant positive impact of furthering student numbers to enterprise revenue. Nevertheless, without the student payments considered, the enterprise still stands to generate profit, whilst the impact of increasing the colleges reputation within the industry, as a well-rounded educational facility, should be considered a consequent intangible asset of substantial value.

A commonality between all examined SA is the ability to demonstrate the resilience of this enterprise structure. Whilst beef system profitability, in England, is often considered poor, and the market volatile, these SAs can serve as reassurance to Rodway management that the proposed system, of rearing its own dairy beef calves to stores, should be not only profitable, but consistently so, both in the face of market fluctuations and potential changes in fixed costs, such as labour, which many farming businesses find challenging.

ENTERPRISE PROFITABILITY		Number of additional students				
		0	1	2	3	4
Store cattle sale price	£ 880	-£ 1,769	£ 5,231	£ 12,231	£ 19,231	£ 26,231
	£ 900	£ 240	£ 7,240	£ 14,240	£ 21,240	£ 28,240
	£ 920	£ 2,249	£ 9,249	£ 16,249	£ 23,249	£ 30,249
	£ 940	£ 4,348	£ 11,348	£ 18,348	£ 25,348	£ 32,348
	£ 960	£ 6,266	£ 13,266	£ 20,266	£ 27,266	£ 34,266
	£ 980	£ 8,275	£ 15,275	£ 22,275	£ 29,275	£ 36,275
	£ 1,000	£ 10,284	£ 17,284	£ 24,284	£ 31,284	£ 38,284

CONCLUSION

Of the three systems proposed, only the 'calf rearing to store' system appeared to generate significant profit. The enterprise was also appealing for Rodway, given the lack of labour required during the summer months (when students are not present and there is labour pressure regarding harvesting and fieldwork) and the ability of the system to utilise dairy beef calves from the dairy herd. Furthermore, marketing the stores was extremely convenient given the farms close location to Sedgemoor market, and storing forage would be achievable, without much impact on the current farm layout. Further scrutiny showed a substantial gross margin of £40,744, comprising £26,744 generated by the beef system, and £14,000 provided for two extra students.

However, significant capital investment would be required to establish a hygienic and safe environment for calves, within the provided building, with a total capital expense of £39,156, and an additional working capital requirement of £42,755. Moreover, fixed costs were substantial (£22,895), totalling 56% as a percentage of gross margin. The partial budget disclosed an annual profit of £18,348, facilitating a return on capital of 50% and payback period of 2 years. DCF analysis generated a difference on investment of £106,378 over 10 years, making it apparent that this would be a sustainable investment for Rodway, encouraging investment into the system.

In conclusion, this report has presented a beef system that has the potential to be a highly successful (and critically needed) educational facility, whilst generating significant profit. A range of sensitivity analyses demonstrated the resilience of the proposed system to changes in input costs, fixed costs, and generated income (including store cattle prices and student payments), facilitating financial stability and security.

This report is limited by the ability to predict future markets, in a rapidly changing agricultural industry, which could affect input/output costs, as well as the impact of labour availability/skills on performance of the enterprise. In reviewing the investment appraisal, reducing the labour costs would quickly benefit the profitability of the enterprise, making it wise that further research should be done on the potential to introduce automatic milk feeders to the system, which would significantly reduce labour required in Stage 1. Further research into cheaper labour forms (namely an apprentice) would also be beneficial.

APPENDICES:

APPENDIX 1: A WINTER FINISHING SYSTEM

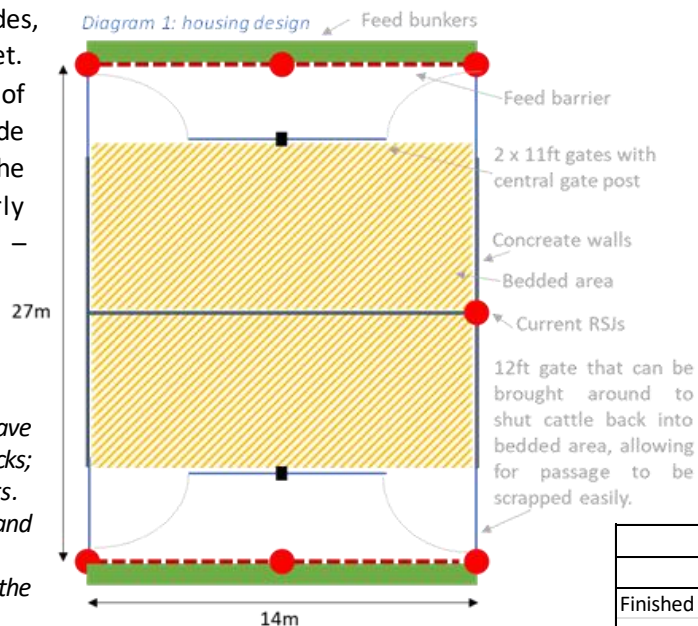
This enterprise would comprise of 54 dairy-bred store cattle, purchased at 400kg (approximately 12 months of age) ¹⁰, with the target of finishing at 604kg liveweight, at 19 months of age ¹⁰. Cattle will be sourced from either a livestock market or via private contract, which may be achievable, as set numbers of stock will be required each autumn. Land required for the enterprise will be 11.86ha, with cattle fed on a diet of grass silage and purchased concentrates. As demonstrated, there are two pens, with 27 cattle in each, with a minimum bedded area of 5m²/head and minimum loafing area of 1.8m²/head ²⁴. The shed provides a floorspace of 378m², making the stocking rate within the building 7m²/head, hence 54 cattle in the system.

Feed barriers are used, providing feed space of 28cm/head ²⁴, as per livestock maximum weigh (604kg). Feed bunkers run along both sides, facilitating space for the diet feeder, providing a TMR diet. Figures presented have been based upon a diet of 3.5kg/day/head of concentrates, alongside 16.82kg/day/head of grass silage ¹⁰. However, note the author advises a more specialised diet, particularly including long fibre, to increase DMI and rumen stability – approximately 1-1.5kg/day of straw is advised ²⁵, comprising 12% of DMI for finishing cattle ²⁶.

Notes on all fixed costs (appendix 1,2 & 3):

- Equipment depreciation and repairs and maintenance have been calculated on all portable structures: gates; hay racks; feed troughs; feed barriers; water troughs; milk feeders.
- Water and electricity ²⁷ (mainly sheep and cattle lowland under 90ha)
- Building depreciation and repairs were not included, as the building is on the farm already.
- Labour charge based on total cost to employer for median labour costs, based on the average farm worker earnings and hours ²¹

FIXED COSTS					
Equipment depreciation	£9,583.92	x	10% pa	£	958
Equipment repairs and maintenance	£9,583.92	x	2.5% pa	£	240
Water and electricity	£ 85.00	per ha	x	11.86	£ 1,008
Rent	£ 166.00	per ha	x	11.86	£ 1,969
Labour	842.4	hrs pa	x	£15.02	£ 12,653
					£ 16,828



STOCKING RATE:					
12-19 months =	0.8	LSU			
Kept for 7 months	7	x	0.8	LSU =	0.47
Whole enterprise	0.47	LSU x	54	=	25.38
Land required	25.38	LSU		=	11.54
High S.R	2.2	LSU/ha			
Land required	25.38	LSU		=	11.86
Rodway S.R	2.14	LSU/ha			

CAPITAL				
Item	Unit Cost	Quantity	Total Cost	Reference
Building				
Concreting floor	£48/m ²	378m ²	£18,144.00	(Redman.G, 2022) (Floors.1)
Drainage passageways	£38/m	28m	£ 1,064.00	(Redman.G, 2022) (Services & Fittings.1)
Lower walls	£115/m ²	53.4m ²	£ 6,141.00	(Redman.G, 2022) (Walls & Ceilings.1.4)
Upper wall cladding	£37.50/m ²	47.7m ²	£ 1,788.75	(Redman.G, 2022) (Walls & Ceilings.1.3)
12ft gates	£835.92	4	£ 835.92	(MoleValleyFarmers, 2023)
11ft gates	£142.00	4	£ 568.00	(Bridgemans, 2023)
Feed/water				
2 x 14m feed barriers	£175/m	28m	£ 4,900.00	(Redman.G, 2022) (Services & Fittings.10)
2 x 14m feed bunkers	£100/m	28m	£ 2,800.00	(Redman.G, 2022) (Services & Fittings.11)
Water trough	£240.00	2	£ 480.00	(McVeighParker, 2023)
Total Capital			£36,721.67	

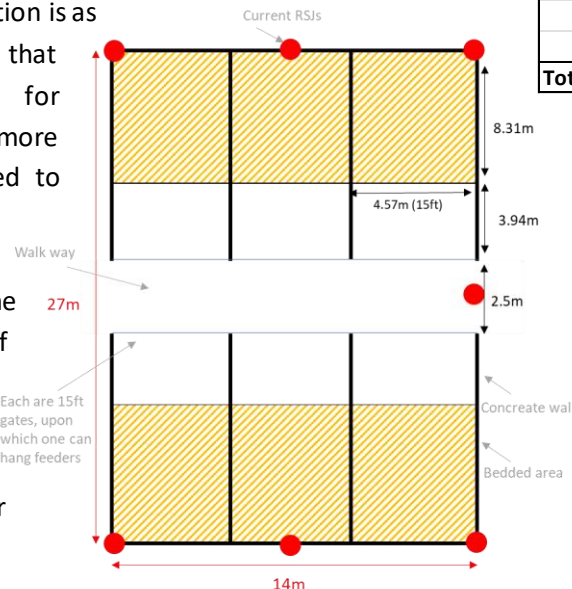
LABOUR		
Head/month	1.2	hrs
X 54 cattle	64.8	hrs
X 7 months in system	453.6	hrs
	842.4	hrs per year
	16.2	hrs/week

WORKING CAPITAL	Per head	Total
Livestock Purchase	£ 959	£ 51,268
Concentrates	£ 179	£ 9,569
Vet & Med	£ 24	£ 1,283
Bedding	£ 49	£ 2,620
Misc.	£ 29	£ 1,550
Forage Variable Costs	£ 133	£ 7,110
Equipment repairs and maintenance	£ 4	£ 240
Water and electricity	£ 19	£ 1,008
Rent	£ 36	£ 1,969
Labour	£ 351	£ 18,979
	£ 1,784	£ 95,596
	£ 892	£ 47,798

GROSS MARGIN		
	Per head	Total
Finished Sales	£ 1,421	£ 75,967
Less purchased store (incl. mortality)	£ 959	£ 51,268
Output	£ 462	£ 24,699
Variable costs:		
Concentrates	£ 179	£ 9,569
Vet & Med.	£ 24	£ 1,283
Bedding	£ 49	£ 2,620
Misc.	£ 29	£ 1,550
Variable Costs (excl. forage)	£ 281	£ 15,022
Forage variable costs	£ 133	£ 7,110
Gross Margin	£ 48	£ 2,566
(Redman.G, 2022)		

APPENDIX 2: SELLING HOME-BRED DAIRY BEEF CATTLE AS STORES

This enterprise consists of 108, primarily autumn born, dairy cross beef calves, transferred from the main dairy herd on Rodway. Calves are transferred at 1-2 weeks of age, reared indoors over winter, before summer grazing, targeting Autumn markets, at 400kg liveweight ¹⁰. Land required is 20.19ha, reduced to 19.64ha for productive land/new leys. Building design is based on six pens of 18 calves. Maximum weights would be 245kg ¹⁰, however the design allows for cattle to reach 300kg (facilitating late turnout), with space exceeding 2m²/head bedded area and 1m²/head loafing area ²⁴. The stocking rate is 3.18m²/head. Nutrition is as shown, but the author notes, that although this has been used for budgeting purposes, a strong and more complex diet is likely to be needed to meet growth targets and maintain calve health, which should be aided by direct transfer from the dairy enterprise, reducing the risk of poor colostrum management (the single most influential management factor on calf health and survival ²⁸) and transfer of diseases at market.



CAPITAL				
Item	Unit Cost	Quantity	Total Cost	Reference
Building/Structural				
Concreting floor	£48/m ²	378m ²	£ 18,144	(Redman.G, 2022) (Floors.1)
Drainage passageways	£38/m	28m	£ 1,064	(Redman.G, 2022) (Services & Fittings.1)
Lower walls	£115/m ²	126m ²	£ 14,490	(Redman.G, 2022) (Walls & Ceilings.1.4)
Upper wall cladding	£37.50/m ²	55m ²	£ 2,063	(Redman.G, 2022) (Walls & Ceilings.1.3)
15ft gates	£ 146	6	£ 876	(Bateman, 2023)
Feed/water equipment				
Milk feeder (12 teat)	£ 246	1	£ 246	(Abbeydale Direct, 2023)
Milk feeder (6 teat)	£ 145	1	£ 145	(Abbeydale Direct, 2023)
Feed trough	£ 185	6	£ 1,109	(Abbeydale Direct, 2023)
Hay rack	£ 84	6	£ 504	(W.Burton&Sons, 2023)
Water trough	£ 86	6	£ 516	(Agridirect, 2023)
Total Capital			£ 39,156	

NUTRITION	
0-3 months:	
20 kg milk substitute	
160 kg concentrates	
10% home-grown grain	
50 kg hay	
3-6 months:	
290 kg concentrates	
30% home-grown grain	
200 kg hay	
6-12 months:	
Grazing	
150 g/day concentrates	
(Redman.G, 2022)	

WORKING CAPITAL		Per head	Total
Livestock Transfer Value		£ 190	£ 19,494
Milk Substitute		£ 74	£ 7,555
Concentrates		£ 178	£ 18,244
Hay		£ 33	£ 3,386
Vet & Med		£ 39	£ 3,971
Bedding		£ 18	£ 1,847
Misc.		£ 26	£ 2,639
Forage Variable Costs		£ 106	£ 10,658
Equipment repairs and maintenance		£ 1	£ 85
Water and electricity		£ 17	£ 1,716
Rent		£ 33	£ 3,352
Labour		£ 125	£ 12,563
		£ 840	£ 85,509
		£ 420	£ 42,755

FIXED COSTS					
Equipment depreciation	£ 3,396	x	10% pa		£ 340
Equipment repairs and maintenance	£ 3,396	x	2.5% pa		£ 85
Water and electricity	£ 85	per ha	x	20.19	£ 1,716
Rent	£ 166	per ha	x	20.19	£ 3,352
Labour	836	hrs pa	x	£ 15.02	£ 12,563
					£ 23,899

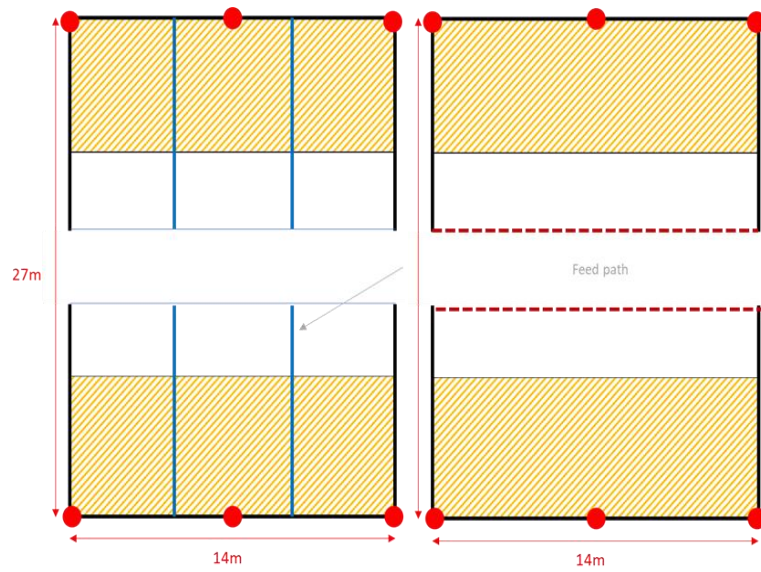
LABOUR			
Stage 1: 0-6 months		Stage 2: 6-12 months	
Head/month	1.6 hrs	Head/month	0.3 hrs
X 108 cattle	173 hrs	X 103 cattle	31 hrs
X 6 months	1037 hrs	X 6 months	185 hrs
Total Labour		1222 hrs pa	
		24 hrs/week	

STOCKING RATE:					
0-12 months =	0.4	LSU			
Whole enterprise	0.4	LSU x	108	=	43.2 LSU
Land required	43.2	LSU		=	19.64 ha
High S.R	2.2	LSU/ha			
Land required	43.2	LSU		=	20.19 ha
Rodway S.R	2.14	LSU/ha			

GROSS MARGIN			
		Per head	X 108
Gross Margin of Stage 1			
Output		£ 360	£ 36,936
Total Variable Costs		£ 330	£ 33,821
Gross Margin		£ 30	£ 3,115
Gross Margin of Stage 2			
Output		£ 379	£ 38,108
Variable Costs (excl. forage)		£ 38	£ 3,821
Forage variable costs		£ 106	£ 10,658
Gross Margin		£ 235	£ 23,629
Overall Gross Margin for System		£ 265	£ 26,744
(Redman.G, 2022)		(Appendix 4)	

APPENDIX 3: SELLING HOME-BRED DAIRY BEEF CATTLE FINISHED

This final enterprise proposes dairy cross beef calves, from the main dairy herd on Rodway, are transferred into the enterprise at 1-2 weeks of age for a transfer value of £180/head ¹⁰. At 6 months, they are transferred to a finishing system, for slaughter at 18 months ¹⁰. Housing allows for 50 animals in two groups of 25, facilitating two intakes of calves, to work with the current AYR calving pattern. Land required is 16.36ha. Two building designs are required to facilitate the change in systems from rearing to intensive finishing, therefore space allowances have been based upon the maximum weights in the finishing stage of 610kg ¹⁰ (5m² bedded area and 1.8m² loafing ²⁴). Blue interior walls are cattle hurdles, so removable, allowing for this change. Stocking rate is 6.86m²/head, with 5 pens of 10 calves (spare pen for storage/isolation) in first 6 months, then two pens of 25 to finish. Calves are reared with the same nutritional plan as the previous system, up to 6 months, then an intensive forage diet of 1.8kg/day concentrates, 5.2kg/day maize silage and 5.1kg/day grass silage ¹⁰ is implemented.



CAPITAL				
	Unit Cost	Quantity	Total Cost	Reference
Building				
Concreting floor	£48/m ²	378m ²	£ 18,144	(Redman.G, 2022) (Floors.1)
Drainage passageways	£38/m	28m	£ 1,064	(Redman.G, 2022) (Services & Fittings.1)
Lower walls	£115/m ²	77m ²	£ 8,850	(Redman.G, 2022) (Walls & Ceilings.1.4)
Upper wall cladding	£37.50/m ²	52.5m ²	£ 1,969	(Redman.G, 2022) (Walls & Ceilings.1.3)
15ft gates	£ 146.00	6	£ 876	(Bateman, 2023)
Cattle hurdles (3mLx1.5mH)	£ 153.00	16	£ 2,448	(Bateman, 2023)
2 x 14m feed barriers	£175/m	28m	£ 4,900	(Redman.G, 2022) (Services & Fittings.10)
Feed/water				
Milk feeder (10 teat)	£212.94	1	£ 213	(KiwiKit, 2023)
Feed trough	£79.80	5	£ 398	(Abbeyle Direct, 2023)
Hay rack	£79.20	5	£ 396	(W.Burton&Sons, 2023)
Water trough	£ 86.00	5	£ 430	(Agridirect, 2023)
Total Capital			£ 39,687	

LABOUR			
0-12 months (intensive beef)		Housed beef finishing	
Head/month	1 hrs	Head/month	1.2 hrs
X 50 cattle	50 hrs	X 48 cattle	57 hrs
X 12 months	600 hrs	X 6 months	342 hrs
Year 1	12 hrs/wk	Year 2	7 hrs/wk
Average labour for the system		471 hrs pa	

STOCKING RATE:						
0-12 months =	0.4	LSU				
12-24 months =	0.6	LSU				
Kept for 6 months	0.6	LSU	=	0.3	LSU	
	2					
Total LSU/head	0.3 +	0.4	=	0.7	LSU	
Whole enterprise	0.7	LSU x	50	=	35	LSU
Land required	35	LSU		=	15.91	ha
High S.R	2.2	LSU/ha				
Land required	35	LSU		=	16.36	ha
Rodway S.R	2.14	LSU/ha				

WORKING CAPITAL	Per head	Total
Livestock Transfer Value	£ 190	£ 9,025
Milk Substitute	£ 53	£ 2,518
Concentrates	£ 399	£ 18,843
Vet & Med	£ 45	£ 2,128
Hay	£ 33	£ 1,568
Bedding	£ 66	£ 3,112
Misc.	£ 102	£ 4,802
Forage Variable Costs	£ 147	£ 6,913
Equipment repairs and maintance	£ 15	£ 757
Water and electricity	£ 28	£ 1,391
Rent	£ 54	£ 2,716
Labour	£ 141	£ 7,074
	£ 1,274	£ 60,846
	£ 637	£ 30,423

GROSS MARGIN			
	Per head	X 50	
Gross Margin of Rearing Stage			
Output	£ 360.00	£ 17,100.00	
Total Variable Costs	£ 309.00	£ 14,677.50	
Gross Margin	£ 51.00	£ 2,422.50	
Gross Margin of Finishing Stage			
Output	£ 767.00	£ 36,068.18	
Variable Costs (excl. forage)	£ 388.00	£ 18,245.70	
Forage variable costs	£ 147.00	£ 6,912.68	
Gross Margin	£ 232.00	£ 10,909.80	
Overall Gross Margin for System	£ 283.00	£ 13,332.30	
(Redman.G, 2022) (Appendix 3)			

FIXED COSTS					
Equipment depreciation	£ 9,660	x	10%	pa	£ 966
Equipment repairs and maintenance	£ 9,660	x	2.5%	pa	£ 242
Water and electricity	£ 85	per ha	x	16.36 ha	£ 1,391
Rent	£ 166	per ha	x	16.36 ha	£ 2,716
Labour	471	hrs pa	x	£ 15.02 per hr	£ 7,074
					£ 12,388

APPENDIX 4: ENTERPRISE PHYSICAL REQUIREMENTS

BUILDING/HOUSING:

Floor surfaces have been concreted and interior walls constructed with concrete panelling, costing just over 80% of the capital expenditure. However, this is highly important to calf health, with enteric diseases the most frequent cause of calf mortality and morbidity²⁹. Smooth, concrete surfaces have lower levels of pathogens, such as e-coli, primarily due to ease and effectiveness of cleansing²⁹. To provide effective drainage flooring has a slope fall of 5%, under the bedded area (with straw at a minimum depth of 15cm³⁰, leading to a covered drainage channel, at the side of the passageway, encouraging draining of the bedded area, keeping conditions optimal for reduction of pathogens and warmth of calves. Solid exterior walls are built to 1m high, with vertical space boarding to 2.45m high, critical with the high stocking rate making effective ventilation critical. Calves are not newborns, so have a broader thermoneutral zone, nonetheless these animals should not be exposed to wind speeds greater than 2m/sec³¹.

FEED REQUIREMENTS AND STORAGE:

This system will require the storage of hay bales and some home-grown grain. The storage of concentrates and milk power is likely achievable within the feed path of the shed presented. Based upon the proposed diet, 27 tonnes of hay and 9.3 tonnes of grain are required. Meanwhile, 0.77ha are required for hay production³² (note this is for hay only, not grazing, hence the difference between this value and that of the enterprise requirement).

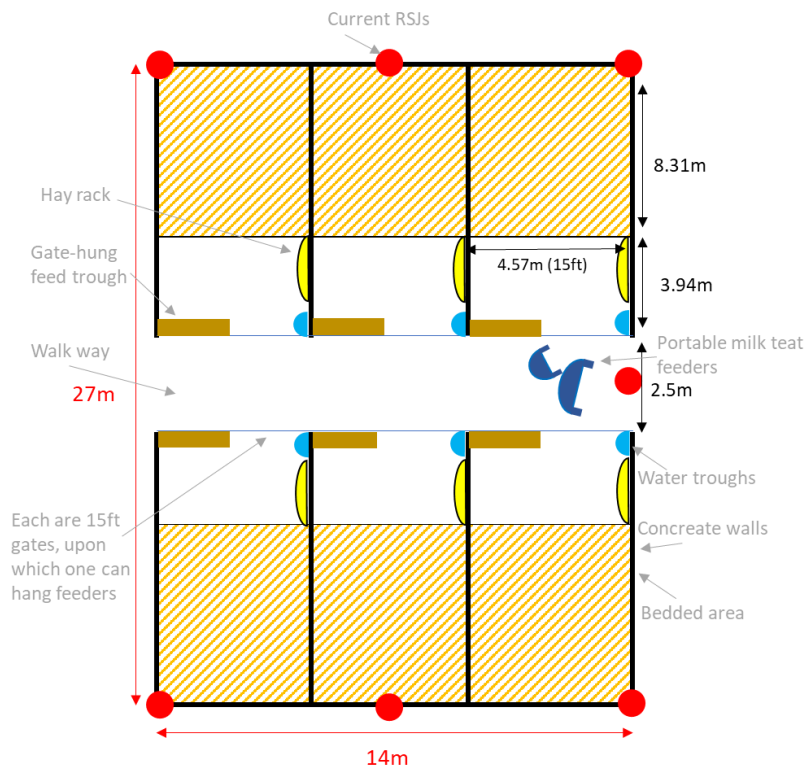
Calculated upon an average 4x5ft hay bale weight of 300kg³³, storage capacity for 90 bales is required. This could be facilitated within the second half of the building discussed, or within the yard space beside the building, as shown in figure 1.

Grain is required to complement starter/rearer feed, to promote rumen development. Grain inclusion can also aid intakes, with calves fed coarse starter mixes initially eating more than those on pelleted feeds¹⁸. An example ration of half oats, half barley grains have been used here, with oats high in fibre, helping to develop rumen muscle²⁵ and barley proven to increase DLWG, feed efficiency and rumen fermentation³⁴, when fed alongside high crude protein starter concentrate (ideally 18%²⁶). On this basis, 4.65t of each grain is required, equating to 0.76ha oats and 0.64ha barley, based on average yields³². This tonnage can be stored in the grain bays available on Rodway Farm.

MANURE MANAGEMENT:

The predicted actual nitrogen production is 2,200kg/year, with the total volume of FYM produced 273m³/year, accounting for the number of months the livestock are in the described growth stage and the number of months they are housed (as this affects bedding contribution to FYM). As the entire farm is in a NVZ (Nitrogen Vulnerable Zone), all hectareage is limited to 170kgN, therefore the whole farm N limit is 25,670kgN¹⁹. With the inclusion of the new enterprise, the farm will be required to export 10,382kgN/year, equivalent to approximately 2,060m³ of dairy cow slurry.

Figure 1: Example of bale stack location outside cattle shed (GoogleEarth, 2023)



MANURE MANAGEMENT:

CURRENT N PRODUCTION ON RODWAY FARM	Number of Livestock Units	N produced by 1 livestock unit kgN/yr	Total N produced by all these livestock kgN/yr	Volume of slurry produced by 1LSU m³/yr	Total volume of slurry produced m³/yr	Volume of dung produced by 1LSU m³/month	Total volume of dung produced m³/month
1 calf (all categories) up to 3 months	18	1.4	25.2	2.5		0.3	4.9
1 dairy cow from 3 months and less than 13 months	54	29.0	1,566.0	7.2	388.8		
1 dairy cow from 13 months up to first calf	72	61.0	4,392.0	144.0	10,368.0		
1 dairy cow after first calf (>9000 litres milk yield)	220	115.0	25,300.0	22.8	5,016.0		
1 female for breeding >25 months weighing >500 kg	8	83.0	664.0	16.2		1.8	14.0
Sheep >60kg inc lambs	160	11.9	1,904.0	1.8		0.2	31.2
			33,851.2		15,772.8		50.2

NEW ENTERPRISE N PRODUCTION							
Livestock Type	Number of Livestock Units	Total N produced by 1 livestock unit kgN/yr	Total N produced by all these livestock kgN/yr	Actual N produced by enterprise kgN/yr	Volume of dung produced by 1LSU m³/month	Total volume of dung produced m³/month	Actual volume of excreta produced by enterprise m³/yr
1 calf (all categories) up to 3 months	108	1.4	151.2	37.8	0.27	29.16	87.48
1 beef cow or steer (castrated male) from 3 months and less than 13 months	103	28	2884	2163	0.6	61.8	185.4
				2200.8			272.88

FARM NITROGEN LIMIT (NVZ)				
Area of farm in NVZ (ha)	x	Livestock Manure N Farm Limit Kg/N	=	Livestock Manure N Capacity Kg/N
151		170		25670

SUMMARY		
Current N production	33,851	KgN/yr
New enterprise N production	2,201	KgN/yr
Total farm N production	36,052	KgN/yr
Farm N limit	25,670	KgN/yr
N to be exported	10,382	KgN/yr

A single dairy cow (>9,000L milk yield) produces approximately 115KgN/year and 22.8m³ slurry per year. On this basis, 2,058m³ slurry per year would need to be exported to achieve the reduction of 10,382KgN/year.

APPENDIX 5: STOCKING RATE CALCULATIONS

Replacement unit 1LSU X 72	= 72 LSU	
Dairy cow 1LSU X 220	= 220 LSU	
Ewe (with lambs) 0.15LSU X 160LSU	= 24 LSU	
Ram 0.15LSU X 6	= 0.9 LSU	
Suckler cow 0.8LSU X 8	= 6.4 LSU	Stocking rate = $\frac{323.3 \text{ LSU}}{151\text{ha}} = 2.14 \text{ LSU/ha}$
	323.3 LSU	

Note: land required for each enterprise proposed has been calculated upon the current farm stocking rate, as it was assumed nearby land for rent would be of similar productivity. Should the stocking rate be increased to 2.2LSU/ha then less land would be required for each enterprise, as suggested in this report.

APPENDIX 6: FIXED COSTS

Fixed costs total £22,895, and are considerably larger than in appendix 2, due to the inclusion of ‘additional’ building depreciation, repairs, and maintenance for further work done (for concreting the floor, and the work done on the lower and upper walls) which were calculated on the value of those features, not the entire building, as that would be accounted for in the whole farm trading account. Again, insurance and interest were calculated only on building items. Meanwhile, equipment values were calculated upon all portable structures (gates, feeders, troughs, etc.). The table left below demonstrates how capitol items have been split between building and equipment for the purpose of calculations ³⁵. Table right below demonstrates labour cost calculations ²¹.

Building and eqiupment calculations					
	Item	Unit Cost	Quantity	Total Cost	Reference
Building items	Concreting floor	£48/m²	378m²	£ 18,144.00	(Redman.G, 2022) (Floors.1)
	Drainage passageways	£38/m	28m	£ 1,064.00	(Redman.G, 2022) (Services & Fittings.1)
	Lower walls	£115/m²	126m²	£ 14,490.00	(Redman.G, 2022) (Walls & Ceilings.1.4)
	Upper wall cladding	£37.50/m²	55m²	£ 2,062.50	(Redman.G, 2022) (Walls & Ceilings.1.3)
Equipment items	15ft gates	£ 146.00	6	£ 876.00	(Bateman, 2023)
	Milk feeder (12 teat)	£246.00	1	£ 246.00	(Abbeydale Direct, 2023)
	Milk feeder (6 teat)	£145.00	1	£ 145.00	(Abbeydale Direct, 2023)
	Feed trough	£184.80	6	£ 1,108.80	(Abbeydale Direct, 2023)
	Hay rack	£84.00	6	£ 504.00	(WBurton&Sons, 2023)
	Water trough	£ 86.00	6	£ 516.00	(Agridirect, 2023)
Total Capital				£ 39,156.30	

Labour				
Stage 1	1.1 hrs/hd/month X 108	119 hrs/month	x 6 months	713 total hrs
Stage 2	0.2 hrs/hd/month X 103	21 hrs/month	x 6 months	124 total hrs
				836 hrs/pa
				16 avg.hrs/wk
				Stage 1: winter months 30 hrs/week
				Stage 2: summer months 5 hrs/week
(Redman.G, 2022)				

APPENDIX 7: CAPITAL COSTS

There is the potential for installation of computerized, automatic calf feeders, known to reduce feeding labour time (compared to bucket feeding) by two thirds ³⁶ (particularly beneficial for Rodway, given staff availability), and used to identify disease cases before emersion of clinical signs ³⁷. These technologies are increasing popular, showing students innovative and progressive practices. However, the cost of this installation has not been included in the capital costs presented, to give a fair picture of a maximum labour impact/cost scenario within fixed costs. Moreover, there are many grants that may aid purchasing this equipment, consequently affecting cost, depending on the college’s individual eligibility, therefore the introduction of automatic milk feeders to the new enterprise is an area for further research.

APPENDIX 8: BUSINESS LOAN COST

Business Loan Cost at 8.25% Interest pa (True Rate)				
Year	Loan value at year start	Interest at 8.25%	Capital repaid	Loan value at year end
1	£ 39,156	£ 3,230	£ 5,779	£ 33,377
2	£ 33,377	£ 2,754	£ 5,779	£ 27,599
3	£ 27,599	£ 2,277	£ 5,779	£ 21,820
4	£ 21,820	£ 1,800	£ 5,779	£ 16,041
5	£ 16,041	£ 1,323	£ 5,779	£ 10,262
6	£ 10,262	£ 847	£ 5,779	£ 4,483
7	£ 4,483	£ 370	£ 4,483	£ -
Total interest paid =				£ 12,601
Loan value =				£ 39,156
Setting up fee @2% =				£ 783
Total capital cost =				£ 52,540

Business Loan Cost at 10.25% Interest pa (True Rate)				
Year	Loan value at year start	Interest at 10.25%	Capital repaid	Loan value at year end
1	£ 39,156	£ 4,014	£ 5,779	£ 33,377
2	£ 33,377	£ 3,421	£ 5,779	£ 27,599
3	£ 27,599	£ 2,829	£ 5,779	£ 21,820
4	£ 21,820	£ 2,237	£ 5,779	£ 16,041
5	£ 16,041	£ 1,644	£ 5,779	£ 10,262
6	£ 10,262	£ 1,052	£ 5,779	£ 4,483
7	£ 4,483	£ 460	£ 4,483	£ -
Total interest paid =				£ 15,656
Loan value =				£ 39,156
Setting up fee @2% =				£ 783
Total capital cost =				£ 55,595

APPENDIX 9: INVESTMENT APPRAISAL FIGURES

Explanation of RoC calculations:

- Original capital investment is the cost of calves (enterprise gross margin), and the costs of building alterations and equipment (enterprise fixed costs).

RETURN ON CAPITAL				
RoC =	profit before interest		x 100	
	original investment			
Profit before interest =				
£ 18,348	+	£ 1,430	=	£ 19,779
RoC =	£ 19,779	x 100 =	33.7	%
	£ 58,650			

Explanation of pay back calculations:

- Cash savings consist of cash income minus cash expenditure.
- Cash income is the enterprise gross margin, as described in partial budget.
- Cash expenditure is derived from cash fixed costs, exclusive of depreciation.
- Cash savings £20,476.
- Payback period is 3 years.
- This assessment is very encouraging for farm management, demonstrating that the enterprise will be a relatively short-term investment, rapidly providing income.

PAYBACK:				
Payback =	original investment			
	Cash savings			
	Cash income = £ 40,744			
	Cash expenditure =			
	Additional building repairs and maintenance	£	715	
	Interest	£	1,430	
	Insurance	£	358	
	Equipment repairs and maintenance	£	85	
	Water and electricity	£	1,716	
	Rent	£	3,352	
	Labour	£	12,563	
	Contractors	£	49	
		£	20,268	
	Cash savings =	£	20,476	
Payback =	£ 58,650.30			
	£ 20,476.00	=		3 years to payback

APPENDIX 10: SENSITIVITY ANALYSIS

IMPACT ON STAGE 1 GM		Milk powder price (£/t)				
		2600	2615	2630	2645	2660
Quantity of milk powder (kg/head)	20	£ 52.00	£ 51.70	£ 51.40	£ 51.10	£ 50.80
	24	£ 41.60	£ 41.24	£ 40.88	£ 40.52	£ 40.16
	28	£ 31.20	£ 30.78	£ 30.36	£ 29.94	£ 29.52
	32	£ 20.80	£ 20.32	£ 19.84	£ 19.36	£ 18.88
	36	£ 10.40	£ 9.86	£ 9.32	£ 8.78	£ 8.24
	40	£ -	-£ 0.60	-£ 1.20	-£ 1.80	-£ 2.40

The impact of milk powder feeding practice is observed. This has considerable ability to impact the performance of livestock, with evidence demonstrating the close relationship between milk replacer quantity and quality, with that of calf growth and performance; higher feeding rates have been found to increase feed conversion ³⁸. Moreover, there are variations in the advised quantities to feed, from 20kg-31kg ^{10, 18, 39}. As demonstrated, increasing the quantity fed would have considerable impact on the GM, even if the milk powder is cheaper, with losses made, in stage 1, when over 40kg are fed.

IMPACT OF CHANGE IN OUTPUT		Mortality Rate						
		4%	5%	6%	7%	8%	9%	10%
Store sale value	£ 800	£ 12,997	£12,862	£ 12,727	£ 12,456	£ 12,456	£ 12,320	£ 12,185
	£ 820	£ 15,071	£14,914	£ 14,757	£ 14,600	£ 14,443	£ 14,286	£ 14,129
	£ 840	£ 17,145	£16,966	£ 16,787	£ 16,609	£ 16,430	£ 16,252	£ 16,073
	£ 860	£ 19,218	£19,018	£ 18,818	£ 18,618	£ 18,417	£ 18,217	£ 18,017
	£ 880	£ 21,292	£21,070	£ 20,848	£ 20,626	£ 20,405	£ 20,183	£ 19,961
	£ 900	£ 23,365	£23,122	£ 22,879	£ 22,635	£ 22,392	£ 22,148	£ 21,905
	£ 920	£ 25,439	£25,174	£ 24,909	£ 24,644	£ 24,379	£ 24,114	£ 23,849
	£ 940	£ 27,513	£27,226	£ 26,939	£ 26,744	£ 26,366	£ 26,080	£ 25,793
	£ 980	£ 31,660	£31,330	£ 31,000	£ 30,670	£ 30,341	£ 30,011	£ 29,681
	£ 1,000	£ 33,733	£33,382	£ 33,031	£ 32,679	£ 32,328	£ 31,976	£ 31,625

The second SA was conducted to distinguish the impact on changing mortality rates and store prices on the whole enterprise GM. Whilst the report was conducted on 108 cattle with a mortality rate of 7% ¹⁰, over the two stages, changes in this mortality rate readily impact the gross margin, with decreases rapidly, increasing GM of the enterprise. This is an interesting observation for the farm and should influence management targets. Furthermore, a reduced mortality rate would increase financial resilience, in the face of potentially lower store prices.

The third SA demonstrates the impact on beef system profit, affected by changing fixed costs and changes in the mortality rate of cattle (and therefore enterprise output). Whilst profits considerably decrease when fixed costs and mortality rate increase, the SA expects the enterprise to achieve a profit even with a substantial increase of £3000 in fixed costs and mortality rate at 10%. Whilst this is a highly undesirable condition for the enterprise to get into, it should serve to reassure investors (the college) of the resilience of the suggested beef system.

IMPACT ON PROFIT		Gross Margin - based on changing mortality rate						
		4%	5%	6%	7%	8%	9%	10%
Fixed Costs	19395	£ 8,117	£ 7,831	£ 7,544	£ 7,348	£ 6,971	£ 6,684	£ 6,398
	20395	£ 7,117	£ 6,831	£ 6,544	£ 6,348	£ 5,971	£ 5,684	£ 5,398
	21395	£ 6,117	£ 5,831	£ 5,544	£ 5,348	£ 4,971	£ 4,684	£ 4,398
	22395	£ 5,117	£ 4,831	£ 4,544	£ 4,348	£ 3,971	£ 3,684	£ 3,398
	23395	£ 4,117	£ 3,831	£ 3,544	£ 3,348	£ 2,971	£ 2,684	£ 2,398
	24395	£ 3,117	£ 2,831	£ 2,544	£ 2,348	£ 1,971	£ 1,684	£ 1,398
	25395	£ 2,117	£ 1,831	£ 1,544	£ 1,348	£ 971	£ 684	£ 398

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