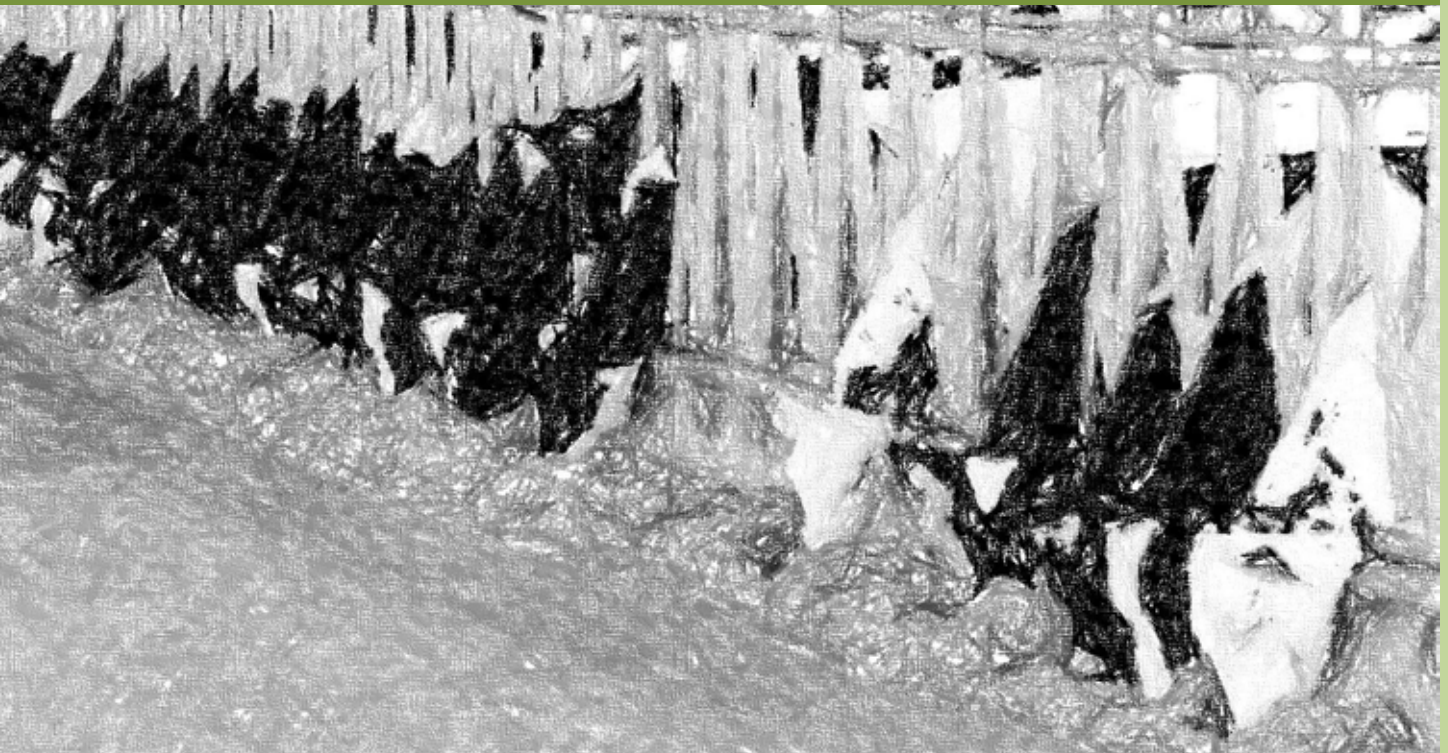


ANNEX 4



Bill of quantities Modular Cow House

ANNEX 4: BILL OF QUANTITIES (BOQ)

I. SPECIFICATION MATERIAL OPTIONS AND COST COMPARISON

In making specifications for the proposed barn design the following assumptions have been made:

- Site preparation work is billed separately including levelling and compacting the ground to a firm sub-structure ready for the floor material and its finishes. However, an estimated provisional amount has been used for purposes of generating a cost estimate for every phase.
- Roof structure is supported on columns and not on walls.
- Quantities are based on the Modular design Phases I to IV annexed herewith.

The Modular Barn is designed in modules of 20 cows. It is herewith noted that the utilities (comprising the farm office, milk parlour, milk room and machine room) are a pivotal component of the dairy farm, irrespective of the herd size, and are therefore a constant element in all the modules designed.

The utility spaces/rooms are designed to accommodate the farm growth from 20 cows up to 80, through expanding the required capacity (of works and equipment) within the existing designed structure (as established in the 1st phase of 20 cows). This ensures continuity and reduced costs incurred at various levels of growth.

The barn consists of four major elements namely: floor, structural columns, roof and joinery (comprising cubicle divisions and fencing post and rail components within and at the extents of the barn). The cost of these four elements varies depending on the choice of material specified in the construction of the barn as described in the tables below. Site preparation, foundations and associated sub-structure works are provisional and dependent on nature of selected site. We have taken a working figure of KES 250 per square meter of floor area of barn for purposes of cost estimates.

Element 1: Floor

Proposed material	Cost per M ² (KES)
<ul style="list-style-type: none"> 150 mm thick mass concrete; A142 BRC mesh reinforcement with diamond pattern grooves; 12mm wide by 5mm deep and 60mm apart. Quantity rates calculation inclusive of associated low height concrete walling for borders and feed fence. 	2,000
<ul style="list-style-type: none"> 40mm thick precast concrete paving blocks. Quantity rates calculation inclusive of associated low height concrete walling for borders and feed fence. 	1,500
<ul style="list-style-type: none"> Dressed natural stone bedded in mortar. Quantity rates calculation inclusive of associated low height concrete walling for borders and feed fence. 	2,000
<ul style="list-style-type: none"> Mazeras stone (regular cut tiles). Quantity rates calculation inclusive of associated low height concrete walling for borders and feed fence. 	1,500

Element 2: Structural columns (up to 6 meters length)

Proposed material	Cost per unit (piece)
• Treated wooden posts; minimum diameter 150mm	4,000
• 3mm thick 150x150mm SHS or 150mm diameter CHS;	11,200
• Reinforced concrete columns; 200x200mm with 4No. Y12 reinforcement bars specs.	14,500

Element 3: Roof Structure and covering (m²)

Proposed material	Cost per M ² (KES)
• G.C.I sheets on steel structure to detailed specs.	4,000
• Galvanized iron sheets on timber structure to detailed specs.	2,500

Element 4: Joinery and fittings (general fencing within the barn, water troughs)

Element 4a: Water troughs

Proposed material	Cost per unit (KES)
• Custom made 3mm thick steel plate water trough; all surfaces primed and painted to check corrosion. Dimensions and specs to approval: (2000x500mm)type	10,000
• Custom made 3mm thick steel plate water trough; all surfaces primed and painted to check corrosion. Dimensions and specs to approval: (1000mm diameter x 900mm deep)type	5,000

Element 4b: Feed fence/yoke

Proposed material	Cost per lm (KES)
• 3mm thick 50mm diameter Steel Circular sections for all the rails complete with centralized manual locking/un-locking system	6,000
• 3mm thick 50mm diameter Steel Circular sections for all the rails	5,000

Element 4c: General confinement fences and control gates

Proposed material	Cost per lm (KES)
• 3mm thick 50mm diameter Steel Circular sections for all the rails, 3 No. horizontals AND 2 meters high 3mm thick 76mm diameter Steel Circular sections for all the posts at 1.2 meters c/c	3,500
• 75x50mm timber sections for all the rails, 3 No. horizontals AND 2 meters high 100x50mm timber sections for all posts; 1.2 meters c/c	1,200

Element 4d: Cows cubicles/sleeping bays

Proposed material	Cost per cubicle (KES)
• 3mm thick 50mm diameter Steel Circular sections for all the rails, 2 No. horizontals AND 2 meters high 3mm thick 76mm diameter Steel Circular sections for all the posts	6,000
• 75x50mm timber sections for all the rails, 2 No. horizontals AND 2 meters high 100x50mm timber sections for all posts	2,500

Element 4e: Calf pens (movables)

Proposed material	Cost per unit (KES)
<ul style="list-style-type: none"> 3mm thick 50mm diameter Steel Circular sections for all the rails, 2 No. horizontals, 2 meters high 3mm thick 76mm diameter Steel Circular sections for all the posts, 25x 50 Rectangular Hollow Section (RHS) sidings and 25x50mm RHS slated raised floor 	12,000
<ul style="list-style-type: none"> 50x50mm timber sections for all the rails, 2 No. horizontals; 2 meters high 100x50mm timber sections for all posts, 25x75mm sidings and 25x75mm timber slated raised floor 	6,000

Element 4f: Milk parlour bays

Proposed material	Cost per unit (KES)
<ul style="list-style-type: none"> 3mm thick 50mm diameter Steel Circular sections for all the rails, 2 No. horizontals, 2 meters high 3mm thick 76mm diameter Steel Circular sections for all the posts; fabricated into the herringbone design to specs 	10,000
<ul style="list-style-type: none"> 50x50mm timber sections for all the rails, 2 No. horizontals; 2 meters high 100x50mm timber sections for all posts; fabricated into the herringbone design to specs 	3,000

Element 5: Prime cost sums

Item Description	Estimate PC sum (KES)
<ul style="list-style-type: none"> Utility rooms construction and finishing works; walling(100m²), openings and ceiling(60m²) 	296,000
<ul style="list-style-type: none"> Plumbing and drainage works 	100,000
<ul style="list-style-type: none"> Electrical works 	120,000
<ul style="list-style-type: none"> Manure storage pit (range between 50m³ to 150m³) 	100,000 to 250,000
<ul style="list-style-type: none"> Water storage tanks 	
<ul style="list-style-type: none"> Biogas plant 	
<ul style="list-style-type: none"> Generator set (standby) 	
<ul style="list-style-type: none"> Spray race 	

II. QUANTITIES BY PHASE

II.1 QUANTITIES FOR PHASE I - 20 COWS BARN

QUANTITY DESCRIPTION	UNIT	QUANTITY
Concrete floor area	M ²	450
Rammed earth floor area	M ²	136
Total barn floor area	M ²	586
Structural columns	No.	30
Roof area	M ²	702
Fence and gates	LM	120
Cows feed fence	LM	15
Young stock feed fence	LM	25
Milk parlour bays	No.	3
Calf pens (movable)	No.	3
Manure storage	M ³	50
Water troughs(Rectangular type)	No.	1
Water troughs(Circular type)	No.	4
• Utility rooms construction and finishing works	Item	Item
• Plumbing and drainage works	Item	Item
• Electrical works	Item	Item
• Water storage tanks	Item	Item
• Biogas plant	Item	Item
• Generator set (standby)	Item	Item
• Spray race	Item	Item

II.2 QUANTITIES FOR PHASE II - 40 COWS BARN

QUANTITY DESCRIPTION	UNIT	QUANTITY
Concrete floor area	M ²	651
Rammed earth floor area	M ²	237
Total barn floor area	M ²	888
Structural columns	No.	45
Roof area	M ²	1040
Fence and gates	LM	170
Cows feed fence	LM	27
Young stock feed fence	LM	37
Milk parlour bays	No.	6
Calf pens (movable)	No.	5
Manure storage	M ³	75
Water troughs(Rectangular type)	No.	3
Water troughs(Circular type)	No.	6
• Utility rooms construction and finishing works	Item	Item
• Plumbing and drainage works	Item	Item
• Electrical works	Item	Item
• Water storage tanks	Item	Item
• Biogas plant	Item	Item
• Generator set (standby)	Item	Item
• Spray race	Item	Item

II.3 QUANTITIES FOR PHASE III - 60 COWS BARN

QUANTITY DESCRIPTION	UNIT	QUANTITY
Concrete floor area	M ²	1016
Rammed earth floor area	M ²	340
Total barn floor area	M ²	1356
Structural columns	No.	60
Roof area	M ²	1404
Fence and gates	LM	220
Cows feed fence	LM	41
Young stock feed fence	LM	51
Milk parlour bays	No.	12
Calf pens (movable)	No.	10
Manure storage	M ³	100
Water troughs(Rectangular type)	No.	4
Water troughs(Circular type)	No.	7
• Utility rooms construction and finishing works	Item	Item
• Plumbing and drainage works	Item	Item
• Electrical works	Item	Item
• Water storage tanks	Item	Item
• Biogas plant	Item	Item
• Generator set (standby)	Item	Item
• Spray race	Item	Item

II.4 QUANTITIES FOR PHASE IV - 80 COWS BARN

QUANTITY DESCRIPTION	UNIT	QUANTITY
Concrete floor area	M ²	1242
Rammed earth floor area	M ²	443
Total barn floor area	M ²	1685
Structural columns	No.	75
Roof area	M ²	1768
Fence and gates	LM	270
Cows feed fence	LM	56
Young stock feed fence	LM	66
Milk parlour bays	No.	12
Calf pens (movable)	No.	10
Manure storage	M ³	150
Water troughs(Rectangular type)	No.	5
Water troughs(Circular type)	No.	9
• Utility rooms construction and finishing works	Item	Item
• Plumbing and drainage works	Item	Item
• Electrical works	Item	Item
• Water storage tanks	Item	Item
• Biogas plant	Item	Item
• Generator set (standby)	Item	Item
• Spray race	Item	Item

NOTE:

Wood is generally produced (sawn) in profiles (usually rectangular or square) **with sharp edges** which are not favourable for cow comfort. To **achieve rounded profiles**, the timber members require rounding through bevelling or working on a lathe machine.

Steel members specified usually come in circular section profiles that are **ideal** for cow comfort. Shaping the rails to the desired shape as in the detailed drawings require specialized labour to achieve the requisite workmanship for optimal cow comfort.

Other components that have a financial component in barn construction and must be factored in at planning level include:

- Plumbing and drainage
- Electrical installations
- Water supply and storage
- Hot water system design and installation
- Manure handling system; manure storage or biogas plant
- Storage of feed
- Milk storage
- Manure storage
- Rain water storage
- Biogas

III: APPROXIMATE BARN COST BY PHASE AND BY CHOICE OF CONSTRUCTION MATERIALS**Table 20. Total construction costs (summary Bill of Quantities)**

ELEMENT DESCRIPTION	COST ESTIMATE IN KENYA SHILLINGS (KSHS)											
	Unit price		PHASE - I 20 COWS		PHASE - II 40 COWS		PHASE - III 60 COWS		PHASE - IV 80 COWS			
	Timber	Steel	Timber	Steel	Timber	Steel	Timber	Steel	Timber	Steel	Timber	Steel
1 Substructure works provisional	250	250	146,500	146,500	222,000	222,000	339,000	339,000	421,250	421,250	421,250	421,250
2 Concrete floor works	2,250	2,250	1,012,500	1,012,500	1,464,750	1,464,750	2,286,000	2,286,000	2,794,500	2,794,500	2,794,500	2,794,500
3 Structural columns	4,000	11,200	120,000	336,000	180,000	540,000	240,000	672,000	300,000	840,000	300,000	840,000
4 Roof area	2,500	4,000	1,755,000	2,808,000	2,600,000	4,160,000	3,510,000	5,616,000	4,420,000	7,072,000	4,420,000	7,072,000
5 Fence and gates	1,200	3,500	144,000	420,000	204,000	595,000	264,000	770,000	324,000	945,000	324,000	945,000
6 Cows feed fence	6,000	6,000	90,000	90,000	162,000	162,000	246,000	246,000	336,000	336,000	336,000	336,000
7 Young stock feed fence	5,000	5,000	125,000	125,000	185,000	185,000	255,000	255,000	330,000	330,000	330,000	330,000
8 Milk parlour bays	3,000	10,000	9,000	30,000	18,000	60,000	36,000	120,000	36,000	120,000	36,000	120,000
9 Calf pens (movable)	6,000	12,000	18,000	36,000	30,000	60,000	60,000	120,000	60,000	120,000	60,000	120,000
10 Manure storage (PC Sum)			100,000	100,000	150,000	150,000	200,000	200,000	250,000	250,000	250,000	250,000
11 Water troughs (Rectangular)	10,000	10,000	10,000	10,000	30,000	30,000	40,000	40,000	50,000	50,000	50,000	50,000
12 Water troughs (Circular type)	5,000	5,000	20,000	20,000	30,000	30,000	35,000	35,000	45,000	45,000	45,000	45,000
13 Utility rooms construction and fin			296,000	296,000	296,000	296,000	296,000	296,000	296,000	296,000	296,000	296,000
14 Plumbing and drainage works			100,000	100,000	100,000	100,000	100,000	100,000	100,000.00	100,000	100,000.00	100,000
15 Electrical works (PC Sum)			120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000
16 Water storage 3x4x5m 60T ltrs *			550,000	550,000	1,100,000	1,100,000	1,650,000	1,650,000	2,200,000	2,200,000	2,200,000	2,200,000
17 Biogas plant			-	-	-	-	-	-	-	-	-	-
18 Generator set 5.5-7.5kva			250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000
19 Spray race			-	-	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000
TOTAL COST ESTIMATE			4,866,000	6,450,000	7,841,750	10,224,750	10,627,000	13,815,000	13,032,750	16,989,750	13,032,750	212,372
TOTAL ESTIMATE COST PER COW			243,300	322,500	196,044	255,619	177,117	230,250	162,909	162,909	162,909	212,372

* = based on water consumption of 100 Litres per cow per day



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