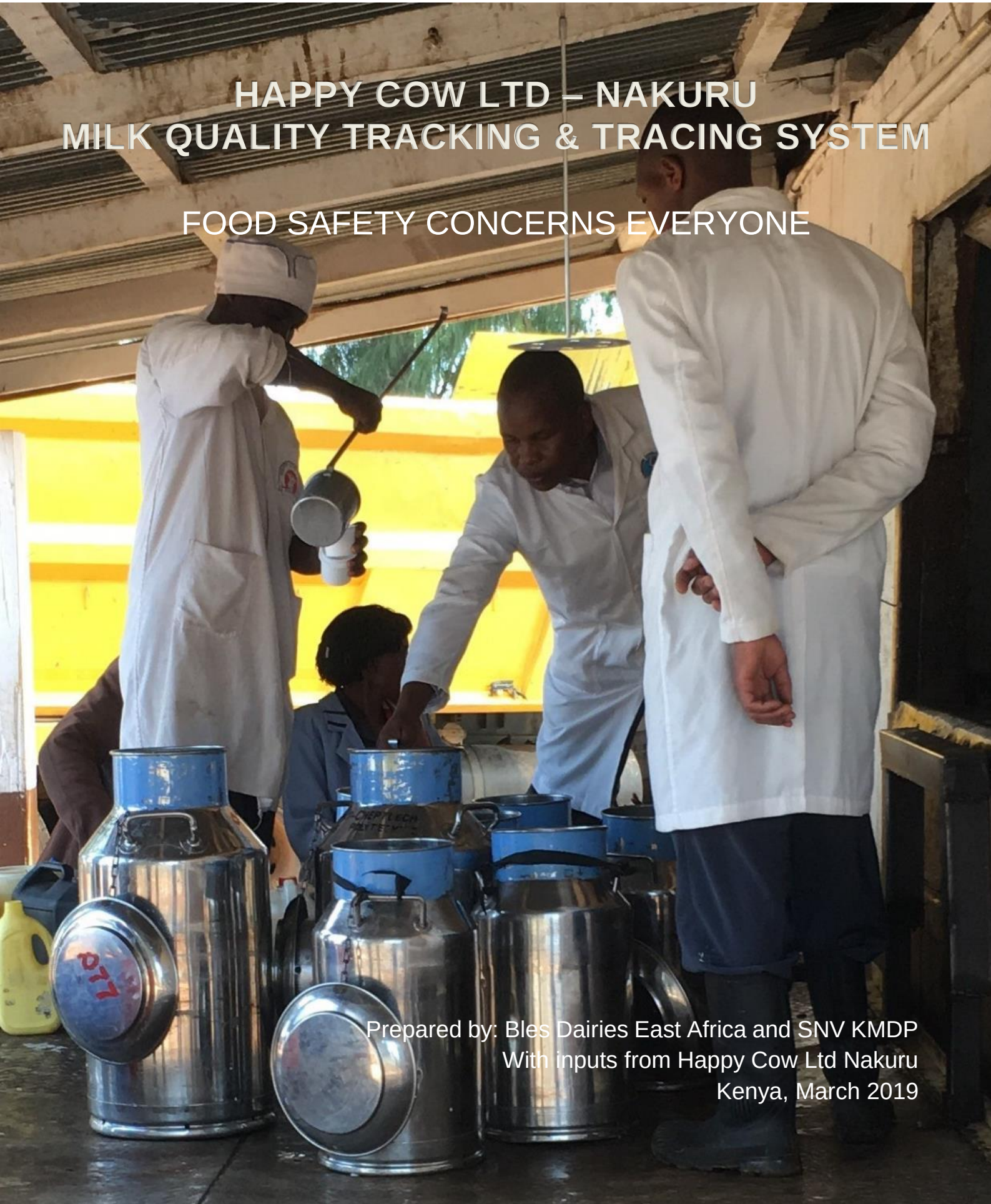
HAPPY COW LTD – NAKURU
MILK QUALITY TRACKING & TRACING SYSTEM

FOOD SAFETY CONCERNS EVERYONE



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With inputs from Happy Cow Ltd Nakuru
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ACRONYMS AND ABBREVIATIONS

alu	Aluminium (milk can(s))
BLF	beta-lactam fast test
CBE	Milk Collection & Bulking Enterprise
CC	Coliform Count
cfu/ml	colony-forming unit per millilitre
FP	Freezing Point
fte	Full time employee
HC	Happy Cow Ltd.
I&R	Identification and Registration (system)
ID	Identification (No.)
IR	Infra-Red
KDB	Kenya Dairy Board
KDPA	Kenya Dairy Processors' Association
KEBS	Kenyan Bureau of Standards
KES	Kenyan Shilling
KMDP	Kenyan Market-led Dairy Programme
KPI	Key Performance Indicator
LPD	Litres Per Day
Lt	Litre
Ltd.	Limited company
KEBS PT	Kenya Bureau of Standards Proficiency Testing
MCP	Milk Collection Point
MQBPS	Milk Quality Based Payment System
MQT&TS	Milk Quality Tracking and Tracing System
NG	New Ngorika Milk Producers Ltd.
OLE	Olenguruone Dairy Society Cooperative
PHE	Plate Heat Exchanger
PT	Proficiency Testing
QA	Quality Assurance
QC	Quality Control
SCC	Somatic Cell Count
SHF	Small Holder Farmer(s)
SNV	SNV Netherlands Development Organisation
SOP	Standard Operating Procedure
SPNT	Sulpha diazine Penicillin No Tablet
ss	Stainless Steel
T&T	Tracking & Tracing system
TA	Technical Assistance
TPC	Total Plate Count
WI	Work Instruction

1. INTRODUCTION

For the last decades the Kenyan dairy sector, dairy farmers, cooperatives and processors, have experienced challenges to comply with food safety standards of raw cow milk. The current volume-based milk payment method does not provide an incentive for farmers and dairy cooperatives to pay attention to aspects of milk quality, e.g. through applying more hygienic and safe production and handling methods and practices.
Implementation of incentive or bonus payments based on quality, is complicated in the Kenyan context. The raw milk supply chain is highly fragmented and dominated by smallholder farmers, whereas traders (also called hawkers) and processors compete over the same milk. In the milk collection chain there are several points where ownership of farmers' milk changes, transportation infrastructure is poor, the cold chain is usually inadequate and there is weak enforcement of food safety regulations and standards.

One of the very first milk processors in Kenya that acknowledged the importance of addressing food safety aspects of the milk it purchases, is Happy Cow Ltd. in Nakuru. Historical data from Happy Cow suggested major challenges in bacterial count or load (TBC), coliform count (CC), milk adulteration (with water and preservatives) and antibiotics residues, way above KEBS standards. This was confirmed during the zero setting at the start of the pilot project that started early 2015 (see below). Apart from inability to comply with the industry standards, this caused major challenges (production losses, rejects and returns) for Happy Cow, that produces cheeses and fermented products such as yoghurts and mala.In 2014 Happy Cow developed a proposal for a pilot project or "proof of concept" to track and trace milk quality and to develop and implement a payment system, based on quality of raw milk sourced from its milk suppliers, Olenguruone Dairy Farmers Co-operative Society and New Ngorika Milk Producers Ltd – hereafter both referred to as milk Collection and Bulking Centres (CBEs) for easy reference. Happy Cow and the two CBEs received financial support from SNV Kenya/The Kenya Market-led Dairy Programme (KMDP) for the implementation of the project. For the project design and technical advice during implementation, Happy Cow was supported by The Friesian Agro Consulting based in the Netherlands.

At the start of the project, New Ngorika Milk Producers Ltd had 600 members who delivered every day approximately 3,500 litres of milk to Happy Cow, whilst Olenguruone Dairy Farmers Cooperative Society had 1,600 members and supplied 5,000 litres of milk daily to Happy Cow. Each CBE collected milk from different routes from the farm gate, where transporters were responsible for milk grading. Basic infrastructure and practices for hygienic milk collection and handling were lacking. For example widespread use of non-food grade plastic containers to deliver milk, no separation of morning and evening milk, no proper weighing devices, disfunctioning cold chain, lack of clean water and so on and so forth. Apart from supplying Happy Cow, the two dairy societies also delivered milk to other processors, a situation not uncommon in Kenya amongst the smallholder-owned dairy societies.
The project design concerned the introduction of a Milk Quality Tracking & Tracing System (MQT&TS) and a Quality Based Milk Payment System (QBMPS), the two being closely connected and supported by a large number of interventions and investments in the raw milk collection chain - from farmer to factory. The project (Phase I and Phase II) covers a period of 4 years (2015-2019). This report focuses on the first part of the project: viz. the setting up of a Milk Quality Tracking & Tracing System. In 2016 when carrying out a mid-term review of the project, it was found that the CBEs collected in total 16.5 tonnes milk per day of which on average 9 tons (55%) was sold to Happy Cow. Out of this 9 tons about 4 tonnes was so called "project milk", viz. milk being collected under MQT&T project conditions. The total number of farmers that supplied milk to the CBEs was at that point in time approximately 2,750. The project milk is collected from an average of 570 farmers (21%).

Table 1. MQT&T project capacities (2016 midterm evaluation)

CBE	Totals CBE		Happy Cow	QBMPS Project		
	Milk Collection Routes (No.)	Total volume collected (kg)	Total delivered to HC (kg)	Total project routes (No.)	Total project milk (kg)	Project milk vs Total HC
Ngorika Avg. per route	16	6,5400 406	5,350 82%	6	2,400 37%	45%
Olenguruone Avg. per route	41	10,000 244	3,700 37%	6	1,600 16%	43%
Totals	57	16,500	9,050 55%	12	4,000 24%	44%

The project established mini-laboratories at the CBEs and (expanded) the main laboratory at the processing plant of Happy Cow in Nakuru, which in December 2018 received KENAS accreditation for a large number of tests, including microbiology.
Using the test results for a range of parameters at the mini-labs and the central lab at Happy Cow, the project designed a bonus payment of KES 1-2 per kilo of milk (on top of the base price), if that milk confirms to certain grades and parameters as determined by Happy Cow. Penalty payments are not applied because of the vulnerable (pilot) position of the project in the market, where other buyers of milk do not impose penalties either. The incentive of bonus payment is based mainly on parameters related to food safety e.g. milk hygiene, adulteration and antibiotic residues (and not on milk composition e.g. protein and fat).

The project faced many challenges and not all objectives have been reached in the 4 years since it started. The major challenge of the project remains the number of farmers that are eligible for a bonus payment and thus comply with the project's milk quality standards. It is also unfortunate that one of the project partners, New Ngorika, left the project prematurely during mid-2018. A detailed assessment of the project's progress and factors that impacted on this, is prepared by the 3R Kenya Project that is led by Wageningen University and Research. In spite of slow progress, the project contributed significantly to put the importance of milk quality and food safety on the national agenda, amongst others through Happy Cow's cordial relations with the Kenya Dairy Board (KDB) and it being a member of the Kenya Dairy Processors' Association (KDPA).

Lastly and most important, Happy Cow and Olenguruone are determined to continue with the systems put in place for milk quality tracking and bonus payment, after the pilot project will come to an end in May 2019. Based on the learnings from the pilot, they have fine-tuned the testing regime and bonus payment system to their needs to make it more effective. This includes installation of a milk analyser at the CBE platform for faster and cheaper testing of some parameters. The new system is described in Chapter 9 and Annex V of this report and will be further operationalised and implemented before the end of the pilot project.

2. RAW MILK COLLECTION AND TESTING REGIME: SUMMARY

The only quality analysis carried out by the CBEs before the start of the project, concerned acceptance tests including organoleptic, alcohol and density tests. This was done at the point of handing over raw milk by the farmer to the transporter (or to the CBE's platform). The tests by transporters were done at farm gate. Milk payment to farmers was volume-based and only based on estimated kilograms delivered, not by weighing. This was changed by the project by introducing Milk Collection Points or MCPs (simple sheds in the milk collection routes), where nearby farmers deliver their milk once a day and are grouped around a milk can with a unique number/ code (see also below). One farmer delivering milk to the MCP is appointed as Prefect to weigh and

record the milk, and to carry out the acceptance test for his peers and to hand over the milk to the transporter, who would then bring the milk cans to the CBE platform for further grading and testing. Milk samples in the routes are taken by a Milk Chain Coordinator.

Quality control was introduced in the project by testing of the milk accepted by the CBEs on a number of parameters, mostly related to food safety and composition. Some of these tests were already performed at Happy Cow's main lab in Nakuru (e.g. antibiotics tests, freshness) but for all tests more accurate testing equipment was purchased. A comprehensive milk sampling & testing regime was put in place for getting a better insight in the quality in the raw milk supply chain, and also for the purpose of introducing a milk bonus payment system. Table 2 below gives a detailed overview of the testing regime developed during implementation of the project. For this purpose the (main) laboratory at Happy Cow Ltd in Nakuru was expanded and at the two CBEs mini-labs were built and equipped. This Milk Quality Tracking & Tracing System analyses a number of parameters at different levels in the milk collection chain and at certain frequency as depicted in Table 2. Analysing milk for each parameter and each individual supplier at every delivery, is not financially sustainable due to the large costs involved. Hence, farmers' milk quality is controlled per group of farmers instead and tested periodically, thereby significantly reducing the number of samples and tests needed.

Table 2. Raw Milk-Testing and -Sampling Regime (Milk Quality Tracking & Tracing System)

#	Parameter	Milk Sample Point (where sample is taken)	Frequency	Point of Analysis (Where sample is analysed	Type of Test	Testing equipment / Consumables
2015 – 2018						
a	Acceptance test: -Freshness -Coagulate -Adulteration	HC platform CBE platform MCP (route)	Each milk delivery	HC platform CBE platform MCP (route)	-Organoleptic test -Alcohol test -Density test	-Human sensing -Salut tester -Density meter
b	Freshness (Titratable acidity)	Happy Cow CBE / MCP	Each milk delivery	HC main lab CBE mini lab	Acidity test	Auto burette / pipette (NaOH)
c	Freshness (pH)	Happy Cow CBE / MCP	Each milk delivery	HC main lab CBE mini lab	pH test	pH meter
d	Total Plate Count Coliform & E.coli count (cfu/ml)	Happy Cow CBE / MCP	2x/month*	HC main lab	Micro-bacterial test	Several lab equipment (3M Petrifilm)
e	Antibiotics residues	Happy Cow CBE / MCP	2x/month* Each delivery	HC main lab CBE mini lab Cans	Test kit Yoghurt test Strip test	Ampules/incubator (Delvo) Yoghurt/incubator Strips
f	Total solids (Fat/Protein/Lactose)	Happy Cow CBE / MCP	2x/month*	HC main lab	Composition test	LactoScope
g	Adulteration (water, preservatives)	Happy Cow CBE / MCP	2x/month*	HC main lab	Freezing point	LactoScope (calculated FP) Cryostar (calibrated FP)
2018						
h	Aflatoxins	Happy Cow	At random	HC main lab	M1 rapid test	Strip kit
i	Somatic Cells	Happy Cow CBE / MCP	At random	HC main lab CBE mini lab	Cell count	Cell counter DeLaval Eko scanner

* = *The tests d., e., f., and g. are tests that are done twice per payment period (payment is done 1x per month).*

3. QUALITY BASED MILK PAYMENT SYSTEM: SUMMARY

To store and analyse the data generated in the main lab at Happy Cow Nakuru and the (mini) labs and to use them for the QBMPS, a tailor made computer software was developed. This software integrated three excel sheets derived from the milk testing equipment to facilitate developing quality reports shared with the dairy societies. The dairy societies also implemented some changes in their initial software to accommodate the quality based reports. Bonus payment is done on monthly basis. The bonus system was designed to capture parameters (d-g) in Table 2, but Happy Cow and the CBEs developed their own standard for each parameter. These were more lenient than the KEBS/KDB industry standards, but considered to be more realistic and attainable by smallholder farmers and the dairy societies. The bonus system was tied to the "milk can level", where it was anticipated that a fixed group of (5-6) farmers bringing milk to the same MCP, would deliver milk always to the same 50 litre milk can(s) with a unique code/number. The milk cans to determine bonus payment are sampled at the CBE platform.

Table 3. QBMPS and KEBS Standards (‡ derived from Happy Cow)

Test	Grade	QBMPS Standard Happy Cow	KEBS Standards	Premium/penalty Score*
Total plate count (Units in cfu/ml)	A	0 - 2,000,000	<200,000	50
	B	2,000,001 - 10,000,000	200,000 - 1,000,000	0
	C	>10,000,001	>2,000,000	-50
Antibiotic residues	All	Negative	Negative	15 **
Adulteration (freezing point)	All	-0.500	-0.525 to -0.565	20***
Total solids	All	>11.75%	>11.75%	15***

*= Premium or penalty score given to milk of the corresponding to the QBMPS standard (column 3)
= AB positive milk is discarded * = Otherwise a 0 score

The scores in Table 2 are then used to determine if a certain milk can would qualify for bonus payment or penalty, and how much. The penalty was set at zero (0) so as not to discourage and upset the payment system that had been in place at the start of project. The payment system is as in Table 3 below.

Table 4. Bonus payment module employed

Grade	*Total score	Payment	Amount (KES)
A	70-100	Premium	+2
B	40-69	Standard	+1
C	<40	Penalty	0

*Calculated by summing the scores from Table

The implementation of the bonus payment system was accompanied by a number of problems, amongst others in the computer software, and as not many farmers qualified for bonus payment, this made the uptake of the incentive scheme slow. It can be concluded that the objectives of this part of the project were for various reasons not fully achieved. Although there was a general reduction in milk adulteration and presence of antibiotic (AB) residues in the raw milk supplied by the CBEs, the latter especially through early detection, still antibiotics remains a concern and bacteriological quality of the milk has not much improved (Total Plate or Total Bacterial Count). As mentioned in Chapter 1 an assessment of the total project – both the part on MQT&TS and the QBMPS - is provided by the 3R Kenya Project.

4. KEY ELEMENTS OF THE MILK QUALITY TRACKING & TRACING SYSTEM

4.1 Identification & registration system

For the MQT&TS to function all individual farmers that joined the T&T system, are identified with a unique identification and registration (number), which is the responsibility of the dairy cooperative. The unique ID number is of course necessary for the milk payment, but also of critical importance to identify farm groups. In addition to the individual farmer ID it is important that also Farmers Group milk is collected (bulked) in well identified and recognisable milk-cans.

Figure 1. ID embossed milk cans (an important part of T&T).

4.2 Milk collection method and Farmers Groups

The collection of milk from farmers is organised through collection points, where farmers are expected to gather and deliver their milk once per day (morning). The farmer groups are organised through milk cans: 4 to 5 farmers use a uniquely identified milk can that may or may not qualify for bonus payment. The transporter picks the milk cans and delivers them to the CBE platform for sampling and testing (2 x per month).

4.3 Milk can sampling and milk quality testing

The milk that is received from farm groups (milk cans) at the cooperative is tested on milk quality parameters twice per payment period of one (1) month. The logistics of identifying the milk sample bottles with the correct identification and distributing these to the relevant locations is organised by laboratory staff of Happy Cow. The analysis of the milk samples is done at the accredited laboratory of Happy Cow and includes tests on milk hygiene and milk foreign particles/residues (not composition).

4.4 Processing data of milk sample analysis results

The processing of the milk analysis results is partly automated at the laboratory at Happy Cow. However, the reporting of the milk incentive payments to the cooperatives is done manually, because the software used at Happy Cow and the dairy cooperatives is not compatible. Happy Cow only reports the milk quality analysis results and incentive payments per farmer groups. Happy Cow has no immediate access to which farmers belong to a farmer group. This information – being important for extension and training purposes - is with the dairy cooperatives (situation mid-2018).

4.5 Milk sampling regime management

The milk sampling regime (collection and analysis) is coordinated mainly through the QC capacities of the (accredited) laboratory of Happy Cow, starting with the technicians preparing the periodical milk sampling schedule (monthly), which is shared among the relevant parties who are in charge of collecting the milk samples at the different critical control points. See also Table 2 for the full list of tests carried out by Happy Cow/and or the mini-labs at the CBEs, periodically or daily and at which sample point.

In accordance to the schedule, the milk sample bottles are prepared for distribution. Great care is given to labelling the sample bottles with the correct identification e.g. from who to collect and for what purpose the sampled milk must be tested. An important aspect of the sampling regime is that farmers are not aware of the

date their milk is sampled. All the procedures that are needed to professionally execute the activities are described in the Organisation Manual and the Work Instructions, which describe for each activity the purpose, scope, references and a detailed description of how to perform the activity and in what sequence.

Figure 2. Milk analysis at main Happy Cow Laboratory

4.6 Milk sample collection

Milk samples that are required for the bonus payment, are collected at two different locations, namely at the milk collection platforms of the CBE as well as the Processor. Milk sample bottles are transported to and from the CBEs by the driver of the bulk milk tanker that travels up and down between the processing plant and CBEs. The work instructions of milk sample collection and how these must be handled are described in the relevant Work Instructions in the Organisation Manual.

4.7 Milk sample analysis at the CBE mini-Lab

Milk received at the CBEs from farmers' groups are analysed per each delivery on acceptance and presence of antibiotic residues (by means of the yoghurt test and strips).

Although these tests are done at the CBE, the analysis is done by the Quality Controller of the processor (Happy Cow) who is stationed at the CBE laboratory. All activities of milk sample collection, sample handling and milk testing/analysis and reporting are described in the Organisation Manual, including reporting formats.

4.8 Milk sample analysis at the main laboratory (Happy Cow)

The analysis of milk samples that concern the parameters of the bonus payment are done at the main laboratory at Happy Cow. The QC/Lab Technician is also responsible for the sampling regime and coordination of logistics for transportation.

All processes and standards of operations are described in the Work Instructions, including the Standard Operating Procedures and reporting lines. All analysis results are digitalised and recorded and stored in a database.

Figure 3. Milk testing mini-lab at Olenguruone

5. ESTABLISHED INFRASTRUCTURE AND TESTING EQUIPMENT

5.1 Milk Collection Points (MCPs) and Transportation

At both CBEs, Milk Collection Points have been constructed for farmers to deliver their milk for testing (grading), weighing and recording. The milk of a certain group of farmers is then bulked in one or more group-owned 50 litre aluminium milk cans with unique identification number. In Olenguruone 40 MCPs are established. In Ngorika 19 MCPs were built but they are hardly used. The MCP is a simple lockable shed with a concrete slab and tub that can be filled partially with water. Milk cans can be placed in the tub in order to keep them cool.

Figure 4. Milk reception: from outside to inside a MCP.

MCPs are manned by Prefects (or MCP Operators) whose role is to grade/test the milk, establish milk can ownership, to ensure traceability and maintain cleanliness and hygiene in the collection point. The CBEs are responsible for the milk collection routes, MCPs and appointing Prefects. The CBEs also organise the transportation of the milk to the CBE platform, either by transporters employed by the CBE or trans-porters that are self-employed and receive payment per litre of milk delivered (usually KES 2.00/litre). During implementation of the project the CBEs put a lot of effort to ban non-food grade plastic containers from the collection routes and replacing these by stainless steel or aluminium milk cans. Transporters were equipped with racks on their motorbikes to carry the 50 litre cans.

Figure 5. Eradicating milk transportation in ordinary plastic jerry cans

5.2 CBE milk cooling facilities

Both CBEs invested under the project in fast cooling equipment through an ice-bank system that enables cooling down of the milk to the required 4 degrees Celsius in a short time. At Olenguruone also the project milk can be stored separately. The latter is important for the processor in order to keep separate the best quality milk for targeted products. The cooling and storing capacity is designed for 5,000 litres a day.

Figure 6. Milk reception and testing at the CBE Platform (Milk Cooling Centre)

Figure 7. Milk cooling system with ice bank

Figure 8. As installed at Olenguruone (see figure above)

5.3 Milk quality analysis capacities at CBEs – incl. type of testing equipment

Milk Collection Points (MCPs): The prefects (MCPs) and the transporters have been trained to carry out milk grading and they have been equipped with devices like the alcohol guns to facilitate alcohol test and with lactometers to detect (especially) water adulteration. Where prefects are not available, the transporters have been equipped with these testing items. This analysis has discouraged water adulteration at the CBE.

CBE platform: During milk acceptance at the CBE platform where milk is bulked and chilled, the QC re-checks again the milk on organoleptic characteristics, water adulteration (density), alcohol test and antibiotic residues, before the milk is accepted for bulking. Also the resazurin test is carried out on daily basis for all the composite samples (i.e. per transporter or per route). The introduction of antibiotic (AB) testing at Olenguruone reception, has shown significant reduction on incidences of antibiotics in the milk. The testing involves grouping of several transporters and individual farmers to obtain a composite sample for analysis. In case it turns AB-positive, the group whose milk turns positive is divided into two and so on until the culprit is found. These vigorous checks (traceability) aim to identify the responsible person and the transporters play a big role in spreading the word (observe withdrawal periods!) as well as delivering milk from the suspected farmers separately. Testing antibiotics residues is expensive. (KES 0.27/litre). This cost includes the cost of tracking and tracing carried out when AB positive milk gets detected. At CBE level also the Somatic Cell Counter (Ekoscanner) is used to confirm farmers' milk if suspected the cows have mastitis. The testing parameters including equipment used in analysis carried out at the CBE mini-labs are depicted in Table 2 (Chapter 2).

5.4 Milk analyses at main laboratory Happy Cow

For milk supplied by the 2 CBEs, the quality analysis tests done at Happy Cow are mainly the QBMPS parameters (NB: for milk supplied by others directly at the Happy Cow factory also the tests performed at the minilabs apply). These include total plate count, antibiotic residues using Delvo SPNT-kit and Quick tests (Delvo BLF and currently Bioeasy, 5min test), total solids and freezing point depression. The DeLaval Counter is used to test for somatic cells for all the samples from the CBEs. Aflatoxin test is for the tanker composite samples.

Figure 9. Impressions of mini-labs (left) and main laboratory in Ngorika and Happy Cow

5.5 Sampling points

The sampling points from where samples are taken that are analysed in the mini-labs and at Happy Cow lab include: farmer, MCP, milk reception of CBE (which comprise the milk can samples), CBE cooler (at point of loading the tanker truck) and the milk tanker truck (at point of arrival at Happy Cow). The sampling point that has many samples is the milk reception platform. This is because it includes all the milk cans for QBMPS which have to be sampled twice in the month. Olenguruone have an average of 40 milk cans on monthly basis currently. This gives a total of around 70 samples per month for analysis. Eight samples were taken per sampling session totalling up to 16 per month at Olenguruone. In the same CBE, at the collection point, the cooling tank and the tanker, 8 samples are taken per month.

5.6 Antibiotic residues testing

Quick testing on antibiotic residues is done on a daily basis at the CBE platform for cans and the bulk milk tanker truck (strips and yoghurt test). At Happy Cow's main lab during the QBMPS sampling session the tanker samples are analysed using the Delvo SPNT 3-hours test to allow for scanning and proper records based on the z-values. This is important because the z-values are used in computing the score and consequently applied on bonus award. The Delvo scanner technology is new for Kenya and only available at Happy Cow laboratory. It is easy to operate but it needs intensive training by the supplier (Biomedica Supplies. Limiting factor is the time involved to get the test results. This test is used by Happy Cow for the Qlip proficiency testing scheme (PT-scheme). It detects all inhibitory substances that can be present in milk. Happy Cow performed well in the ring test or PT-scheme with a score of 98%.

Figure 10. Micro analysis and equipment to analyse Freezing Point and SCC

5.7 Microbiology testing (3M-Petri Method)

Total Plate Count, Coliform Count, E. Coli Count. The Total Plate Count is carried out at Happy Cow lab for all samples taken (i.e. milk cans, CBE cooling tank, tanker samples). To count the colonies, the 3M-Petri technology is used. The plate reader eliminates human errors and the results are directly imported into an excel sheet. The technology also takes a photo and has an option to save the results. The technology is also applicable for Coliform Count and E.coli Count. In Kenya, only Happy Cow lab has the 3M-Petri technology fully implemented i.e. analysis using 3M plates and colony counting using the 3M plate reader. The Coliform and E coli. Counts are used in analysis of finished products at Happy Cow as well as for the Kenya Bureau of Standards (KEBS) or the East Africa proficiency testing (PT) scheme. Happy Cow has been getting z-score within ±2, which is satisfactory. To support the PT-scheme, Happy Cow lab has the certified reference materials to act as positive control.

5.8 Compositional parameters (Fat, Protein, Lactose, Total solids)

These parameters are analysed using the Delta LactoScope machine. Initially the use of the Delta LactoScope was a challenge for Happy Cow laboratory staff, including calibration. Happy Cow learned that the equipment was not working properly after participating in Qlip PT-scheme. The z-scores were unacceptable: beyond ±4. After technical support from South Africa based Agri Enviro Solutions (AES) these problems were solved and the z-score came within acceptable range, i.e. ±2 on all parameters.

5.9 Freezing point depression

Happy Cow analyses the freezing point using the LactoScope and Cryoscope. The LactoScope freezing point depression analysis is used for QBMPS, while the Cryoscope is used to calibrate the LactoScope on the freezing point depression and is also used in Qlip PT-scheme. The Cryoscope is also used in KEBS PT. Happy Cow always performed well in proficiency testing for this parameter.

5.10 Somatic cell count (SCC)

At Happy Cow the somatic cell count was initially carried out using the Ekomilk scanner. This equipment was unable to detect the somatic cells for the Qlip PT-scheme. Happy Cow resolved this by taking the same samples for analysis to the DeLaval agent in Nairobi. The DeLaval Cell Counter (DCC) was used and the z-scores were within the required limits (±2). Hence Happy Cow procured the DCC for somatic cell count analysis and use this machine for the next TP- batch of samples with satisfactory performance (z-score within ±2).

Figure 11. Analysis of milk composition (LactoScope) and Total Plate Count (3M-petri method)

6. KENAS ACCREDITATION

As part of the project Happy Cow has been seeking accreditation of its laboratory on ISO/IEC 17025:2005 standard with the Kenya National Accreditation Service (KENAS). The standard is called “General requirements for the competence of testing and calibration laboratories”. Happy Cow participated during 2018/19 in the so-called proficiency schemes referred to above (Qlip Netherlands and KEBS Kenya).

Accreditation was granted in December 2018 for 9 physicochemical milk parameters: butter fat, protein, lactose, total solids, antibiotic residues, density, freezing point, Ph and lactic acid. The 3 microbiological parameters for which the lab is accredited are: total aerobic count, coliform count and E-coli count. The next 2 parameters Happy Cow seeks to get accreditation for are aflatoxins/mycotoxins and somatic cells. Reference is made to Annex IV for the KENAS accreditation certificate which also indicates for each parameter the type of test and test methods accredited.

Attainment of KENAS accreditation involved amongst others:

a) Developing ISO Handbook for internal procedures in the lab (SOPs, work instructions, registration, etc.) and training of Happy Cow staff.
b) Expanding the laboratory (including introduction of positive and negative air flow)
c) Purchasing of accredited testing equipment.
d) Continuous calibration of all the laboratory equipment.
e) Participation in two proficiency testing schemes (Qlip and KEBS).

More training of Happy Cow staff and investments in the laboratory are foreseen in 2019/20 as a result of the transition from ISO/IEC 17025:2005 to ISO/IEC 17025:2017. ISO/IEC 17025:2005 shall be declared obsolete by 30th November 2020. Transition training should be carried out before February 2019 and the transition documents should be complete and ready for submission to KENAS by 2nd June 2019 as per its requirements. This applies to all laboratories that wish to retain their accreditation certificate, not just to Happy Cow only.

Accreditation of the Happy Cow lab not only means that the test results of samples taken of the milk it is buying and the products it is selling are rated as credible by the relevant authority, it also implies that Happy Cow can test for others stakeholders in the sector. KEBS and Kenya Dairy Board may for example explore this opportunity for testing milk samples collected for market surveillance. This is therefore an opportunity to raise extra income to sustain the laboratory and continue training its staff.

The total cost of accreditation of the main laboratory is KES 3.26 million, which is reflected in Table 5 below.

Table 5. Cost of accreditation for 12 milk quality parameters HC lab (in KES).

HC KENAS Accreditation and recurrent costs.		
Application and Documentation		
A KENAS Accreditation costs incl application	748,000	
B Increase scope to include SCC and AflaToxin M1	200,000	
C Positive negative pressure installation	130,210	
D Consultancy costs: Good laboratory practices and documentation	205,308	
E Consultancy costs: Transition from ISO/IEC 17025:2005 to ISO/IEC 17025:2017	331,463	
Sub total		**1,614,981**
Other costs as occured in 2018 & 2019		
F Proficiency tests (Pt) QLIP-NL	748,241	
G Proficiecy test (Pt) KEBS	66,000	
H Calibration costs (KEBS)	346,840	
I Training costs staff HC in ISO surveilance and Accreditation	80,000	
J Consultancy training costs: Implementation of ISO/IEC 17025:2005	164,400	
K Consultancy training costs: Method validation and uncertainty of measurements	243,600	
Sub total		**1,649,081**
Grand Total HC Application and initial recurrent costs		**3,264,062**

Notes:

A) Due to high expenses of accreditation it is recommended for laboratories to provide commercial services in order to get revenues.

B) Comparison: Major shareholder of Analabs is Cooper-K Ltd and Prolab is with Promarco / Chr. Hansen.

With the accreditation of the main laboratory and implementation of the QBMPS project, also an extensive database was developed for reporting on trends in the results of the tests on the quality parameters that are part of the QBMP bonus payment system, plus somatic cell count, aflatoxins, butterfat and protein.
Although the project faced come complications with the software development for this data base, this is now being sorted, allowing data to be accessed for trend analysis for most parameters, for over a period of 2 year or more. All the analysis results are captured in a database for which the project developed a software programme. The software and the database are important for Happy Cow to scale-up the project, and also for providing tools and insights to other dairy sector stakeholders about the quality of raw milk.

Table 6 provides insights in the estimated recurrent costs by Happy Cow for keeping KENAS accreditation alive. Due to high expense of accreditation and annual upkeep of KENAS, it is recommended for those milk processors that wish to have their laboratories accredited, to provide commercial services in order to create revenues from testing for third parties.

Table 6. Annual recurrent costs main laboratory Happy Cow (in KES)

Annual recurrent (operating) cost accreditation		
Proficiency tests (Pt) QLIP-NL 50% of 2019	375,000	
Proficiecy test (Pt) KEBS	66,000	
Calibration costs - competitve bidding	250,000	
Training costs staff HC in ISO surveilance and upkeep Accreditation	60,000	
Consultancy training costs: Upkeep ISO/IEC 17025:2017 and internal audits	200,000	
KENAS registration costs, surveillance & audit costs	250,000	
Total yearly recurrent costs for accredition (12,000 Lts/day)		**1,201,000**
Total monthly recurrent costs for accredition per cooperative (4,000 Lts/day)		33,361
Recurrent costs for accredition per litre		0.28

7. ESTABLISHED OPERATIONAL PROCEDURES

All project related processes of both the MQT&TS and the QBMPS are described in a project operations manual that contains the work processes, the standard operating procedures, the job descriptions and the work instructions of all functions involved in the MQT&TS QBMPS by Happy Cow and the two CBEs. All persons involved in the project and the raw milk supply chain need to be well-informed and trained on their tasks and the reporting structures. The total MQT&T and QBMPS project identifies 4 main processes, namely:

a) Identifying and registering farmers and farmer groups
b) Milk collection, transportation and cooling system
c) Quality Control (QC) of milk collected (sampling and testing**) *See additional explanation below.***
d) Paying a bonus to farmers and farmer groups whose milk meets the agreed quality standards

The processes, work instructions, job descriptions etcetera are subject to change, due to alterations in the project implementation and therefore the manual needs continuous updating if and as required.
As this report focuses on the MQT&TS, below is a brief description the procedures for (c) Quality Control (QC) of milk collected (sampling and testing). The quality control procedure describes in detail how milk sampling for the parameters of the QBMPS is organised, both for bulk deliveries and for the different farmer groups (milk cans). It further explains how quality analysis results are recorded and reported to the relevant persons responsible for communicating the results and for milk payments.

The milk sampling schedule for the QBMPS parameters is prepared monthly by the Happy Cow QC (Quality Control manager) and is shared with the CBE Managers and the CBE milk reception staff, the laboratory staff/QC at the mini-labs and Happy Cow main lab, and the Milk Chain Coordinators (coordination the Prefects and transporters at the MCPs). Samples from farm groups are taken 2x per month at random, meaning that farmer groups are not aware when their group milk will be sampled. The type of tests and the frequency of testing – both for the mini-labs and for the main lab - are listed in Table 2 in Chapter 2.

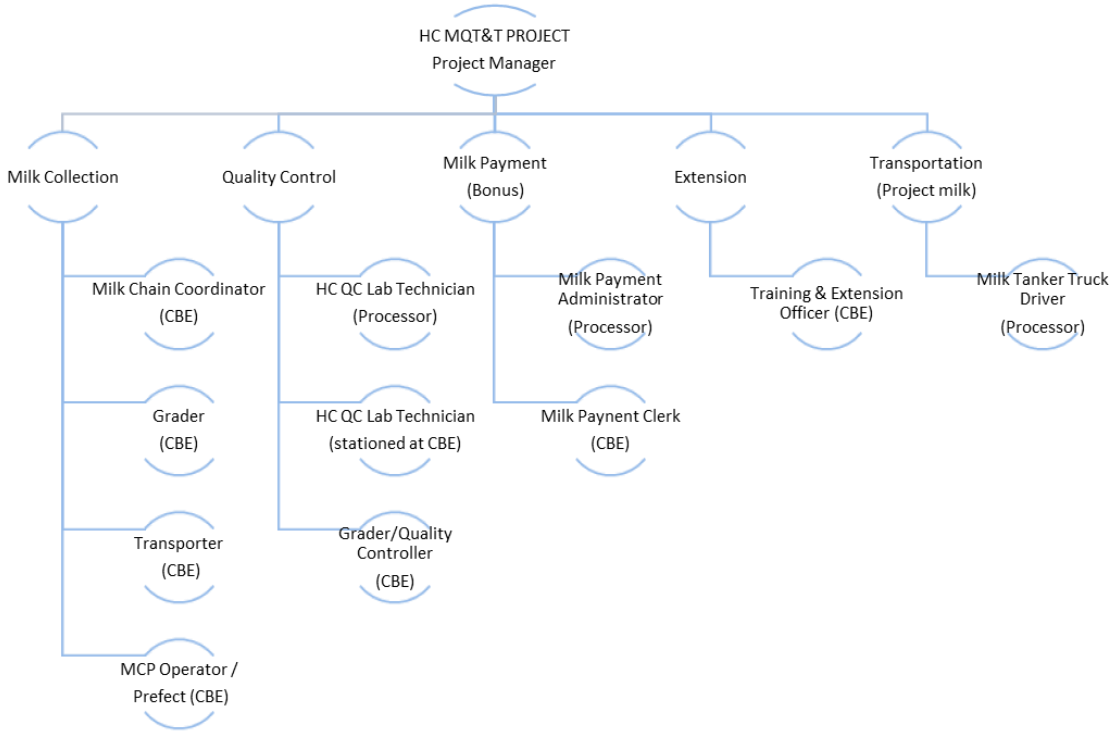
The lab technicians/QCs at the CBE receive the empty sampling bottles from the main Happy Cow laboratory. They are delivered by the driver of Happy Cow's milk tanker truck that collects milk daily from the CBEs.
The lab technicians of the CBE mini-labs take samples from the milk cans (2x per month) and of the bulk milk daily, perform the tests to be carried out at this level and report the results to the CBE, the Project Manager and the QS at Happy Cow. The QC of Happy Cow (main laboratory) receives the cooled milk samples from the lab technician of the mini-lab QC (CBE) through the driver of the milk tanker truck. He analyses for the parameters that are done at his level (the main laboratory). He also takes samples of the bulk milk that is delivered to Happy Cow's platform in Nakuru for analysis.

8. PROJECT ORGANISATION AND HUMAN RESOURCE

8.1 Functions and organogram

In order to manage the implementation and operations of the milk quality tracking and tracing system and the milk quality based payment system, the project established a project organisation that consists of employees from both Happy Cow and the 2 CBEs Olenguruone and New Ngorika. Most of the project responsibilities were integrated in existing functions of both organisations giving them new or revised tasks and responsibilities.

Figure 12. Project organisation



8.2 Manual for project implementation

In the above chapters reference was made to a manual that was developed to guide project implementation. This manual provides technical guidelines for implementation of the project (both the MQT&TS and the QBMPS). It includes processes and systems put in place and standard operating procedures, job descriptions and work instructions, and it provides the reporting and communication structures.

The four most important SOPs (Standard Operational Procedures) in the manual are:
a) Identification & registration of farmers and farmer groups
b) Milk collection
c) Milk quality control,
d) Milk (bonus) payments

In addition to the Standard Operating Procedures, the manual also includes the Job Descriptions of all functions and Work Instructions per function. The latter is a description of activities that are part of the SOP and function responsibilities. Example of a SOP (flowchart), a Work Instruction and Job Description are shown in Annexes I, II and III. The Manual is meant to assist the project partners and their staff in good understanding of the processes and systems that were agreed to put in place, and to instruct and train their employees.

Figure 13. Periodical field training and group meeting at Milk Collection Points.

9. INVESTMENTS AND OPERATIONAL COSTS OF THE MQT&TS

The cost of tracking and tracing raw milk quality as applied in the Happy Cow project, consists of expenses made for testing (consumables), purchase and maintenance of the laboratory equipment, the calibration of equipment and labour costs. Table 7 gives the costs of testing raw milk at Happy Cow's main lab for different parameters per test, and also in terms of total costs related to the sampling regime of two scenarios:

(1) "Pilot situation": during the project), and (2) "Up-scaled situation": after the project.

The "Up-scaled situation" is the follow-up of the project. The parameters for testing remain the same and are given in Table 8 (i.e. the standard platform tests, Total Bacterial Count, Composition, Antibiotics residues, Somatic Cells, Aflatoxin M1). The sampling regime foreseen after the pilot is less intensive and costly. Annex V contains the draft protocol for the Up-scaled situation. Below is the proposed sampling regime for after the pilot.

a) A milk analyser is placed at the CBE reception platform to analyse milk on composition and adulteration. Samples are taken and analysed daily from all the milk cans delivered at the reception platform.
b) A composite sample for testing at the Happy Cow Laboratory is taken once per month and unannounced from the 2-3 50 litre milk cans carried by each of the motorbike transporters (currently 28). The composite samples (28) are analysed at Happy Cow laboratory for the standard tests, but especially for Total Bacterial Count. TBC can only be tested at Happy Cow and is the parameter for bonus payment to transporters.
c) Once a week (on different days) a milk sample will be taken from the CBE cooling tank and from the Happy Cow tanker truck, for analysis at Happy Cow laboratory for the food safety parameters listed in Table 8
d) Separate protocols will be made for early detection of antibiotic residue in consultation with the CBE.
e) The bonus system will be enhanced to also include the transporters and the cooperative, and not only the farmers. The responsibility to award the bonus shall be delegated to the cooperative.

The Up-scaled situation results in a cost reduction of 15% for the Happy Cow laboratory operations and 3% for the CBE. This is illustrated in the cost calculations shown in the tables below. The costs for *testing and analysis* include 12% indirect costs, which cover expenses such as spoilages, repeat testing, price increases, electricity & water, transportation, administration, selling & distribution, security, insurance, legal fees levy and provision for levies and duties. The calculation of *cost per litre*, includes 2% miscellaneous (unforeseen).
In case of replication of this pilot by other processors, different parameters and frequencies of testing may be chosen, depending on the critical quality issues and the available budget. This obviously will have implications for the costings.

9.1 Happy Cow main laboratory milk analysis tests costs, investments and other expenditures

The costs of sampling, testing and analysing the raw milk quality at Happy Cow's main laboratory is shown in table 7. These costs - mainly consisting of consumables and labour - are based on an average milk volume intake from 3 dairy cooperatives of 4,000 litres each per day, totalling 12,000 litres milk per day. Based on this capacity, cost of testing and analysing totals KES 0.34 per litre in the Pilot situation (milk can) and KES 0.18 per litre in the Up-scaled situation (transporter). Labour costs are estimated at KES 0.65 per litre.
Table 10 shows investment costs and depreciation for all the testing equipment, computers and software that were bought during the pilot project for Happy Cow's main lab and of for one laboratory at CBE level, which is KES 8.8 million and 1.2 million respectively. The depreciation of the equipment is based on a lifetime usage of 3, 5 or 8 years (depending on the item) and results in average depreciation of 20% annually, which equals KES

0.40 per litre in the Pilot situation and KES 0.36 in the Up-scaled situation (NB: it must be noted that in the up-scaled situation the estimated lifetime of the equipment is longer resulting in a correction of 2% on depreciation). This makes the total costs of the sampling regime applied in the pilot project at Happy Cow's lab *without* accreditation KES 1.42. If the costs of annual renewal of accreditation are included (KES 0.28) this amount is KES 1.70 per litre. In the Up-scaled scenario these costs are respectively KES 1.16 and 1.44

9.2 CBE laboratory milk analysis tests costs, investments and other expenditures

The costs of testing and analysing the milk quality at the CBE (cooperative) laboratory is shown in table 8. These cost are based on an average milk volume intake from a single dairy cooperatives with an intake of 4,000 litres each per day (equal to 80 x 50 litre milk cans). Based on this capacity the cost of sampling, testing and analysing totals KES 0.21 per litre in the Pilot situation (milk can) and KES 0.20 per litre in the Up-scaled situation. Depreciation of equipment is set at KES 0.22 for both the Pilot and the Up-scaled situation.
Total costs of applying the sampling regime of the pilot project at CBE level is 0.44 and KES 0.43 in the Up-scaled situation. This excludes labour costs at CBE level, as the lab technician based at the CBE mini-lab is an employee of Happy Cow. This person tests the milk at the CBE platform that is supplied to Happy Cow.

9.3 Costs of laboratory staffing

Labour cost is factored in at KES 78,000.- per month for the Happy Cow's main laboratory, which is based on salaries for the Project Manager (fte 0.2) and two laboratory staff (fte 1.0 and 0.7) of which one lab technician is outsourced to the CBE (see above). The labour cost in the Up-scaled situation is reduced by KES 6,000 to KES 72,000. This is KES 0.65 per litre in the Pilot situation and KES 0.60 per litre for the Up-scaled situation.

9.4 Raw milk testing cost per litre (summary)

In the table on the next page the total testing costs per litre are shown for Happy Cow's main laboratory and for one mini lab at CBE level (based a capacity of 12,000 litres of milk per day at Happy Cow and 4,000 litres at CBE level).
The table shows that the total cost of the sampling regime applied in the Pilot situation for Happy Cow and CBE together, is KES 2.14 per litre. In the Up-scaled situation this is KES 1.87 per litre. In both situations these costs are including accreditation of the Happy Cow laboratory at KES 0.28 per litre.

Table 7. QBMP test costs per litre milk (in KES)

HC laboratory	Pilot situation	Up scaled situation
Milk Sample testing & analysing	0.34	0.18
Depreciation	0.40	0.36
Salary cost	0.65	0.60
Accreditation	0.28	0.28
Miscellaneous	0.03	0.03
Total cost per litre	**1.70**	**1.44**
CBE laboratory	**Pilot situation**	**Up scaled situation**
Milk Sample testing & analysing	0.21	0.20
Depreciation	0.22	0.22
Salary cost	-	-
Accreditation	-	-
Miscellaneous	0.01	0.01
Total cost per litre	**0.44**	**0.43**
GRAND TOTAL	**2.14 / litre**	**1.87 / Litre**

Table 8. Cost of QBMP Happy Cow in project situation and upscale (in KES).

Happy Cow Laboratory with intake capacity of 4,000 Lts per day per 1 Coop (following QBMP guidelines).

Milk Sample Analysis Tests	Consu-mables	Min cost per Unit	Indirect costs * 12%	Cost per unit	Sampling unit	80 milk cans and 28 Transporters per day							
						During the project period (per milk can)				At scaling up (per transporter)			
						Samples /month	Incl. tanker	Cost per month	Per liter	Samples /month	Incl. tanker	Cost per month	Per liter
1 Platform tests (e.g. organoleptic, density , alcohol): N/a													
These tests are done at - and at costs - of CBE													
2 Total Plate or Bacteria Count													
Aerobic count TBC (3M Petri films) and diluent & gas, dilution 5	1 plate	95.00	11.40	106.40	all cans	80	84	8,938		28	32	3,405	
									0.07				0.03
3 Composition													
Total solids, freezing point, protein, fat, lactose (Lacto Scope IR)	misc	150.00	18.00	168.00	all cans	80	84	14,112		28	32	4,704	
Freezing Point Depression - Cryoscope	misc	120.00	14.40	134.40	per tanker	4	4	538		4	4	538	
									0.12				0.04
4 Antibiotic residues													
Antibiotics Bioeasy 3 in 1, rapid test tanker at CBE, everyday	1 ampoule	192.71	23.13	215.83	per tanker	30	30	6,475		30	30	6,475	
Antibiotics Delvo test SPNT, when tanker tested positive	1 ampoule	185.00	22.20	207.20	per case	4	4	829		4	4	829	
									0.06				0.06
5 Somatic Cel Count													
Somatic Cell Count, Eko Milk Scanner, daily qualitative	Ekoprim	40.00	4.80	44.80	per can	80	80	3,584		28	28	1,254	
Somatic Cell Count (DeLaval) once/2 week tanker, quantitative	cassette	400.00	48.00	448.00	per tanker	2	2	896		2	2	896	
									0.04				0.02
6 Aflatoxin M1													
Aflatoxin M1 BioEasy, once/2 weeks tanker, qualitative	strip, 0.4ppb	300.00	36.00	336.00	per tanker	2	2	672		2	2	672	
Aflatoxin M1 Elisa, once/2 week tanker, quanitative	well, 0-500p	500.00	60.00	560.00	per tanker	2	2	1,120		2	2	1,120	
									0.01				0.01
7 Consumables													
Misc: soap, sanitizers, books, etc…	misc	15.00	1.80	16.80	all samples	80	84	1,411		28	32	538	
Glass-ware	misc	20.00	2.40	22.40	all samples	80	84	1,882		28	32	717	
									0.03				0.01
Total milk sample analysis costs								40,456	0.34			21,147	0.18
Depreciation equipment						Avg.	20%	48,098	0.40	Avg.	18%	43,211	0.36
Salary costs (0.20 PM, 1.0/0.7 lab staff, 1.0 staff at CBE and 0.1 IT staff)								78,000	0.65			72,000	0.60
Accreditation costs (w/o revenues)								33,361	0.28			33,361	0.28
Sub total								199,914	1.67			169,719	1.41
Misceleneous							2.0%	3,998	0.03		2.0%	3,394	0.03
Total monthly costs QBMP HC								**203,913**	**1.70**			**173,113**	**1.44**
Total monthly costs QBMP EXCLUDING accreditation costs and one CBE lab staff								142,552	1.19			108,358	0.90

Notes calculations

1 *Project milk was at 50% and tested twice per month which equals as if 80 milk cans were tested once per month.*
2 *Monthly depreciation based on intake of 3 coopeartives with 12,000 ltr/day. A correction of -2% is applied on extensive versus intensive testing*
3 ** = Indirect costs of 12% on nett costs for spoilages, repeat testing, price increases, electricity & water, transportation, administration, selling & distribution, security, insurance, legal fees levy/taks provisions.*
4 *Excluding building costs for laboratories at HC & CBE (one-off costs) and farmer's training costs at CBE (other budget line).*

Comparison Milk can vs Transporter	KES / Lt
Project situation (milk cans)	*1.70*
Upscaled situation (transporters)	*1.44*
Savings Transporter vs Milk can	*0.26*
	15%

Justification or requirement to change from T&T from Can to Transporter

1 *The proposed changes are scaling-up the T&T to a more econmical unit (per transporter with 150 ltrs), scaling-up to higher bonus system for transporters/farmers and to lowers lab costs.*

Table 9. Cost of QBMP of CBE project situation and upscale (in KES).

CBE / COOP costs with intake 4,000 Lts per day (following QBMP guidelines).

Milk Sample Analysis Tests	Consu-mables	Min cost per Unit	Indirect costs 12%	Cost per unit	Sampling unit	80 milk cans and 28 Transporters per day							
						During the project period (per milk can)				At scaling up (per transporter)			
						Samples /month	Incl. tanker	Cost per month	Per liter	Samples /month	Incl. tanker	Cost per month	Per liter
1 Platform tests (e.g. organoleptic, density , alcohol).													
Alcohol test: Ethanol and Distilled Water. All cans	Misc	0.72	0.09	0.81	All cans	2,400	-	1,935		2,400	-	1,935	
									0.02				0.02
2 Water adulteration with H2O2													
Peroxide test. 1 strip/d/15 cans (5 transporters), m 2400/15 = 160 s	1 strip	35.00	4.20	39.20	Random	160	-	6,272		160	-	6,272	
									0.05				0.05
3 Milk analyzer, consumables, all cans													
Water, disinfectant ,etc	Misc	0.20	0.02	0.22	All cans	0	-	0		2,400	-	538	
									-				0.00
4 Antibiotics Rapid Tests. Cost provision for incidences													
Antibiotics Rapid Bioeasy 3 in 1 kit, provision 2 tests at CBE everyd	1 ampoule	192.71	23.13	215.84	Composite	60	-	12,950		60	-	12,950	
									0.11				0.11
5 Freshness, in case failed parameter milk analyzer													
Lactic acid (NaOH, Phenolphthalein and distilled H2O)	Misc	1.46	0.18	1.64	Composite	840	-	1,374		420	-	687	
									0.01				0.01
6 Somatic Cel Count													
Eko Milk Scanner, random and on request for samples of fresh milk	Eko prim	8.80	1.06	9.86	Random	10	-	99		56	-	552	
									0.00				0.00
7 Consumables													
Misc: soap, sanitizers, books, etc…	Misc	1.00	0.12	1.12	All samples	2,400	-	2,688		840	-	941	
									0.02				0.01
Total milk testing costs								25,318	0.21			23,875	0.20
Depreciation equipment								26,929	0.22	Avg.	18%	26,929	0.22
Salary costs (one lab staff at CBE paid by HC)								-	-			-	-
Accreditation costs								-	-			-	-
Sub total								52,246	0.44			50,803	0.42
Misceleneous							2.0%	1,045	0.01		2.0%	1,016	0.01
Total monthly costs QBMP CBE								**53,291**	**0.44**			**51,820**	**0.43**

Notes: upscale

1 In case of anti-biotics, these costs are for the CBE, like the T&T costs finding the culprit(s).
A provisionary cost factor is included. In case of no AB case, these costs can be put on KES 0.00

2 The calculated cost for the CBE need to be off-set against: received from Happy Cow:
a) good dairy practices resulting in lower rejection rates, b) monthly bonus for better quality milk

3 ** = Indirect costs of 12% on nett costs for spoilages, repeat testing, price increases, electricity & water, transportation, administration, selling & distribution, security, insurance, legal fees levy/taks provisions.*

Comparison Milk can vs Transporter	KES / Lt
Project situation (milk cans)	*0.44*
Upscaled situation (transporters)	*0.43*
Savings Transporter vs Milk can	*0.01*
	3%

Table 10. Investment and depreciation laboratory equipment (in KES).

Happy Cow intake capacity 12,000 Lts per day. Milk can

HC equipment	Depreciation l/t-yrs	%	Quan-tity	Unit Procure-ment Cost	Total cost	Annual depre-ciation
Computer and QBMP software						
Computer hardware	3	33.3%	0.8	400,000	320,000	106,667
QBMP Software	3	33.3%	0.8	900,000	720,000	240,000
				Sub total	**1,040,000**	
Butter fat, Proteins, Lactose, Total solids, Freezing point						
Delta Lactoscope	8	12.5%	0.8	3,474,911	2,779,929	347,491
Milk analyzer old	5	20.0%	0.3	150,000	45,000	9,000
Analyzer at CBE new AVIVA (50% sharing HC/CBE)	5	20.0%	0.5	260,000	130,000	26,000
				Sub total	**2,954,929**	
Antibiotic testing kit						
Bioeasy incubator	5	20.0%	1	21,000	21,000	4,200
Delvo software	3	33.3%	1	45,000	45,000	15,000
Delvo Scanner	5	20.0%	1	49,000	49,000	9,800
Delvo Incubator	5	20.0%	1	24,750	24,750	4,950
				Sub total	**139,750**	
Aflatoxin						
Aflatoxin testing BioEasy	5	20.0%	1	178,520	178,520	35,704
Aflatoxin testing Elisa	5	20.0%	1	265,000	265,000	53,000
				Sub total	**443,520**	
Somatic Cell Count						
Ekomilk scan	5	20.0%	1	100,000	100,000	20,000
DeLaval	5	20.0%	1	426,200	426,200	85,240
				Sub total	**526,200**	
Microbiological analysis (TPC, CC, E.C)						
3M reader	5	20.0%	1	747,668	747,668	149,534
Incubators	8	12.5%	2	37,450	74,900	9,363
Pipette	3	33.3%	3	7,500	22,500	7,500
Hot air	8	12.5%	1	35,000	35,000	4,375
Autoclave	5	20.0%	1	52,500	52,500	10,500
Gas cylinder	8	12.5%	1	6,000	6,000	750
Bunsen burner and gas	8	12.5%	1	7,139	7,139	892
				Sub total	**945,707**	
Freezing point depression						
Cryoscope	5	20.0%	1	572,198	572,198	114,440
				Sub total	**572,198**	
pH						
PH meter	3	33.3%	1	107,982	107,982	35,994
Dairy pH meter	3	33.3%	1	67,000	67,000	22,333
				Sub total	**174,982**	
Others						
Fridge	8	12.5%	2	52,660	105,320	13,165
Water bath	8	12.5%	2	35,000	70,000	8,750
Hygrometers	5	20.0%	2	1,500	3,000	600
Moisture analyzer	5	20.0%	1	308,560	308,560	61,712
Centrifuge (Gerber)	8	12.5%	1	267,960	267,960	33,495
Dispensers	3	33.3%	2	7,500	15,000	5,000
Alcohol gun	8	12.5%	2	23,800	47,600	5,950
Lactodensimeter	3	33.3%	2	7,500	15,000	5,000
Auto burette	5	20.0%	3	18,000	54,000	10,800
Thermometer	3	33.3%	2	1,000	2,000	667
Infrared thermometer	3	33.3%	3	7,500	22,500	7,500
Analytical balance	5	20.0%	1	20,000	20,000	4,000
Moisture analyzer	5	20.0%	1	250,000	250,000	50,000
Pipete pump	8	12.5%	2	3,867	7,733	967
Lovibond comparator	8	12.5%	1	40,700	40,700	5,088
Assorted glassware	3	33.3%	1	178,330	178,330	59,443
Sampling bottles 10mls	3	33.3%	100	195	19,488	6,496
Sampling bottles 100 mls	3	33.3%	110	438	48,180	16,060
Sampling bottles 250 mls	3	33.3%	115	478	54,970	18,323
Sampling dipper	8	12.5%	3	11,793	35,380	4,423
Viscometer	3	33.3%	1	75,400	75,400	25,133
Cool box	5	20.0%	4	4,650	18,600	3,720
Soap/sanitizer dispenser	3	33.3%	4	5,220	20,880	6,960
SS work bench	8	12.5%	2	69,600	139,200	17,400
Lab items holder rack	5	20.0%	1	25,000	25,000	5,000
Misc computer set	3	33.3%	1	109,596	109,596	36,532
Cabinets	8	12.5%	3	13,143	39,429	4,929
Misc lab equipment	3	33.3%	1	5,000	5,000	1,667
				Sub-total	**1,998,826**	

HC MILK CAN METHOD (Intensive)			
Total investment HC for capacity 12,000 Lts/day (3 coops) - Testin			**8,796,111**
Annual depreciation per 3 coops 12,000 Lts/day	Avg.	20%	1,731,511
Annual depreciation per coop 4,000 Lts/day			577,170
Monthly depreciation per coop 4,000 Lts/day			48,098
Depreciation per liter			0.40

HC TRANSPORTER METHOD HC (extensive)				
Total investment HC for capacity 12,000 Lts/day (3 coops) - testin			**8,796,111**	-2%
Annual depreciation per 3 coops 12,000 Lts/day	Avg.	18%	1,555,588	correction
Annual depreciation per coop 4,000 Lts/day			518,529	on
Monthly depreciation per coop 4,000 Lts/day			43,211	depreciati
Depreciation per liter			0.36	

CBE intake capacity 4,000 Lts per day. Transporter

CBE equipment	Depreciation l/t-yrs	%	Quan-tity	Unit Procure-ment	Total cost	Annual depre-ciation
Computer and QBMP software						
Compter hardware	3	33.3%	0.8	110,000	88,000	29,333
QBMP Software	3	33.3%	0.8	100,000	80,000	26,667
				Sub total	**168,000**	
Antibiotic testing kit						
Bioeasy incubator	5	20.0%	1	21,000	21,000	4,200
Delvo Incubator	5	20.0%	1	24,750	24,750	4,950
				Sub total	**45,750**	
Milk analyzer and software						
Analyzer at CBE old	5	20.0%	0.3	150,000	45,000	9,000
Analyzer at CBE new AVIVA (incl scale, 50% sharing HC)	5	20.0%	0.5	260,000	130,000	26,000
Mobile apps (software/year)	3	33.3%	10	3,000	30,000	10,000
Analayzer software	3	33.3%	1	30,000	30,000	10,000
				Sub total	**235,000**	
Somatic Cell Count						
Ekomilk scan	5	20.0%	1	100,000	100,000	20,000
				Sub total	**100,000**	
Others						
Fridge	8	12.5%	1	52,660	52,660	6,583
Water bath	8	12.5%	1	35,000	35,000	4,375
Dispenser	3	33.3%	1	7,500	7,500	2,500
Alcohol guns	8	12.5%	35	23,800	833,000	104,125
Lactodensimeter	3	33.3%	1	7,500	7,500	2,500
Auto burette	5	20.0%	1	18,000	18,000	3,600
Normal thermometers	3	33.3%	35	400	14,000	4,667
Pipete pump	8	12.5%	1	3,867	3,867	483
Lovibond comparator	8	12.5%	1	40,700	40,700	5,088
Droppers	3	33.3%	1	1,733	1,733	578
Assorted glassware	3	33.3%	1	89,165	89,165	29,722
Sampling dipper	8	12.5%	1	11,793	11,793	1,474
soap/sanitizer dispenser	3	33.3%	4	5,220	20,880	6,960
SS work bench	8	12.5%	1	69,600	69,600	8,700
Cabinets	8	12.5%	1	13,143	13,143	1,643
				Sub total	**1,218,541**	

CBE TRANSPORTER METHOD (extensive)				
Total investment CBE for capacity 4,000 Lts/day - testing per tra			**1,767,291**	-2%
Annual depreciation per coop 4,000 Lts/day	Avg.	18%	323,146	correction
Monthly depreciation per coop 4,000 Lts/day			26,929	on
Depreciation per liter			0.22	depreciati

Depreciation brackets are based on 3, 5 and 8 years life/time
No residual value is accounted for.

ANNEXES

ANNEX I. EXAMPLE JOB DESCRIPTION (HAPPY COW MANUAL)

JD-002: Quality Controller / Lab Technician (Processor)

Job Title: Quality Control/Laboratory Technician
Department: MQT&T Project
Location: Happy Cow Lab
Reporting to: Project Manager
Name of Post Holder:
Employee No:

The Quality Controller / Lab Technician oversees quality control operations of raw milk quality analysis at Happy Cow and facilitates the QBMPS through generating reports to guide the awarding of bonuses to farmers in specific milk cans.

Primary responsibility
Reporting to the project manager, the Quality Controller will be in charge of the laboratory at Happy Cow Ltd. He/she will also be responsible for grading milk at Happy Cow, sampling for the QBMPS and keeping quality analysis records. The QC is further tasked with preparing and submitting reports to the management in line with the required standards and time frame.

Duties and responsibilities:

1. Perform milk acceptance and laboratory tests at Happy Cow and weigh the quantities of milk at the reception platform.
2. Prepare and analyse samples from the CBEs (or any other source Qlip, KEBS etc.) especially on the quality based parameters. Execute the analysis of raw milk according to the approved procedure, work instructions and professional standards, including for quality based milk payments.
3. Review quality analysis data and keep up-to-date records with relevant scientific and technical developments.
4. Keep milk sample analysis results confidential and report only for processing of milk payment purposes within set disciplines and timelines.
5. Maintain a professional level of hygiene in the laboratory.
6. Secure the operation, maintenance and calibration of all equipment at Happy Cow and at the CBEs through liaising with the QC (CBE).
7. Take administrative stock control for all consumables in the laboratory at Happy Cow and at the CBEs (including expiry and storage conditions).
8. Report on all the developments in the laboratory and compile QBMPS and laboratory monthly reports, including all the achievements, challenges and possible solutions for the project.
9. Replace the QCs (when called upon) for their off day at the CBE laboratory.
10. Implementation of ISO/IEC 17025 standard.
11. The quality control person can be assigned any other duties as deemed by the top management of Happy Cow Ltd.

Date signed for acceptance: ……...

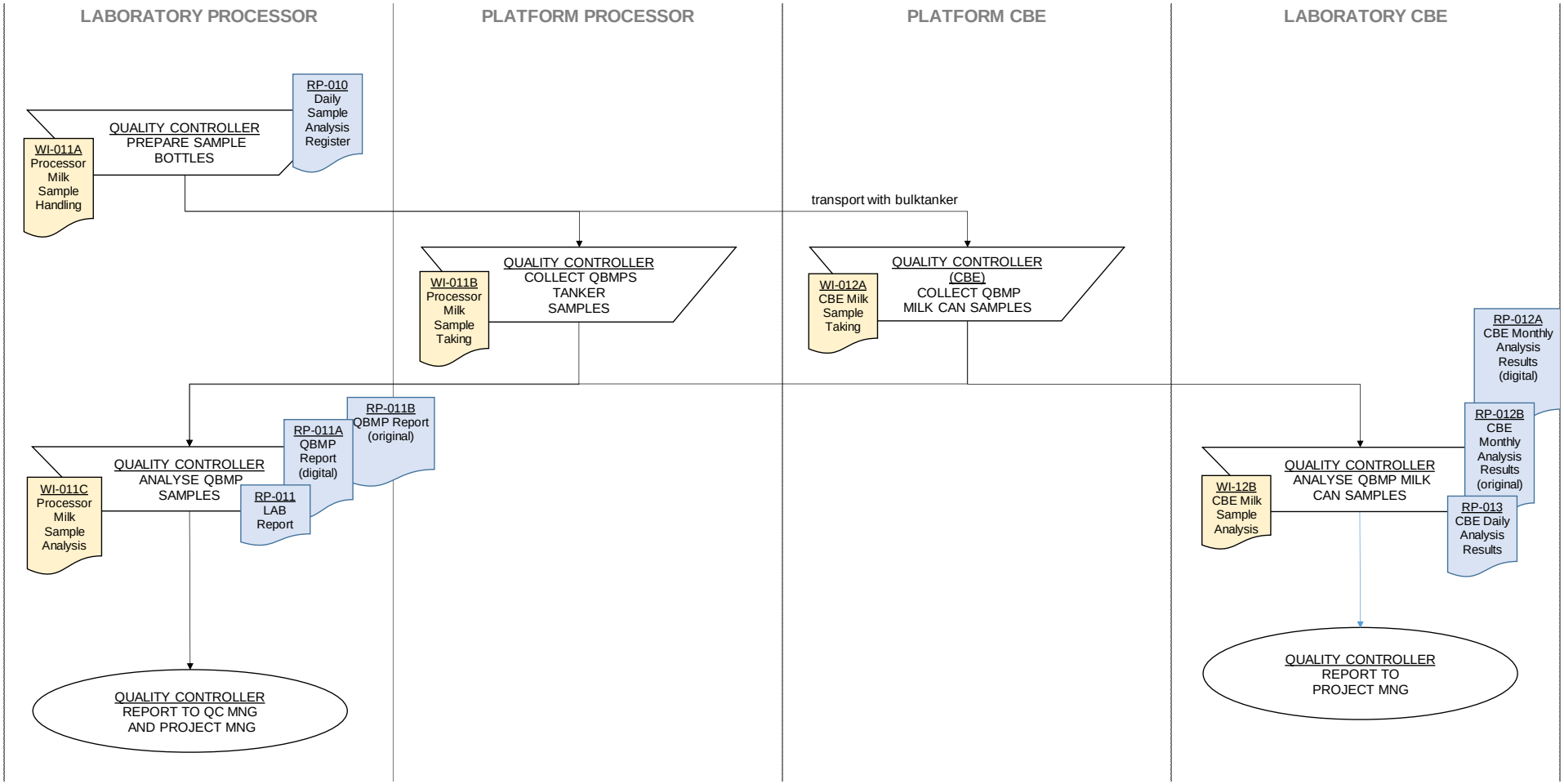
Quality controller : …… Signature: …….

Project manager : …… Signature: …….

Human resource manager: …….. Signature: …….

ANNEX II EXAMPLE SOP OF MILK QUALITY CONTROL (FLOWCHART) (HAPPY COW MANUAL)

FLOW CHART 3: MILK QUALITY CONTROL PROCEDURE BONUS PAYMENT (MILK SAMPLES HANDLING & ANALYSIS).



ANNEX II Continued: EXAMPLE SOP MILK QUALITY CONTROL

Purpose

The quality control procedure describes in detail how milk sampling is organised for both bulk deliveries and the different farmer groups (milk cans). It further explains how quality analysis results are recorded and reported to the relevant functions responsible for verifying the results and processing milk payments.

Scope of operations

This procedure describes the preparation of milk samples at different sample collection points in the milk collection chain. In addition, it explains the process used for milk quality analysis and reporting.

Reference

In developing the milk quality control procedure, the following documents have been used as references:
Minutes of project meetings with CBEs, *dated 26 July 2016*
Happy Cow Company Directives *DR-002*
Happy Cow Quality Manual 2017

Definitions

The following abbreviations are used in this procedure:

CBE	Cooling and Bulking Enterprise
MCC	Milk Chain Coordinator
MQT&T	Milk Quality Tracking & Tracing
QBMPS	Quality Based Milk Payment System
QC (CBE)	Quality Controller at the CBE Platform
QC (Processor)	Quality Controller at the Processor Platform
RP	Record and Report
WI	Work Instruction

Description of the procedure

a. Preparation of the milk samples

Every month the QC/ Lab Technician (Processor) prepares the–QBMPS milk sampling schedule, titled *Daily Platform Analysis Register* (RP-010). He/she shares the schedule with the Project Managers, QCs and MCCs at the CBE Platforms.

The QC (Processor) then prepares the milk sample bottles as set out in the *WI Processor Milk Sample Handling* (WI-011A). At his moment care must be given that the samples are well identified for the sample takers (Graders) and that samples from farm groups are not routinely taken but at random, meaning that farmer groups are not aware when their group milk will be sampled.

b. Milk sample taking at CBE Platform

The QC (CBE) receives the sampling bottles from the QC (Processor) through the Bulk Tanker Driver and collects the QBMPS milk can samples as set out in the *WI CBE Milk Sample Taking* (WI-012A).

c. Milk sample taking at Processor Platform

The QC (Processor) also collects the QBMPS milk samples from the Bulk Tanker Driver as set out in the *WI Processor Milk Sample Taking* (WI-011B).

d. Milk sample analysis at the CBE Lab

The QC Processor (stationed at the CBE) analyses the QBMPS milk can samples in the CBE Laboratory as set out in the *WI CBE Milk Sample Analysis* (WI-012B). The QC (CBE) then generates two reports, *CBE Daily Analysis Results* (RP-013) and the *CBE Monthly Analysis Results* (RP-012A/B) and forwards them to the Project Manager: RP-013 on a daily basis, and RP-012 on a monthly basis.

e. Milk sample analysis at the Processor Lab

The QC/Lab Technician (Processor) receives the QBMPS milk can and milk cooler samples from the QC (CBE) through the Bulk Tanker driver. The QC Processor then analyses the QBMPS milk samples as set out in the *WI Processor Milk Sample Analysis* (WI-011C). Following the analysis, the QC / Lab Technician (Processor) produces two reports, the *Lab Report* (RP-011) and the *QBMPS Report (digital)* (RP-011A). The QC (Processor) then reports to the Project Manager (Processor) by sharing two reports in digital format: *QBMPS Report* (RP-011A) and the CBE Monthly Analysis Results (RP-012A). The two digital reports are based on the original/field versions of these records, RP-011B and RP-012B respectively.

Work Instructions used

Quality Control Work Instructions

Rep. No.	Name	Job function
WI-011A	Processor Milk Sample Handling	QC (Processor)
WI-011B	Processor Milk Sample Taking	QC (Processor)
WI-011C	Processor Milk Sample Analysis	QC (Processor)
WI-012A	CBE Milk Sample Taking	QC (CBE & Processor)
WI-012B	CBE Milk Sample Analysis	QC (Processor)

Records used

Quality Control records and reports

Rep. No.	Name	Job function
RP-010	Daily Sample Analysis Register	QC (Processor)
RP-011	Lab Report	QC (Processor)
RP-011A	QBMPS Report (digital)	QC (Processor)
RP-011B	QBMPS Report (field report)	QC (Processor)
RP-012A	CBE Monthly Analysis Results (digital)	QC (CBE)
RP-012B	CBE Monthly Analysis Results (field report)	QC (CBE)
RP-013	Daily Analysis Results	QC (CBE)

ANNEX III. EXAMPLE WORK INSTRUCTION (HAPPY COW MANUAL)

WI-011A: Processor Milk Sample Handling (example), see Quality Control Flow Chart.

1. Purpose

This Work Instruction is intended to detail how the QBMPS milk samples should be collected and handled, starting with the preparation of sample bottles at the Happy Cow Laboratory.

2. Scope

Determining the number of QBMPS samples to be taken per sampling session, developing a daily sample analysis register, and autoclaving and labelling the sample bottles.

3. References

Processor Directive (DR-002)
Happy Cow Quality Manual

4. Definition of Terms

CBE	Cooling and Bulking Enterprise
HC	Happy Cow
MCC	Milk Chain Coordinator
QBMPS	Quality Based Milk Payment System
QC	Quality Controller

5. Description of activities

a. Confirming the active QBMPS project milk cans at the CBE

The QC/Lab Technician (Processor) shall confirm the active QBMPS project milk cans from the QC Processor based at the CBE platform so as to determine the number of sample bottles to prepare. He/she does this by writing an email to the QC Processor at the CBE and copying the CBE Manager, the Project Manager and the MCC.

b. Cleaning the Sampling bottles

The Processor QC/Lab Technician shall clean the sample bottles properly as detailed in the SOP (HCL/QP/09/BC) and as provided in the Processor Directives (DR-002).

c. Sterilising the sample bottles

The Processor QC/Lab Technician sterilises the sample bottles by filling them with de-ionised water and placing them in an autoclave for sterilisation as set out in the Processor Directives (DR-002).

d. Labelling the Sample bottles

The Processor QC/Lab Technician shall then label the sample bottles after sterilisation. He will randomly label them based on the active project milk cans. However, no project milk can shall be sampled and/or analysed twice in a specific sampling session.

e. Compiling the Daily CBE Sample Analysis Register

The Processor QC/Lab Technician shall compile a *Daily Sample Analysis Register* (RP-010) of the labelled sample bottles so as to keep track of the sample bottles released to the field and keep track of their return from the CBEs.

f. Dispatching the sample bottles to the CBEs

The Processor QC/Lab Technician shall dispatch the labelled sample bottles to the Processor QC (CBE) through the bulk milk tanker in readiness for sampling from the project milk cans by the Processor QC (CBE);

6. Report- and record-template (not included in this example).

ANNEX IV. ACCREDITATION CERTIFICATE MAIN LABORATORY HAPPY COW

Certificate No. TL/49

KENYA ACCREDITATION SERVICE
KENAS

Accreditation Certificate

This is to certify that

HAPPY COW LIMITED

is accredited as a Testing Laboratory
upon satisfying the requirements of

ISO/IEC 17025: 2005

General requirements for the competence of testing and calibration laboratories in respect of the attached schedule

Effective from: **14th December 2018**

Expiry on: **13th December 2022**

KENYA ACCREDITATION SERVICE
KENAS

ilac-MRA

Martin Cheshire

Chief Executive Officer / Authorised Officer
Kenya Accreditation Service

KENYA ACCREDITATION SERVICE

(A STATUTORY ORGANIZATION OF GOVERNMENT)

Tel: +254 725 227 640
Tel: +254 787 395 679
Email: info@kenas.go.ke / info@kenyaaccreditation.org
Website: www.kenas.go.ke

Embankment Plaza, 2nd Floor, Upper Hill
Longonot Road, Off Kenya Road
P.O. Box 47400-00100 GPO
Nairobi, Kenya

Our Ref: KENAS/CL/049

14 December 2018

The Director
Happy Cow Limited
P. O. Box 558-20100
NAKURU

Attention: Mr. Gerald Oosterwijk

Dear Sir,

RE: INITIAL ACCREDITATION EFFECTIVE 14TH DECEMBER 2018

We wish to convey the accreditation committee decision made on 14th December 2018 on your testing laboratory with respect to the Initial accreditation assessment conducted in your laboratory.

The committee made a decision to grant accreditation to your laboratory as indicated in the enclosed accreditation schedule.

The first surveillance assessment will be undertaken six months from the date of the last assessment.

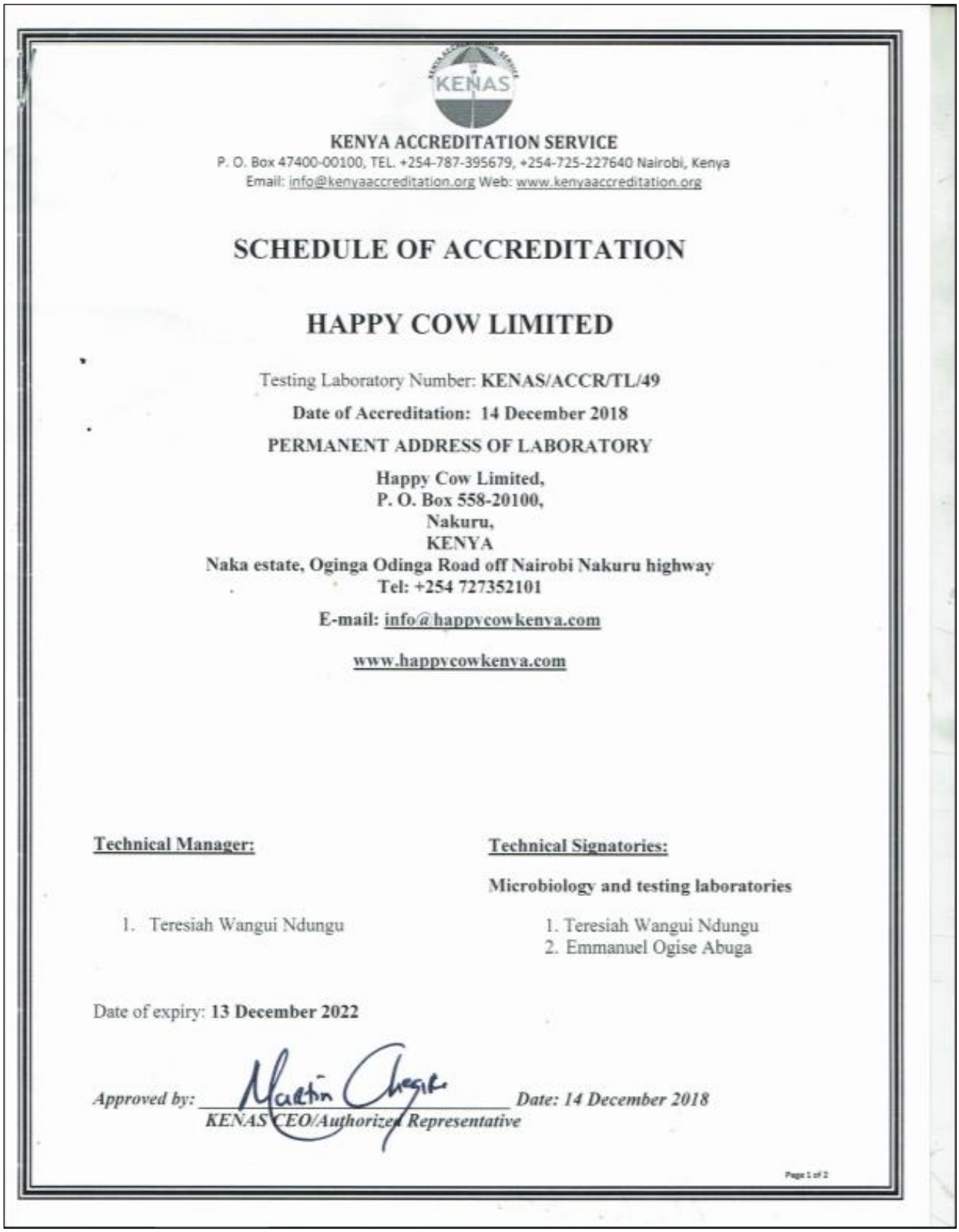
I take this opportunity to congratulate you on this achievement and we remain available to provide any further clarification.

Meanwhile, seasons best wishes, and Happy New Year!

Yours sincerely,

Martin Chesire
CHIEF EXECUTIVE OFFICER
MCH/fny

Encl.



KENAS

KENYA ACCREDITATION SERVICE

P. O. Box 47400-00100, TEL. +254-787-395679, +254-725-227640 Nairobi, Kenya
Email: info@kenyaaccreditation.org Web: www.kenyaaccreditation.org

SCHEDULE OF ACCREDITATION

HAPPY COW LIMITED

Testing Laboratory Number: **KENAS/ACCR/TL/49**

Date of Accreditation: 14 December 2018

PERMANENT ADDRESS OF LABORATORY

Happy Cow Limited,
P. O. Box 558-20100,
Nakuru,
KENYA
Naka estate, Oginga Odinga Road off Nairobi Nakuru highway
Tel: +254 727352101

E-mail: info@happycowkenya.com

www.happycowkenya.com

Technical Manager:

1. Teresiah Wangui Ndungu

Technical Signatories:

Microbiology and testing laboratories

1. Teresiah Wangui Ndungu
2. Emmanuel Ogise Abuga

Date of expiry: **13 December 2022**

Approved by: _____ *Date: 14 December 2018*
KENAS CEO/Authorized Representative

Page 1 of 2

KENAS

KENYA ACCREDITATION SERVICE

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SCHEDULE

No.	Testing Field	Type of Test	Test Method	Test Object / Matrix	Test Parameter	Measurement Range	Test Location
1.	Chemistry	Mid-infrared spectroscopy	AOAC Official method 972.16	Milk	Butter fat	0 – 55%	Happy cow limited-Physicochemical lab
2.	Chemistry	Mid-infrared spectroscopy	AOAC Official method 972.16	Milk	Protein	0 – 5%	Happy cow limited-Physicochemical lab
3	Chemistry	Mid-infrared spectroscopy	AOAC Official method 972.16	Milk	Lactose	0 – 8%	Happy cow limited-Physicochemical lab
4	Chemistry	Mid-infrared spectroscopy	AOAC Official method 972.16	Milk	Total solids	8 – 17%	Happy cow limited-Physicochemical lab
5	Chemistry	Qualitative colour reaction	AOAC Official method 982.18	Milk	Antibiotic residues	Positive or Negative	Happy cow limited-Physicochemical lab
6	Chemistry	Physical	FAO/TCP/KEN /6611	Milk	Density	1.010 – 1.040g/mL	Happy cow limited-Physicochemical lab
7	Chemistry	Thermistor cryoscope	AOAC official method 990.22	Milk	Freezing point	0.480 to -0.625	Happy cow limited-Physicochemical lab
8	Chemistry	Potentiometric	ISO 7238/IDF 104	Milk	pH	0 – 14	Happy cow limited-Physicochemical lab
9	Chemistry	Titration	AOAC Official method 947.05	Milk	Lactic acid	0 – 0.9%	Happy cow limited-Physicochemical lab
10	Microbiology	Enumeration	AOAC Official method 990.12	Milk	Total aerobic count	0 – 999000000	Happy cow limited-microbiology lab
11	Microbiology	Enumeration	AOAC Official method 991.14	Milk	Coliform count	0 – 999000000	Happy cow limited-microbiology lab
12	Microbiology	Enumeration	AOAC Official method 990.12	Milk	E.coli count	0 – 999000000	Happy cow limited-microbiology lab

Original Date of Accreditation: 14 December 2018

This is the first schedule issued subject to the terms and conditions of KENAS Accreditation

Approved by: Martin Cheruiyot *Date: 14 December 2018*

ANNEX V. DRAFT PROTOCOL QBMPS UP-SCALED

This **draft protocol** is designed for implementing during the Up-scaled situation (after the end of the pilot project in May 2019).

1) Milk analyser

Happy Cow (HC) and Olenguruone (Ole) will procure together one milk analyser to be stationed at the Platform at Olenguruone. The cost of the milk analyser is estimated at KSH 250,000 including software, reader/printer and digital weighing scale of 200kgs. Ole will repay their share to HC through milk payment deductions. The analyser will be sourced from AVIVA and has a measuring speed of 18 secs per sample. Maintenance and repair cost are for Ole. The milk analyser should be used at the platform as follows:

a) All milk meant for Happy Cow shall pass the milk analyser.
b) All individual milk cans brought by the transporters shall pass the milk analyser.
c) Appropriate records/evidence must be shared with HC, e.g. rejected milk does not enter into the HC-cooling tank and kilograms of such milk should be recorded.

2) Mobile app for transporters

The milk analyser can come additional with a Mobile App for transporters. This software can be down-loaded and used on an Android phone at a cost of around KES 3,000/year. The transporters can record all basic data from their farmers, as measured along the route, including daily deliveries and quality of milk. The Mobile App for transporters is an ideal situation but likely not practical for Ole because:

- The mobiles of the transporters are basic and not always Android based.
- The yearly software cost per transporter needs motivation for them to embrace.

A more cheaper and sustainable way forward is that Rejected Results of the milk analyser are relayed to the concerned transporters and his/her farmers by SMS. The milk analyser will also be connected to an audio devise that “bleeps” at the platform when Rejected Results are recorded.

3) Bonus awards

The bonus award scheme will be as follows:

a) <u>Milk analyser award</u>

At this micro-level, HC cannot be involved too much, but tangible evidence needs to be commuted to HC-IT platform in Nakuru that milk analysing is indeed happening: recording total intake, rejection rates, fat%, density rates, etc. All milk meant for HC needs to go through the milk analyser and will receive KES 1.00 bonus.

Example: Ole will receive: 4,000 Lt daily * 30 Days * 1 KES = **KES 120,000 additional monthly**.

b) <u>Transporters bonus award</u>

The composite sample from each transporter (e.g. one sample of its 3 cans) will be analysed once every month at random and at HC lab. At the HC lab several quality parameters will be analysed with main emphasis on **Total Bacteria Count**; a low count is an indication of good raw milk. If at Ole all 28 transporters would participate, HC will provide monthly the outcome of these 28 transporters on TBC and the 25% best transporters (7) will receive KES 2.00 bonus for all milk delivered to HC in that month. Conditional is that these transporters must perform also well consistently on all the parameters at the platform and its milk analyser, for them to qualify for this bonus award. Ole will arbitrate which amount goes to the transporters and what amount goes to the farmer.

Example, if the transporter and his farmers supply 150 litres of milk daily, in a month it will be:
30 days * 150 ltr * 2 KES = KES 9,000 additional monthly. If the amount is divided by two, the transporters will get KES 4,500 and the other KES 4,500 will be divided amongst the farmers.
Or for 25% best transporter (7) this amounts monthly to **7* KES 9,000 = KES 63,000**

c) Society bonus award for improvement on Total Bacteria Count

Currently, over last four months (October 2018 to January 2019) the bacteria load averaged monthly well above 10,000,000 cfu/ml (KEBS standards is below 2,000,000 cfu/ml). Olenguruone board needs to work on basic quality principles to bring Total Bacteria Counts soonest below 10,000,000 cfu/ml. Note that the 10,000,000 cfu/ml is still a factor 10 higher than KEBS standards. Ole's cooling tank will be analysed once a week (4 times in a month). It should never have antibiotic residues and the bacterial count should be seen to improve. If an improvement of 25% reduction in TBC is achieved over time, Ole will get KES 0.5 per litre for all milk delivered to HC.

Example: if an average of 4,000 litres per day is supplied to HC, this monthly bonus amounts to: **4,000 Lts *30days *KES 0.5 = KES 60,000**. This monthly bonus (only when average TPC has improved compared to previous month) will pay for efforts of the Board, trainings, AB strips, etc.
Note: the easiest way for Ole's Board to achieve this bonus is practicing Good Milk Handling Practices, such as: using the existing PHE combined with the Instant Cooler, use 100% alu/ss milk cans, in-time milk deliveries, availability potable water, etc. These are all factors known to improve instantly raw milk quality (or TBC). If, as we have agreed, there are no significant efforts to work on this quality improvement, Ole will not access the KES 0.50 bonus from HC.

4) Sampling regime for samples to be tested at Happy Cow Laboratory

Happy Cow will take monthly samples from all transporters (once/transporter/month) and the cooling tanks samples. The table below shows how the samples will be taken per month.

Sampling analysis schedule			
	Where	**Who**	**Total samples/month**
1	Milk reception platform CBE	All transporters composite samples	28
2	Milk cooling tank CBE	QC at CBE will take this sample	4
3	Milk tanker truck HC	The QC at HC will take this sample	4
	Total samples		**36**

For HC, the quality of the tanker sample is paramount; monthly improvement on tanker composite sample on TBC and milk free of antibiotic residues is required. HC will transfer the quality bonus amounts, as mentioned above, to a separate+ quality account of Olenguruone Society.

Happy Cow Ltd

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SNV

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www.cowsoko.com/kmdp