Dairy Training Institute
Naivasha

Dairy Training Institute Naivasha

Business Plan

December 2013

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
AHITI	Animal Health and Industry Training Institutions
AI	Artificial Insemination
AIE	Authority to Incur Expenditure
ATC	Agricultural Training Centre
CBL	Competence Based Learning
CDAAC	Curriculum Development Assessment Accreditation and Certification
CDM	Certificate in Dairy Management
CHU	Conference Hall Unit of DTI
CIP	Cleaning In Place
DFO	District Finance Officer
DFU	Dairy Farm Unit of DTI
DST	Dairy Science and Technology
DTC	Dairy Training Centre, the Netherlands
DTI	Dairy Training Institute
DTU	Dairy Training Unit of DTI
EAAPP	Eastern Africa Agricultural Productivity Project
EAC	East African Community
EDFA	Eldoret Dairy Farmers' Association
EGU	Egerton University
ESL	Extended Shelf Life
EUR	Euro, 1 Euro = KES 116 (Oct 2013)
FAO	Food and Agriculture Organization of the United Nations
FTC	Farmers' Training Centre
GDP	Gross Domestic Product
Ha	Hectare
HACCP	Hazard Analysis Critical Control Point
HF	Holstein-Friesian
ICT	Information and Communications Technology
IFAD	International Fund for Agricultural Development
ILRI	International Livestock Research Institute
IRR	Internal Rate of Return
ISO	International Organisation for Standardization
IT	Information Technology
KAPAP	Kenya Agricultural Productivity and Agribusiness Project
KARI	Kenya Agricultural Research Institute
KDB	Kenya Dairy Board
KDPA	Kenya Dairy Processors' Association
KES	Kenyan Shillings, 1 KES is 0.00862 EUR (October 2013)
KIE	Kenya Institute of Education
KMDP	Kenya Market-led Dairy Programme
KNEC	Kenya National Examinations Council
kW	Kilowatt
LNA	Labour-Market Needs Assessment
LPD	Litre Per Day
LPO	Local Purchase Order
LPU	Lucerne Production Unit of DTI
Lt	Litre
LTO	Agriculture and Horticulture Organisation (Netherlands)
M	Million
m^2	Square meter
MALF	Ministry of Agriculture, Livestock and Fisheries
MoU	Memorandum of Understanding
MT	Metric Tons
NKCC	New Kenya Cooperative Creameries Ltd

NUFFIC	Netherlands Universities Foundation for International Cooperation
PTC+	Practical Training Centre, the Netherlands
RVIST	Rift Valley Institute of Science and Technology
SAGA	Semi-Autonomous Government Agency
SDCP	Smallholder Dairy Commercialization Programme
SNV	Netherlands Development Organization
SOP	Standard Operating Procedures
SWOT	Strengths Weakness Opportunities and Threats analysis
TIVETA	Technical and Vocational Education and Training Authority
ToT	Training of Trainers
TPC	Total Plate Count
TVET	Technical Vocational Education and Training
UHT	Ultra High Temperature
WUR	Wageningen University and Research Centre

EXECUTIVE SUMMARY

According to the recent Kenya Dairy Labour-market Needs Assessment carried out by SNV and partners in 2013, there is a strong need for practically skilled labour in the dairy sector, not only in Kenya but in neighbouring countries as well. Technical skills needed include dairy farm management, milk collection, bulking and testing, dairy processing and marketing. Additional skills are required in communication, IT and business skills.

The Dairy Training Institute in Naivasha (DTI) is mandated to carry out technical dairy training and has been providing this training since the 1960s. DTI currently falls under the Department of Livestock Production of the Ministry of Agriculture, Livestock and Fisheries. As such it is constrained by not being able to receive direct external funding or to invest revenues back into the institute, to manage the institute in commercial manner, to employ its own staff and to develop a training portfolio based on market needs. For this reason, the parent ministry and the DTI steering committee have embarked on establishing a more commercially oriented and (semi-) autonomous DTI.

In order to assist DTI's transition, a business planning team was fielded, comprising The Friesian, SNV, DTI, DTC staff, and a consultant representing the Kenya Dairy Processors Association; this report is the outcome of the mission.

The current status of DTI is summarized in the report, a policy review was done and the team received feedback regarding the state of affairs on dairy training in the country from stakeholders in the sector, including other training institutions, the Kenya Dairy Board and dairy processors.

The business plan focuses on the key mandate of DTI, e.g. practical dairy training, and proposes to structure DTI around four business units: the Dairy Training Unit, the Dairy Farm Unit, the Conference Hall Unit and the Lucerne Production Unit.

The Dairy Training Unit, which will cater for 420 students from year 5 onwards, will comprise a laboratory and a milk processing facility, which will be used for training purposes only and will not run as commercial entities. This unit will offer a one-year course focusing on all aspects of the dairy value chain, and a two-year course with specializations in either dairy farm management or dairy processing. Next to these longer-term courses, DTI will offer a range of short courses, from standard residential courses to tailor-made external courses. These short courses will form an important revenue stream for DTI.

The Dairy Farm Unit has been designed for fifty milking cows as well as young stock. The unit has been designed in a modern way, including a state-of-the-art milking parlour, a fodder-growing sub-unit, and a smallholder demonstration farm. The farm will be run as a separate commercial unit.

The Conference Hall Unit comprises a conference facility and a guesthouse. The conference facility is currently under construction with funding from IFAD, and is not included as an investment in this business plan. The guesthouse for the conference facility could also be used as accommodation for trainees following short courses at DTI.

The Lucerne Production Unit will be run on a purely commercial basis, separate from the training unit and the farm unit.

Linkages are proposed with the Dairy Campus and the Dairy Training Centre in the Netherlands, as well as other training institutes, in order to obtain internationally recognised standards for DTI. By complying with these international standards, DTI will be an accredited state-of-the-art training centre that can serve the whole East African region.

This business plan includes substantial investments in infrastructure and equipment for all four units. Renovations are proposed for the existing administration blocks, classrooms, dormitories and restaurant. In order to cater for the proposed in-house population of 420 students, new classrooms, dormitories and staff houses will be constructed. In addition, it is proposed to construct a guesthouse for the conference centre.

The business plan involves a total required investment in infrastructure, working capital and equipment of around EUR 5,331,000 for all four business units, at current exchange rates and unit costs. Under the proposed business plan, financial calculations indicate that DTI can operate on a profit-making basis, with an internal rate of return of 15% after interest and tax. The financial projections include a continued government funding for at least a period of five years and a contribution from the dairy industry of KES 0.128 per kg processed milk as a training levy. It is proposed that the training levy will be administered in a Dairy Training Fund owned and controlled by the Kenya Dairy Processors Association or any other body as proposed and agreed by the industry.

Attached to this business plan is a financial projection for each DTI business unit and other proposed public and private income streams. The financial evaluation is presented in chapter 4 of this report.

CHAPTER 1: INTRODUCTION

1.1 Objectives and Scope of the Assignment

The work carried out under this assignment has been funded by SNV Kenya through its Kenya Market-led Dairy Program (KMDP), a five-year program financed by the Netherlands embassy in Nairobi. The assignment for the preparation of a business and investment plan for the Dairy Training Institute (DTI), was carried out by The Friesian Dairy Development Company and the Dairy Training Centre (formerly PTC+) from the Netherlands, in collaboration with SNV and DTI staff and a local consultant representing the Kenya Dairy Processors Association (KDPA).

The Friesian and DTC bring cutting edge international livestock and dairy training expertise and business knowledge, while SNV adds its local presence, networks and knowledge of the dairy value chain in Kenya. SNV Kenya, DTI and the (former) Ministry of Livestock Development signed a Memorandum of Understanding (MoU), focusing on SNV support for assisting and facilitating the transition of DTI in a commercially oriented and industry-driven training institute.

The potential for DTI to operate in a more commercial manner and to be successful in providing market-conform skilled labour for the dairy sector is high. The institute however needs to undergo a fundamental transformation in its legal structure, human resources, management and governance structure, and in its facilities like buildings, practical training equipment, course portfolio, course fees, marketing strategy, revenue streams and business centres.

To facilitate this process of transformation, the DTI steering committee recommended in July 2013 to engage a qualified team with experience in setting up and managing dairy training institutes, to prepare a business and investment plan for the renewal of DTI, with a reduced dependence on the Government.

1.2 Background and Justification

Dairy is the single largest agricultural sub-sector in Kenya, and the development goals as outlined in Vision 2030 have identified agriculture in general and dairy in specific as key drivers for economic growth. To realize this growth, there is need to transform the predominant informal milk production and trade into a commercially oriented and competitive industry.

In order to accelerate the development of the dairy industry, there is an urgent need to develop appropriate human skills, from skills in farm management, milk production, collection and bulking, transporting and

processing, to skills in marketing and distribution. The Dairy Master Plan, the draft Dairy Industry Policy and the corresponding Dairy Bill, all Government of Kenya documents, acknowledge the shortcomings in human resources and the need for quality technical training.

DTI has a national (and even regional) mandate and offers practical training of one- and two-year certificates in Dairy Management and Dairy Science and Technology, as well as shorter practical courses on demand, covering animal husbandry, milk quality control, value addition and technology transfer, business development and entrepreneurship and marketing.

In order to respond to the market needs, the (then) Ministry of Livestock Development prepared a strategic plan in 2012 for the renewal of DTI, and its transformation into a Semi-Autonomous Government Agency (SAGA). The objective of this transformation is to establish a sustainable commercially oriented and industry-driven DTI, which meets the needs of the dairy industry.

1.3 Outline of the Report

Following this introduction (chapter 1), a brief summary of the current situation of DTI is given in chapter 2. A more comprehensive overview of the diagnostics of the current DTI can be found in the DTI Transition - Status Report. Chapter 3 provides an overview of the proposed business scenario, while chapter 4 summarizes the financial projections for each business unit, which are attached to this report as annex 3. Lastly, chapter 5 highlights the main conclusions and recommendations.

CHAPTER 2: ANALYSIS OF CURRENT DTI

2.1 Introduction

This chapter provides a brief summary of the current status of the Dairy Training Institute (DTI). For the full diagnostics of DTI, reference is made to the DTI Transition - Status Report of July 2013, a report prepared and financed under KMDP's MoU between SNV, DTI and the Ministry of Livestock. An additional report was prepared under KMDP, the dairy Labour-market Needs Assessment (LNA). The main findings, conclusions and recommendations of these two reports have been incorporated in the business plan for DTI.

DTI was founded in 1963 as a dairy training school and has since operated as a government institution, providing trained personnel for the dairy industry. The institute was established with assistance from the United Nations Children's Fund (UNICEF), under the milk conservation programme, to provide trained personnel to promote and strengthen small-scale farmer milk production, processing and marketing in the rural areas. From 1963 to 1990, DTI was the regional Dairy Development and Training Centre for the English speaking countries in East and Central Africa under the Food and Agriculture Organization (FAO).

Currently, DTI is offering practical oriented, hands on training in Dairy Science Technology and Dairy Management in the East African region. DTI is located on a 1,308-acre piece of land in Naivasha district of Nakuru county, 100 kilometres North West of Nairobi, off the Nairobi-Nakuru highway.

SNV recently facilitated DTI in carrying out a topographical survey (see annex 4 and 5), including the re-establishment of the beacons for land marking. The maps that are part of this survey provide an overview of the land, existing infrastructure, as well as the conference facility under construction (land reference number LR5210). With these documents, DTI or the ministry should be able to apply for a title deed.

2.2 Organisational Setup of DTI

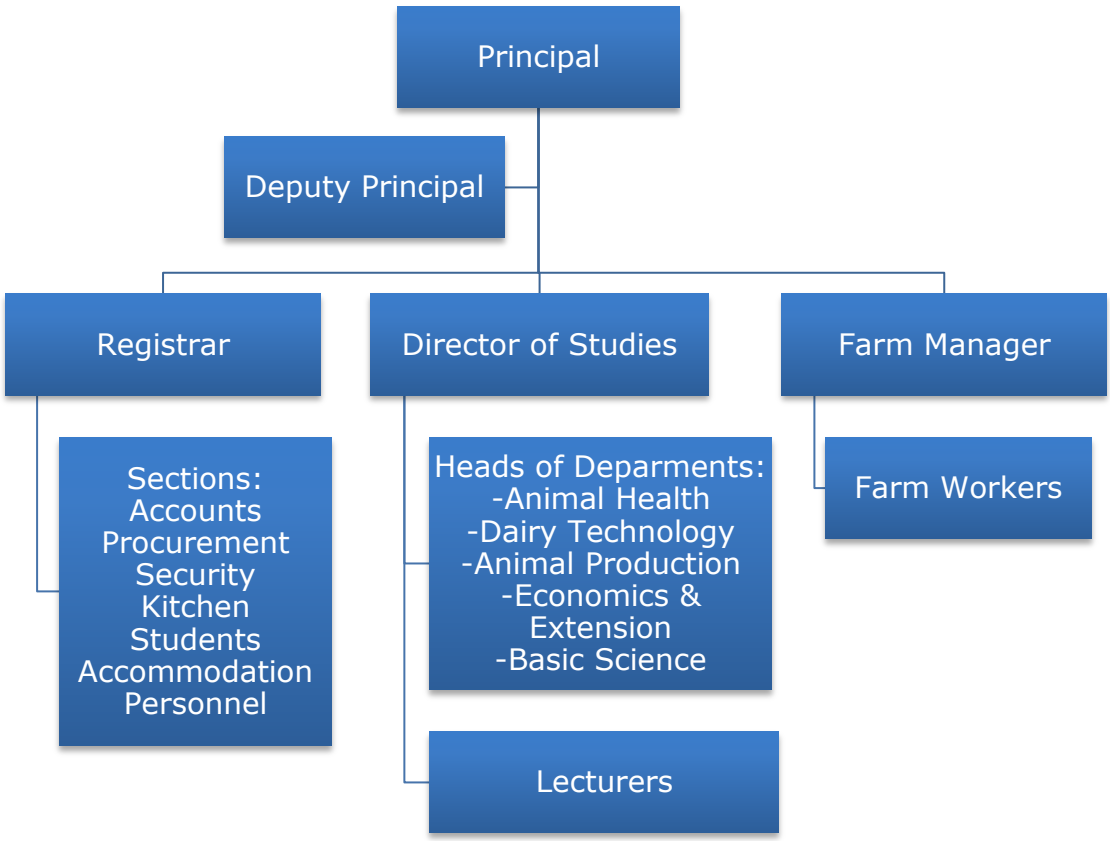
DTI currently has a staff capacity of 41 of which 30 are male and 11 are female; all are employed by the government. The teaching section has 32 members of staff while the rest are in support services. With a student population of 214 (2012), the teacher to student ratio is 1:5. There are five technical departments within DTI, with a departmental head for each:

- animal health
- dairy technology
- animal production
- economics and extension
- basic science.

There are only three classes for the two courses, which means that at any particular point of time, only three lecturers are in class. It is however important to note that the same lecturers also act as technicians in providing practical training.

The figure below illustrates DTI's current organizational structure.

Figure 1. DTI's Current Organizational Structure



DTI's principal is the head of the management team and is in charge of running the institute, reporting directly to Ministry of Agriculture, Livestock and Fisheries (MALF). The registrar is in-charge of administrative issues in the institute including accounts, procurement, security, students' accommodation, catering as well as personnel matters. The director of studies is responsible for the implementation and administration of all aspects of the academic programme, including the management of the teaching team and their performance.

As government employees, DTI staff is entitled to a basic salary and allowances as stipulated by civil service terms. The civil service salary structure is based on grading levels, which take into consideration economic performance, availability of funds and productivity level of members of staff.

The government Code of Regulations requires staff performance appraisals to be done every quarter, as well as an end-of-year appraisal covering the period 1st July to 30th June of the following year. Currently, only the principal has a performance contract and his performance appraisal is based on the following skills and work attributes:

a. leadership
b. planning and organizing
c. training and development of staff
d. accountability and resource management
e. judgment and objectivity
f. performance management
g. promotion of the use of ICT.

Education and Skills Levels of Staff

The minimum level of education required for teaching staff within an institute like DTI is an undergraduate Bachelors degree. For non-teaching and support staff, Certificate and Diploma level qualifications may be considered. The management team and other selected senior members of staff at DTI possess Masters degree qualifications. More than half (68%) of the staff have a Bachelors degree and above, as illustrated in the table below.

Table 1. Current DTI Staff Qualifications

Level of Education	Number of staff	Percentage (%)
Masters degree	11	27
Bachelors degree	17	41
Diploma	6	15
Certificate	7	17
Total	**41**	

Source: DTI Management

2.3 Current Training Program and Facilities

DTI is offering two long-term courses in Dairy Management and Dairy Science and Technology with a duration of one- and two-years respectively for around 140 students, as well as a series of short-term technical courses on demand. Most of the training is done in-house, but the training facilities and other infrastructure, including student and staff accommodation, laboratories and training grounds, are all out-dated and in poor condition.

The table below shows the admission of students in the period from 2008 to 2012. The certificate course in Dairy Science and Technology (DST) attracted a higher admission rate during four consecutive years as compared to the Dairy Management (CDM) course, with the exception of 2012 enrolments.

Table 2. Student Enrolment 2008-2012

Year	Dairy management (1y)	Dairy science and technology (2y)
2008	44	54
2009	50	52
2010	52	53
2011	72	70
2012	80	64

Source: DTI Management

To assist the practical training, the institute runs a farm and operates an out-of-date and non-functional dairy plant. DTI also offers consultancy and business development services and is engaged in collaborative research.

2.4 Current Linkages with other Organizations

DTI currently has a number of linkages with other organizations: it is operating under the Department of Livestock Production under the ministry of Agriculture, Livestock and Fisheries (MALF), and there are a few donor-funded programs under the ministry that have links with DTI. These programs include EAAPP (funded by the World Bank) and SDCP funded by IFAD, which is establishing a conference facility.

SNV's engagement with DTI has been referred to above: to support the SAGA transition process, the establishment of a steering committee, the preparation of the dairy Labour-market Needs Assessment, the DTI Transition - Status report, a land and boundary survey and this business plan.

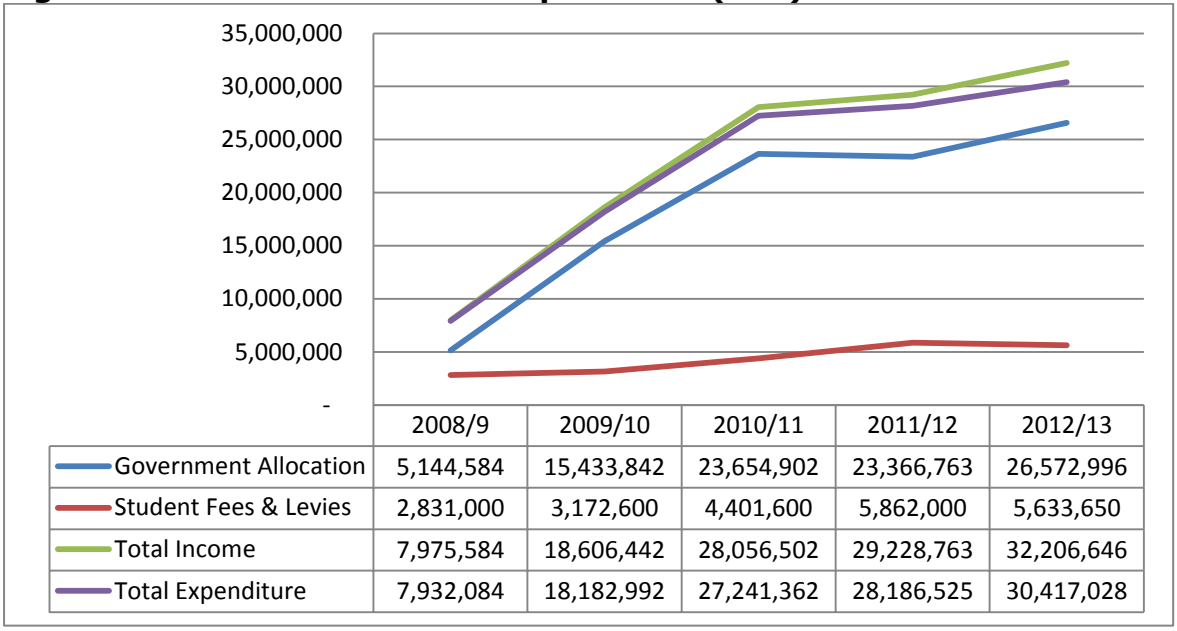
Other organizations are linked to DTI on a more incidental basis, including FAO, which has developed interactive radio programs in cooperation with DTI focusing on dairy farming. Other links are with KDB, the World Bank funded KAPAP, NUFFIC, and others.

2.5 Financial Management

The accounts of DTI, being a government institution, are kept at the district accountant's office. The District Finance Officer (DFO) manages the financial records of DTI, releasing funds to the institute using the authority to spend vouchers provided. The finance clerk of DTI records the income and expenditure in a ledger, no detailed financial records or statements are kept at the institution. This method of financial management is quite inefficient.

Currently, DTI has two main sources of income: the central government funds and student fees. Any additional income from other sources is charged based on a cost recovery basis. The table below illustrates DTI's income and expenditure for the period 2008 to 2013.

Figure 2. DTI's Income and Expenditure (KES)



	2008/9	2009/10	2010/11	2011/12	2012/13
Government Allocation	5,144,584	15,433,842	23,654,902	23,366,763	26,572,996
Student Fees & Levies	2,831,000	3,172,600	4,401,600	5,862,000	5,633,650
Total Income	7,975,584	18,606,442	28,056,502	29,228,763	32,206,646
Total Expenditure	7,932,084	18,182,992	27,241,362	28,186,525	30,417,028

Source: Authority to Incur Expenditure provided by DTI management

The institute receives the government funds every quarter through the District Treasury, the custodian of the government accounts. There is an elaborate process in place before any funds are released by the District Accountant; first an application to DTI's accounts clerk is presented with details of the expenditure to be incurred. The clerk then raises a Local Purchase Order (LPO) that is forwarded to the principal for approval. An imprest warrant is then prepared and presented to the District Treasury for release of the funds.

DTI operates a petty cash amount of KES 100,000 per week and for its release, a receipt as proof of expenditure is needed. The institution has to spend the money as per the Authority to Incur Expenditure (AIE) as the ministry does not encourage any deviations from the budget. Any balances that occur as a result of under-spending are returned to the treasury. Suppliers are paid directly from the District Treasury after approval of the LPO by the institute.

The student fee for the one-year course is KES 45,250, and KES 68,250 for the two-year course. The student fees and levies have been on an upward trend, but the cumulative growth for the last five years has been only 12%, against an annual inflation in Kenya of approximately 12% per year.

2.6 Policy Review and Legal Status of DTI

Since its establishment, DTI has been under the management of the Ministry of Livestock, which now falls under the Ministry of Agriculture, Livestock and Fisheries. There is no specific legal framework establishing or guiding the operations of DTI, and DTI is entirely dependent on the parent ministry for direction and funding. This means that currently it is not possible for DTI to develop its own course portfolio and curricula based on the needs of the market, apply market conform course fees, receive directly funding from donors and the private sector, develop business centres to generate revenues for investments and operations, and put in place performance based human resource policies.

A policy review was carried out in order to determine the most appropriate policies and regulations. Some of these legislations that impact on the dairy industry, are listed below:

- Dairy Industry Act (Cap 336)
- Standards Act (Cap 496)
- Public Health Act (Cap 242)
- Food, Drugs and Chemical Substances Act (Cap 254)
- Animal Diseases Act (Cap 364)
- Veterinary Surgeons Act (Cap 366) – revised as "The Veterinary Surgeons and Para-Professionals Bill", 2010
- Pharmacy and Poisons Act (Cap 244)
- Fertilizer an Animal Foodstuffs Act (Cap 345)
- Agriculture Act (Cap 318) and the Agriculture, Fisheries and Food Authority Act
- Co-operative Societies Act (Cap 490)
- Land Act (Cap 280)
- Factories Act (Cap 514)
- Companies Act (Cap 486)
- Trade and Licensing Act (Cap 497)
- State Corporations Act
- Environmental Management Act.

The Dairy Industry Act states the following in relation to DTI: *"Capacity building is crucial (…). The Naivasha Dairy Training Institute, Animal Health Training Institutes (AHITIs) and the FTCs have been mandated by the government to offer this service through formal and on-the-job training. However, these institutions have been underutilized due to severe reduction in their funding levels. In addition, the respective curricula have remained unresponsive over time and cannot cope with the dynamic needs of the dairy industry. Although there exists a relatively liberalized dairy industry, the institutions continue to depend on the limited government resources to build human capacity".*

The policy commits the government through the following statement: *"In order for the dairy industry to have an adequate and competent human capacity to address the current and future challenges, the government will empower agricultural colleges and universities to provide updated formal and on-the-job training. In this regard, the Naivasha Dairy Training Institute, the AHITIs and the FTCs will be restructured and granted semi-autonomous status to enable commercialization of their training services. Further, stakeholders will be encouraged to contribute to capacity building by setting up their own training institutions, which will be vetted and licensed by the government to ensure conformity to the set high standards of such training institutions."*

Other policies of relevance to the DTI transformation are:

- Agriculture, Fisheries and Food Authority bill
- Kenya Agricultural Research bill
- The Sessional (policy) paper of 2012 by the then Ministries of Education and of Higher Education, Science and Technology – a policy framework for education and training (reforming education and training in Kenya)
- TVET Act of 2013
- Industrial Training Act.

Specifically the TVET Act has far reaching impact because it establishes a Technical and Vocational Education and Training Authority with the following functions:

a. Regulate and coordinate training under this act.
b. Accredit and inspect programs and courses.
c. Advise and make recommendations to the Cabinet Secretary on all matters related to training.
d. Determine the national technical and vocational training objectives.
e. Promote access and relevance of training programs within the framework of the overall national socio-economic development plans and policies.
f. Prescribe the minimum criteria for admission to training institutions and programs in order to promote access, equity and gender parity.
g. Recognize and equate qualifications awarded by local or foreign technical and vocational education institutions in accordance with the standards and guidelines set out by the Authority from time to time.
h. Develop plans, and guidelines for the effective implementation of the provisions of this act.
i. Establish a training system that meets the needs of both the formal and informal sectors as provided under this act.
j. Collect, examine and publish information relating to training.
k. Inspect, license, register and accredit training institutions.
l. Advise on the development of schemes of service for trainers.
m. Assure quality and relevance in programs of training.

n. Liaise with the national and county governments and with the public and the private sector on matters relating to training.
o. Undertake, or cause to be undertaken, regular monitoring, evaluation and inspection of training and institutions to ensure compliance with set standards and guidelines.
p. Mobilize resources for development of training.
q. Ensure the maintenance of standards, quality and relevance in all aspects of training, including training by or through open, distance and electronic learning.
r. Approve the process of introduction of new training programs and review existing programs in Technical and Vocational Education and Training Board institutions.

From the above the impact of the TVET Act on DTI is clear. No person or institution shall offer training in Kenya unless the person or institution has been accredited, licensed and registered under this act to offer such training. Those institutions and trainers already offering training at the commencement of this act, shall, within six months from the date of such commencement, submit an application to the Board for accreditation, registration and licensing under this act.

From the discussions above, it is safe to note here that the legal and policy framework in Kenya is in support of the transformation of DTI to a SAGA. It is however necessary to be cautious as there are on-going policy change processes with the newly established government. The overarching policy direction is pro-liberalization and privatisation, and there is a willingness of the government to engage in public-private partnerships.

2.7 Dairy Labour-market Needs Assessment

As mentioned above, KMDP facilitated a dairy Labour-market Needs Assessment (LNA), carried out by KMDP staff and PKF consulting. The team worked closely with various knowledge institutes from the Netherlands, Egerton University, DTI Naivasha, and Bukura Agricultural College. The overall objective of this study was to assess the demand and supply of skills and competences for the dairy sector in Kenya and to give recommendations to the institutions to bridge the gaps identified. Data was collected from graduates of several training institutes and from dairy industry players. This chapter contains a short summary of the findings of the needs assessment in relation to DTI, further information can be found in the full LNA report.

Market Analysis
The DTI Transition - Status Report and the LNA give a comprehensive overview of the demand side and the supply side of the market. The conclusions of these studies are that the supply of skilled labour for the dairy

industry is very limited and almost solely confined to DTI. There is a high and increasing demand for skilled labour in the dairy value chain, which is not surprising considering the following indicators:

- Dairy is the largest agricultural sub-sector, contributing 14% to the agricultural GDP.
- Milk volumes have grown from 2.8 billion kilograms in 2002 to 4.2 billion kilograms in 2012.
- Processed milk has grown from 140 million kilograms 2002 to 500 million kilograms 2012.
- There are currently an estimated 800,000 smallholder dairy farmers.
- There are 250 dairy cooperatives and registered producer groups.
- There are around 3,500 medium and large-scale commercial dairy farms.
- The number of operational registered milk processors is 32.
- The dairy sector employs an estimated 841,000 full time jobs (2008).
- Every 1,000 litres of milk produced creates 23 full-time jobs for the self-employed, 50 permanent jobs for employees, and 3 full time casual labour jobs, resulting in a total of 77 direct jobs in the dairy value chain (Source: Staal, Pratt and Jabbar, "Dairy Development for the Resource Poor", ILRI, 2008).
- Milk consumption in Kenya is estimated at 100 litres per capita per year.
- The prognosis for 2015 – 2030 is that demand for milk will out pass supply.

Market Drivers
Major drivers for the skilled dairy labour market are:

- General growth in demand for milk and milk products.
- Growth of the formal market and investments in the value chain and into value addition by dairy societies and processors.
- Growing number of farmers and farm managers that see dairy farming as a business and preparedness to invest in skills and knowledge.
- Growing number and professionalism of service and input suppliers, all looking for appropriate skills and skilled staff.
- High interest from development partners in the dairy sector and in vocational training as opposed to academic courses.

Remarks made by DTI graduates
The following are remarks made by DTI graduates:

- DTI attracts a relatively high percentage of female students compared to other institutes.
- DTI attracts mainly young people (majority between 20 and 25 years of age) coming from high school, not many mid career professionals.
- Certificate level graduates receive a low salary.

- High employability of graduates (over 75 % within one year after graduation).
- 53 % of interviewed graduates have supervision duties, but management and leadership is not part of curriculum.
- DTI should shift focus from training for government to training for the industry.
- High level of interest for self-employment due to low salaries, however just 23 % of interviewed candidates were interested in general or dairy farming.
- Practical training facilities at DTI are in a dilapidated state.

Remarks regarding curriculum development from employers

Milk processors recommended including the following subjects in the curriculum:

- agribusiness and business research
- franchise management
- staff management, training and leadership
- financial management and entrepreneurship
- record keeping, monitoring and evaluation and impact assessment
- communication including report writing
- product development
- work ethics
- ICT
- value addition, looking at emerging trends in terms of future consumer demands (new cheeses, etc.)
- marketing, analytical, laboratory and life skills.

In order to cover the gaps in the DTI curricula, milk processors are also organising the following in-house courses:

- HIV awareness/ safety training/ gender training
- team building
- annual refresher on quality assurance and extension
- financial management
- production and operational training
- practical training in new/ innovative skills
- herd handling
- ISO certification
- marketing and sales
- specialized cheese making
- employability skills.

Dairy farmer associations recommended including the following topics in the curricula:

- dairy business training including farm administration, accounting, bookkeeping and basic business mathematics
- general practical farm management and hygiene.

2.8 Views of Dairy Processors on DTI

Questionnaires were developed (see annex 6) to gather views on DTI from the main dairy processors in Kenya. The team received feedback from processors like NKCC, Sameer, Happy Cow, Githunguri and Brookside. A summary of these filled-out questionnaires can be found below.

Location of DTI
There is divided opinion on whether the current DTI location is suitable for practical dairy training, with the main concern being the semi-arid climatic conditions. However, many processors acknowledge that dairy farming has been successful in the area (e.g. at KARI, Delamere and other farms), when irrigation was used to produce fodder. The area is known for the potential to grow high quality lucerne under irrigation. Suggestions were made that DTI can serve as a training base for the theoretical and food technology part of the curriculum while the institute makes arrangement with commercial dairy farms, other institution like RVIST and processors to offer training venues to be used by DTI students during practical sessions.

Training
There is a general consensus that current short and long-term courses should continue, however they need to be improved and aligned with (international) best practices and the latest technology. Training should include ICT applications for the dairy industry and management training, whereas the exposure and experience of the students needs to be enhanced.

An additional remark made by processors was that the current curriculum is biased towards post milking, with little attention for milk production. There is a need to create a better balance between dairy farming, quality assurance along the value chain and processing. These areas should be the trainees' specialisation after going through the initial general courses.

It is also suggested that DTI should develop a training program for small-scale dairy farmers, with a focus on youth. It is observed that these new farmers have very minimal understanding of dairying and that is why productivity seems to be on the decline. This has been emphasized as very important. DTI should also address the issue of offering refresher and specialized courses for those already working in the dairy industry so as to enable them keep up with the new developments.

Processors' role and potential contribution to DTI

The commercialization and attainment of (semi-) autonomy of DTI are the main preconditions for processors to fully participate in the development and management of DTI. Once this is assured, the processors seem willing to take up a leading role in the governance of DTI and, for example, be part of the management board, and set aside a training levy to co-finance the institute.

Land issue

While the processors are willing to participate and play a role in the DTI transformation process, there is still the land issue that needs to be resolved. The land currently does not have a title deed and falls under MALF. More critical is that the land ownership (or use) is disputed by squatters who have entered part of the farmland that is under DTI for grazing their animals. This issue is elaborated upon in more detail in paragraph 3.4 below.

2.9 SWOT Analysis

The Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis in the figure below is a compilation of findings of the team, combined with information from the SWOT analysis in the DTI Transition - Status report.

Table 3. DTI SWOT Analysis

Strengths	**Weaknesses**
• The brand name of the institute (DTI – Naivasha) in Kenya and in the East Africa region is widely known • DTI is one of the very few institutes in Kenya with the mandate to carry out dairy vocational training • DTI's curricula have a practical approach to training • DTI students are highly employable • DTI has existing infrastructure which can be utilized (e.g. land, buildings) • There is on-going Government and donor support (e.g. IFAD/World bank) • There is a conference facility that is currently being constructed • DTI is centrally located and relatively close to Nairobi	• Current low organizational capacity • Prone to a high level of bureaucracy • Current staff capacity and motivation • Current facilities/utilities are dilapidated • Low quality of access road • DTI is situated in a semi-arid area • Few existing linkages with private sector and other training institutions • Quality of curricula can be improved • Low level of incorporation of ICT • Low level of product marketing • Staff time shortages for short courses • No official curricula for short courses • No official accreditation of courses • No existing credit transfer for student transfer to other institutes • No ISO certification • No commercial/market driven approach • Little ability/drive to attract investors
Opportunities	**Threats**
• Former Ministry of Agriculture and Ministry of Livestock now one ministry, providing opportunities for collaboration • Vision 2030 includes a clear government vision for dairy sector • High Demand for practical dairy training (farm management and processing) • Large demand for short courses • Relative strength of Kenya dairy sector within the East Africa region • Growth of Kenyan dairy sector • Devolution of government to counties • Development of Naivasha town • Donor interest in investment (if SAGA) • Private sector interest (if SAGA) • Proven potential for irrigated fodder production • Training levies can be reimbursed • TVET development, new TVET Act	• Issue of land ownership and land dispute • SAGA status might take some time • Competition from other training institutes - upcoming • Turnover of staff • Devolution of government to counties

2.10 Alternative Scenarios

Part of the Terms of Reference of the study team was to look at alternative scenarios or locations for dairy training, in case the pre-conditions for revival of DTI Naivasha cannot be met within a reasonable time span. Although this part was only briefly looked into, the business plan as such – or elements thereof – can be used and adapted in case the dairy stakeholders would opt for a different location or institution to partner with.

The first alternative scenario, in case the land issue cannot be resolved, has already been discussed above. The practical training can be outsourced to commercial dairy farms and processors and partnerships can be sought for this part of the training with KARI Naivasha, Technology Farm (RVIST) or EGU's farm. In this scenario, DTI itself will host the more theoretical parts of the training portfolio and the students.

Although it is not the preferred option for this business plan, a second alternative scenario could be to engage with other existing training institutes. Some candidates for this scenario are:

- Rift Valley Institute of Technology (RVIST)
- Egerton University (EGU)
- Moi University
- others.

It must be noted that in this business plan the cost of land is not included, as DTI already has access to the land. For any other scenario, which requires lease or purchase of land, the investment will be substantially higher.

CHAPTER 3: PROPOSED BUSINESS SCENARIO

3.1 Introduction

The potential for DTI to operate more commercially and be successful in providing the required quality and mix of skilled labour for the dairy sector is high. The institute however needs to undergo a fundamental transformation in its legal structure, management and governance structure, improve on its facilities, practical training equipment and infrastructure, course portfolio, course fees, marketing strategy, revenue streams and profit centres.

What follows is a proposed business scenario for DTI, as suggested by the business-planning team. The business plan distinguishes several business units within DTI; from an organisational point of view each business unit is organised as a department under the managing director. The following four business units are identified, which will be described in detail later in this chapter:

- DTU: Dairy Training Unit
- DFU: Dairy Farm Unit (including a forage production sub-unit)
- CHU: Conference Hall Unit
- LPU: Lucerne Production Unit.

3.2 DTI's Mandate

In order to be focused and successful as a practical dairy training institute, the mandate of DTI will have to be clear. The proposed mandate for DTI is the following:

a. To provide technical training in dairy farm management and milk collection, bulking, processing and marketing with a focus on practical training for graduates from basic education institutes to enable them to be employed within the dairy value chain.
b. To provide practical short-term market-driven training and refresher courses in dairy farm management, milk collection, bulking, processing and marketing to people already in employment.
c. To design tailor-made courses based on emerging training needs in the dairy value chain.
d. To provide continuing education and further training through part-time or distance learning modules or any other appropriate mode.
e. To establish and run income-generating business units for the purpose of the financial support to DTI as well as provide facilities for practical training.
f. To provide technical support in the form of consultancies for the dairy industry.

DTI focuses on providing practical skills, sound work attitudes, communication and entrepreneurial skills, based on competency-based learning. DTI will have a mandate to provide practical training not only in Kenya, but also in neighbouring countries.

3.3 Legal Status

The process of transformation of DTI into a Semi-Autonomous Government Agency (SAGA) has been initiated by MALF, as per the Dairy Policy mentioned in chapter 2. The (then) Ministry of Livestock Development prepared a cabinet memo that was sent for review and approval to the Ministry of Finance. Meanwhile the new government initiated a Taskforce on Parastatal Reforms, the result of which might be policy changes that impact the on-going DTI transformation process, and therefore delay the process. However, the study team was informed that the Minister for Agriculture, Livestock and Fisheries strongly supports the SAGA status of DTI and is willing to sort out the land issue.

The perceived benefits of DTI's transformation into a SAGA are the following:

a) Mobilization of resources: the transformation will automatically give the institution an incentive to collect additional financial resources, as DTI will have the authority to utilize the resources itself.
b) Specialization and efficiency: it is envisaged that the creation of an (semi-) autonomous DTI will promote efficiency in its operations, especially if the oversight of the Management Board is effective and if performance contracts are used that will ensure that the leadership delivers according to the signed contract.
c) Better skilled manpower: Once the transformation has been completed, DTI will have the ability to instil major changes in its human resource department, where the focus will be to attract and retain strong skilled manpower in management, human resource management, curriculum development and training, through better terms and conditions of service and performance contracts.
d) Commercial orientation: Under SAGA status, DTI can charge fees for services delivered at market conform rates and develop business units for creation of additional revenue for the institute.
e) Industry-driven products and services: After attaining SAGA status DTI has more opportunities and ability to develop training modules and curricula that are required by the market, especially short courses and training.

After the transformation of DTI, there will be two different legal frameworks that will govern the institution. In its intended SAGA status, DTI may have to

wear two hats; one being a SAGA governed by the State Corporations Act and the second as a middle level training college under the TVET Act (for details reference is made to the DTI Transformation - Status Report).

State Corporation Act

As a SAGA, DTI will be guided by the State Corporation's Act, which regulates the formation of state corporations and specifically guides the formation of management boards that manage the institutions as well as the control of finances. Strict adherence to the set provisions will go a long way into helping DTI set up a commercialization plan and consequently implement it.

The TVET Act

Educational reforms in Kenya have led to the Technical Vocational Education and Training (TVET) Act, focusing on skills development programs for youth and adults. The bill has implications for all training institutes in the country, including DTI. The act is defined as "an act of parliament to provide for":

- Establishment of a technical and vocational education and training system.
- To provide for governance and management of institutions offering technical and vocational education and training.
- To provide for coordinated assessment, examinations and certification.
- To institute a mechanism for promoting access and equity in training.
- To assure standards, quality and relevance.

The guiding principles of the Act state that training shall be availed to all qualified Kenyans without discrimination and that all appropriate mechanisms will be instituted to promote access, equity, quality and relevance in training to ensure adequate human capital for economic, social and political development. The training programmes will also be designed to operate within a framework that leads to lifelong education and training, which facilitates innovativeness and creativity and complementary education for those receiving technical and vocational training in the form of "on the job training".

The Technical and Vocational Education and Training Authority (TIVETA) was set up to play a regulatory role with the mandate that includes the following functions:

- To regulate and coordinate training under the Act.
- Accredit and inspect TVET programs and courses.
- To establish minimum criteria for admission to institutions and programs in order to promote access, equity and gender parity.
- To recognise and equate qualifications awarded in local institutions on foreign TVET institutions in accordance with the standards and guidelines.
- Collect, examine and publish information relating to training.
- Inspect, licence, register and accredit training institutions.

- Register and licence trainers.
- Advise on the development of schemes of service for trainers.
- Mobilise resources for training.
- Promote private sector investment and participation in training.
- Maintain a register of all institutions accredited under this act.

The TVET Act has put in place strict requirements for licensing, registration and accreditation of trainers. Article 17, chapter one of the Act, states that no person or institution shall offer training in Kenya unless it has been accredited, licensed and registered under the Act. No program or course of training shall be mounted in an institution without prior approval by the management board and any academic award or qualification issued by an institution not yet accredited, registered and licensed in accordance with the Act. Any person/institution that contravenes this requirement is liable to a fine of KES one million or jail term for three years.

3.4 Land Ownership

The size of the land on which the institution is located (Land Reference number: LR5210) is estimated at 1,308 acres (see Annex 4) and is shared with the Kenya Agriculture Research Institute (KARI), the Sheep and Goat Station, and the Livestock Recording Centre. KARI is the custodian of the documentation regarding the ownership of the land, and until now the government has agreed for DTI to use the land.

The issue of land ownership will need to be addressed and it is presented in this business plan as a precondition for further investment. It would need a government intervention to enable DTI to acquire the title deeds for the land. The current arrangement of ownership doesn't refrain DTI from utilizing the land. SNV Kenya assisted DTI in carrying out a topographical survey, including the renewal of beacons demarcating the land, which will facilitate the process of acquiring the title deeds. The maps produced under this survey can be found in annex 4 and 5.

In addition to the issue of land ownership, there is also a court case on-going regarding squatters, which also affects part of the land of LR5210. It is expected that under the new land laws this will not be a major issue, as the squatters have not been using the land long enough to claim land rights.

3.5 Organisational Structure and Human Resource Management

In this section the proposed staff requirements and the management structure are summarised. The proposed organisational structure for DTI can be found in figure 3.

Management Board
As per State Corporations Act, a Management Board of a SAGA should include the following members:

- a chairman appointed by the President
- the chief executive
- the Permanent Secretary of the parent Ministry
- the Permanent Secretary to the Treasury.

In addition, the Act states that not ,more than seven other members, not being employees of the state corporation can be included in the Board, of whom not more than three shall be public officers, appointed by the Minister. Board members are appointed for a renewable period of three years or shorter. The Management Board should meet at least four times every financial year and not more than four months can elapse between meetings.

It is recommended under this business plan that members of the most important dairy value chain stakeholders are included in the DTI Management Board, including the Kenya Dairy Board, the Kenya Dairy Processors' Association, and others.

Business Units
This DTI business plan distinguishes several business units and from an organisational point of view, each business unit is organised as a department under the managing director. Each department is headed by a manager who is accountable for the department's day-to-day operations, achievements, financial results and budget. The following business units are identified:

1. DTU: Dairy Training Unit
    a. Administrative department: Logistics, Human Recourses, Marketing, Accounting, Procurement, ICT, Catering etc.
    b. Training Department: Dairy Farming, Dairy Processing, Basic sciences, Mini Dairy and Laboratories

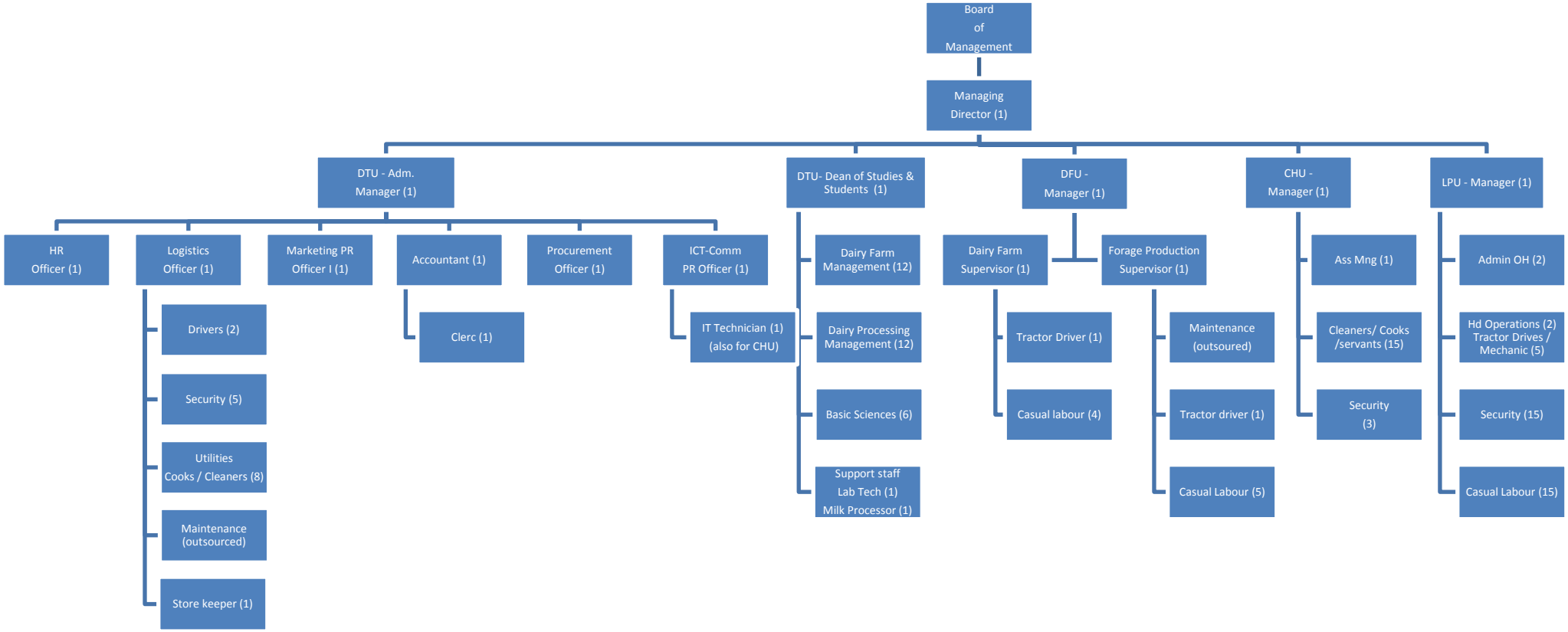
2. DFU: Dairy Farm Unit (including the forage production sub-unit)
    a. Farm Operations
    b. Forage Production
    c. Smallholder Dairy Farm

3. CHU: Conference Hall Unit
    a. Administration / Logistics
    b. Guesthouse Rental

4. LPU: Lucerne Production Unit
    a. Administration / Sales / Logistics
    b. Operations.

These business units will be described in detail in chapter four.

Figure 3. Proposed Organizational Structure



Staff Requirements

The Managing Director reports to the Management Board and is represented by the Dean of Studies during his/her absence. Based on the proposed business structure, the job groups and gross salaries are summarised in the table below.

Table 4. Job Categories and Gross Salaries

Title	Job Group	Gross Salary (KES/month)	Gross Salary (EUR/month)
Managing Director	S	337,608	2,910
Sr Department Manager / Ast. Director	Q	224,755	1,938
Department Manager	P	194,152	1,674
Section Manager / Principal Lecturer	N	152,513	1,135
Senior Lecturer / Technician	M	130,439	1,124
Supervisor / Lecturer level I	L	97,152	838
Senior Operator / Lecturer II	K	77,865	671
Operator (driver / security)	H	46,087	397
Clerical Officer I	G	39,812	343
Clerical Officer II	F	30,050	259
Skilled Labour	E	24,917	215
Casual Labour	D	21,248	183

The proposed gross salary for DTI staff is based on the realignment of the salary structure for civil servants, which has been issued by the Ministry of State for Public Service in July 2012. In order to be competitive for the labour market, 15% of the gross salary amount is added to the annual gross salary, as well as an additional 25% for job groups N, M, L and K and one extra month of salary for all job groups. The table below summarizes the total staff requirements based on the job groups.

Table 5. Staff Requirements

Designation / cadre	Job Group	DTU	DFU	CHU	LPU	Total
Managing Director	S	1	-	-	-	1
Senior Dept. Manager / Assistant Director	Q	1	-	-	-	1
Department Manager	P	1	1	1	1	4
Section Manager / Principal Lecturer	N	36	-	-	2	38
Senior Lecturer / Technician	M	-	-	1	-	1
Supervisor / Lecturer level I	L	1	2	-	2	5
Senior Operator* / Lecturer II	K	0.5		0.5	-	1
Operator (driver / security)	H	10	2	3	15	30
Clerical officer I	G	1	-	-	5	6
Clerical officer II	F	8	-	15	-	23
Skilled labour	E	-	-	-	-	0
Casual labour	D	-	6		15	21
Totals		**59.5**	**11**	**20.5**	**40**	**131**

**ICT technician shared by DTU and CHU*

3.6 Training Programme and Methodology

3.6.1. Proposed Training Program

Under this section, first the long-term courses are described, followed by a description of the shorter courses. The Ministry of Education states in the new TVET Act 2013 (see section 2.6 for details) that curricula should be developed by the concerned training institutions in close collaboration with the private sector, which is something that should be followed by DTI as well. There will be two long-term courses, a one-year and a two-year course.

One-Year Certificate Course
The curriculum for the one-year course currently in use will be adjusted in line with recommendations made in the LNA report and recent meetings with the main dairy processors in Kenya. In the adjusted curriculum, an equal amount of time will be allocated to dairy farm management and milk collection and bulking, processing and marketing subjects. This course will allow students to get a general insight in the dairy value chain in Kenya. It will equip them with basic skills and competences required for the existing jobs in the dairy value chain. Participants applying for both the one-year course as well as those applying for the two-year course will participate in this curriculum.

Two-Year Certificate/Diploma Course
After completion of the one-year certificate course, those candidates that applied for the two-year course will have to choose between these two specializations:

1. Dairy Farm Management
2. Milk Collection, Processing and Marketing.

The curricula for these two specializations will be newly developed, in line with Competence Based Learning (CBL) principles (see 3.6.3), and also in line with the new TVET Policy of the Ministry of Education. Profession profiles will be elaborated for all jobs in the dairy sector, in cooperation with representatives from the private sector. These profiles will form the basis for the course modules and assessments for both specializations, which will increase the employability of the graduates.

Initially the two-year specialization courses will be offered as certificate programs. Over time, when the private sector will need higher qualified staff, the two-year course will be developed into a diploma course.

Training Modules
The second year specialization courses will have a curriculum with a modular set up. Modules will be developed as much as possible in line with the

profession profiles that have been developed. These training modules will be reflected in the annual training calendar and these modules can be advertised as short courses for outsiders. The following crosscutting issues will be included in these modules:

- economics
- management
- HIV and gender
- animal welfare (dairy farm management specialization)
- environmental issues, including impact of climate change
- communication
- innovation and creativity.

Potential Short Courses

In this section a draft list is proposed of potential short courses to be given at DTI, based on market needs and profession profiles. The development of curricula for these courses should take place in close cooperation with industry actors. The following categories of short courses are distinguished:

1. residential standard courses
    a. at DTI premises
    b. standard courses with a duration of 3 days, 1 week or 2 weeks
    c. courses can be modules under the certificate / diploma courses
2. residential tailor-made courses
    a. at DTI premises
    b. flexible timing and content
    c. higher fees as tailor-made curriculum is required
3. external courses
    a. by DTI trainers outside DTI premises
    b. higher fees as DTI staff has to travel
    c. could either be a standard or tailor-made curriculum.

It is expected that the demand for short courses will increase considerably once the new DTI infrastructure has been completed and marketing of these short courses has been optimized. It is also expected that the variation of the training demand in terms of topics, level, location, duration, etc., will be considerable. Expertise required for the implementation of short courses that is not available within the DTI team, should be hired from outside. These are potential short courses in Dairy Farm Management:

- Dairy Farm Management (basic): using CowSignals principles, stable design, animal health, hoof trimming, calf management, etc.
- Dairy Farm Management (advanced): setting objectives, action plans, monitoring, evaluation and analysis through the use of key performance indicators, etc.

- Dairy Farming as a Business (advanced): focusing on business principles, calculating key indicators for business success, financial management, etc.
- Dairy Record Keeping
- Housing of Dairy Animals
- Young Stock Rearing: including calf management, feeding, growth standards, etc.
- Dairy Animal Nutrition: including supplementation strategies, use of crop residues, feed formulation and rations for calves, dry cows, lactating cows, etc.
- Forage Production: including pasture management, growing fodder crops, fodder harvesting, preservation and storage, including hay and silage making
- Laboratory Feed Testing: sample taking, interpretation of results and use in ration calculation, etc.
- Dairy Herd Reproductive Management: Breeding systems, fertility organs, heat cycle, detecting and recording heat signals, determining optimum moment for insemination, use of AI and pregnancy diagnosis, fertility performance indicators, etc.
- Dairy Farm Mechanization
- Milking: hand and machine milking techniques, maintenance of milking machines, etc.
- Dairy Farm Extension: including use of ICT technology, communication methods.

Potential short courses in Milk Collection and Bulking, Processing and Marketing are the following:

- Dairy Cooperative Management: including bookkeeping
- Milk Testing and Quality Control at collection level
- Laboratory Milk Testing: microbiological, compositional
- Quality-based Milk Payment Systems: for cooperatives and/or processors, including practical work on designing a payment system
- Milk Hygiene in the Value Chain: all aspects of milk hygiene, at farm-level, collection, transport and processing level
- Milk Processing: cheese, butter and buttermilk, ghee, cream, yoghurt and fermented milk, ice cream, liquid milk products, milk powder, UHT/ESL milk
- Maintenance of Milk Processing Equipment
- Dairy Product Quality Assurance
- Milk Processing as a Business: management, key indicators, making of business plans, etc.
- ISO/HACCP/SOP
- ICT in the Dairy Industry
- Marketing of Milk and Milk Products.

DTI and the Kenya Dairy Board should collaborate in designing specialized courses for milk testers, transporters, personnel of milk collection centres and other key personnel in the dairy value chain. KDB could make these courses a prerequisite for licensing skilled personnel, which would include mandatory refresher courses. Mandatory refresher courses could also be introduced for other professions in the dairy value chain (AI technicians, food safety and hygiene for milk collectors, etc.). This would provide additional revenue for DTI.

3.6.2. Accreditation and Certification

Once the curriculum has been worked out, it should be submitted for approval to the accrediting body CDAAC (Curriculum Development Assessment Accreditation and Certification). DTI will also have to apply to the TVET board for accreditation and licensing, and the trainers will have to be licensed under the 2013 TVET Act.

According to the Ministry of Education, CDAAC is currently not functional. Therefore for the moment, all stakeholders should be involved in curriculum development, including professional bodies like KDPA, to regulate and monitor the curricula and students' assessments. Once the new training program commences, guidance should be sought from the ministry in regard to the state of affairs of CDAAC and the implementation of the TVET Act.

Currently many training programs in Kenya are accredited by the KIE (Kenya Institute of Education) and examined and certified under KNEC (Kenya National Examinations Council). Training programs that are not accredited by KIE and certified by KNEC, are certified by other professional bodies.

Given the above situation, a pragmatic approach should be adopted for accreditation of DTI, its staff and training programs. Given the CBL approach, professional bodies will already be involved in curriculum development and assessments. Their role could be expanded if it appears that CDAAC is still not operational. DTI should also look for a partnership with an international reputable dairy training centre, which could accredit DTI's training programs (see also 3.7).

ISO Certification

Most of the professional organizations in the dairy value chain in Kenya are ISO certified. It is essential for these organizations that parties from which they derive their inputs and services, including skilled personnel, are also ISO-certified. It is therefore important for DTI to obtain ISO certification.

3.6.3. Training Methodology

The most important aspects of a successful curriculum are communication and adaptation to a caring professional culture. Research has shown that training methodology and student activity have a major impact on the so-called attention curve, which governs a student's recall of what has been taught. The traditional method of lecturing in a classroom is the least effective (over time only 20 % will be reproduced). Lessons including demonstrations are only a little more effective (over time around 50 % will be reproduced by students). Practical lessons which include hands-on exercises and which allow students to explore situations are the most effective (over time 90 % will be reproduced).

This does not imply that traditional lecturing is a wrong training tool; it can still be used to introduce the specific topic, as long as lectures are part of a package of training tools that also allow for hands-on training. The figure below illustrates the different training methods and their effectiveness.

Figure 4. Hear-See-Do-Discover

"What people discover they hardly forget!"

DTI will move away from the traditional way of teaching as much as possible and will use the following range of training methods:

- lectures to introduce topics
- lectures given by external experts
- case studies
- practical / hands-on lessons
- traineeships/ attachments and applied management periods
- excursions to dairy farms, collection centres, processors, etc.
- report writing and presentation
- implementing various tasks/ assignments individually or in groups
- e-learning using ICT.

One of the important changes in the way the learning processes will take place at DTI will be the introduction of Competency Based Learning (CBL). CBL is a learner-focused approach to teaching that is often used in learning concrete skills. It uses an individual skill or learning outcome (known as a competency) as a starting point. If students can demonstrate they already master certain learning modules, these can be skipped altogether. Students can learn specific individual skills at their own pace and learning can therefore be more effective.

Use of ICT

Learning to learn is an important principle in the CBL approach and essential for students to realize that learning does not stop once their studies are completed. For this "life-long-learning" - attitude the internet has become an essential tool in order to access new developments, latest manuals, instructional movies, etc. The DTI website will be used to update and store all training materials. It will be possible for students to download and use all this material as per the instruction of their trainers. Trainers and students will be able to send assignments through email. This DTI virtual library makes the real library at DTI obsolete in a few years time.

The internet also makes it possible to link up with expertise worldwide; through video links it will be possible to invite international experts to contribute to the certificate and short courses. For this, as well as for the e-learning programs, a reliable and stable internet connection is needed. No computer rooms will be established, as students will be obliged to have their own laptop/ tablet computer in order to be admitted.

3.6.4. Staff Development

Once DTI is up and running under the proposed changes, a structural program should be developed for in-service staff training. Given the above new approaches in the curriculum, training methods and the use of ICT in training programs quite some time and effort will be required to bring the staff up to date with the new e-learning system. Staff will also need coaching in order to help them implement the training programs during the first 2 to 3 years.

To remain competitive it will be important to have up to date knowledge and expertise, which will require a substantial investment in staff training every year (equal to 4% of the annual DTU salary costs). A budget allocation should therefore be made available for each staff to select those staff development activities that suit her/his specific needs best. Activities can include the participation in training programs, on-line subscriptions, excursions, voluntary attachments, etc.

3.6.5. Target Groups for Training

The following target groups have been identified for long-term training courses at DTI:

- high school graduates (O-level grades D+, C-, A levels)
- mid-career professionals.

All dairy value chain actors can in principle apply for the standard courses and requests can be sent to DTI to organize tailor-made training programs, for the following target groups:

- dairy cooperatives
- farmers and farmer groups
- milk testers and graders
- milk traders and transporters
- extension staff
- milk processors
- dairy entrepreneurs including personnel of milk bars
- hoteliers
- retirees and school leavers
- students
- government employees
- other mid-career professionals.

3.6.6. Training Facilities and Locations

The business plan proposes to have all training facilities in one specific location, both for theoretical and practical training. To outsource part or all of the practical training of the certificate and diploma courses is logistically and organisationally not feasible.

This of course does not apply to attachments, internships, demonstrations and excursions. For these elements of the curriculum, collaboration will be sought with cooperatives, processors, dairy farms, research institutions, feed manufacturers, AI service providers, farm mechanisation companies, slaughter houses, etc.

The short standard and tailor-made residential courses will also be organized mainly at the DTI premises. Outreach programs will be organized at the clients' premises and selected satellite training centres like ATCs and dairy training farms.

In order to carry out the full training program, the existing classrooms and dormitories at DTI require renovations and expansion with new classrooms

and dormitories, to cater for 420 in-house students. The costs for these renovations and constructions are included in the financial analysis in section 4.2.

3.7 Proposed Partnerships

The ambition of DTI, as stated in its mandate, is to become the leading knowledge and innovation centre for the dairy value chain for Kenya and neighbouring countries such as Uganda, Tanzania, Rwanda, and South Sudan. To capitalize on its mandate and the need for skilled staff in the dairy sector in the neighbouring countries, DTI should be able to offer training programs, which are accredited not only by the Kenyan authorities but also by reputed international dairy training institutes. Establishing strong partnerships at international, regional and national level is key for the success of DTI.

3.7.1. Partnerships in the Netherlands

The dairy sector in the Netherlands is internationally reputed for its high level of technical performance, sector governance, organization, its innovations and quality and variety of its dairy products. Below follows a summary of potential partners in the Netherlands.

Dairy Campus
The Dairy Campus is located in Leeuwarden in the Netherlands, in the province of Friesland, which is the heart of the Dutch dairy sector. It is the centre for innovation, education and research for the Netherlands dairy sector, and the result of the collaboration between dairy stakeholders like the Dairy Training Centre (DTC), Wageningen UR (WUR) Livestock Research, Van Hall – Larenstein Agricultural College, the National Farmer Organization "LTO" and commercial enterprises active in the dairy value chain in the Netherlands as well as abroad.

The ambition of the Dairy Campus is to integrate research with education and knowledge dissemination to the entire Netherlands dairy industry. As such the Dairy Campus is set to become the focal point for the innovative and dynamic development of the dairy sector in the Netherlands as well as abroad.

Dairy Training Centre (DTC)
DTC is the leading practical dairy training centre in the Netherlands in all aspects of the dairy value chain. DTC is a collaboration between the (former) PTC+ in Oenkerk, The Friesian Dairy Development Company and AB Vakwerk. Its ambition is to become the national and international centre of excellence for practical training in dairy farming and dairy processing.

DTC is officially accredited by NUFFIC as a training centre for the organization of certificate and diploma courses in dairy farm management and milk processing. It is very important for DTC to keep up to date with all aspects in the dairy value chain, since knowledge and techniques change faster than ever before requiring new skills and adjusted training programs. DTC organizes once a year a NUFFIC sponsored fellowship training program called: "From a competence profile to a competence based training program".

DTC is a very interesting partner for DTI because of its guaranteed up to date training programs, training material and expertise. It is recommended that DTI develops partnerships with DTC and other related organizations in the Netherlands. DTC could accredit DTI's training programs in order to give an international appeal.

DTC can offer a so-called franchise arrangement, in which another institute can be liaised to DTC, and be allowed to offer and organize training programs under full DTC accreditation, using DTC hand-outs, manuals, presentations, software and assignments. Members can also utilize DTC staff (on-site or via video link) for training or consultancies, organize part of their training in the Netherlands, use the DTC brand name for marketing and quality assurance, and issue certificates with the DTC logo.

Under this franchise model, trainers will have to be trained by DTC, have to demonstrate their competence before being accredited, and they will be monitored regularly. Training facilities and training programs should meet DTC quality standards and CBL principles, and make use of the latest teaching methods and ICT applications. In addition, DTC will participate in the assessments of students of certificate- and/ or diploma courses. DTC is in the process of developing a fee structure for the provision of the above service package.

For DTI specifically, in order to meet the DTC requirements, curricula will need to be updated, teaching methods modernized and brought in line with CBL approaches. DTC can assist DTI in the process of official accreditation of the institute, its trainers and curricula through the relevant Kenyan authorities. DTC can also assist in the analysis of knowledge and skill gaps of DTI's trainers, and develop tailor-made Training of Trainers (ToT) programs and modules for coaching DTI trainers during the implementation of the training program.

Vetvice / CowSignals

Vetvice is a Netherlands based private enterprise that develops practical training material for dairy farmers, farm managers, training institutions and training and extension workers worldwide, in the form of handbooks and manuals for optimal cow housing, cow comfort and cow management.

CowSignals, one of Vetvice's key programs, is a training company active in more than 35 countries worldwide, which organizes training based on the concept of information the cows give. How to interpret these "cow signals" is key to the welfare of the animals, and good welfare of the animals leads to higher milk production and fertility, which in turn leads a profitable business to the farmer.

For its trainings, CowSignals has a range of highly practical and innovative training materials and books. It is recommended that DTI explores future partnerships with Vetvice, and includes their innovative approach in dairy farm management.

3.7.2. Regional and National Partnerships

Once the DTI infrastructure is completed, DTI trainers are trained and new curricula developed, DTI should start marketing itself in neighbouring countries as the regional "practical dairy training centre of excellence". Students from countries such as Tanzania, Uganda, Rwanda, and others should be able to enrol in the DTI courses.

In the short term, DTI could already advise practical dairy training centres in Kenya and neighbouring countries on the development of short courses, provide accreditation for these courses and possibly help in implementation. DTI could for example assist Agriculture Training Centres (ATC) and successful commercial dairy farms that have already started organising dairy training at their farms. DTI could help to structure these training programs and develop short courses that are accredited by DTI.

There are many partnerships to be established at national level and throughout the business plan suggestions for these partnerships are mentioned. Partnerships will be with the following institutions: the Ministry of Agriculture, Livestock and Fisheries, the Ministry of Education, the Kenya Dairy Board, TVETA, Kenya Dairy Processors' Association, dairy processors, KARI, RVIST, Egerton University, farmers' organizations, and many others.

3.8 Monitoring, Evaluation and Marketing of DTI Products

DTI should work towards an embedded system of monitoring and evaluation of their products, for long-term as well as short-term courses. Traceability of students is important, and an alumni organization could be set up to guide the operations of DTI. Once the facilities are in place, DTI will develop plans for a marketing and promotion campaign and strategy for its training programs and consultancy services including the following methods:

- DTI website
- emails followed by telephone calls
- newspaper/ agricultural magazine advertisements
- newsletters, new training programs, yearly calendar of events
- farmer field days, agricultural show, trade fairs, farmer field schools
- radio/ television programs on dairy development.

Alumni form an important target group for this marketing, as well as key companies and stakeholders of DTI, e.g. Kenyan embassies of neighbouring countries, KDB, EDFA, KDPA, Ministry of Education, and the Ministry of Agriculture Livestock and Fisheries.

CHAPTER 4: BUSINESS UNITS – FINANCIAL ANALYSIS

4.1 Introduction

Under this business plan, it is proposed that DTI operates as an independent entity with the following four operational business units:

- Dairy Training Unit (DTU)
- Dairy Farm Unit (DFU, including a forage production sub-unit)
- Conference Hall Unit (CHU)
- Lucerne Production Unit (LPU).

Financial data and assumptions of the four units are given in the sections 4.2 through to 4.5 while the consolidated data are presented in section 4.6. Financial projections have been made for a period of 16 years from year 0, the pre-operational year, to the final year 15. These projections include residual values for working capital and fixed assets, with a linear depreciation and lifetimes of 5, 8, 10, 15 and 25 years. Furthermore salvage values of 10% of the investments have been taken into account for buildings and part of the installed equipment, while land is not depreciated. The herd value of DFU has been valued on the basis of opportunity costs.

Land is not included in the investments because it is assumed that DTI will be able to obtain title deeds for the land that is currently in use. Land is however included in the residual values. The size of land required for the four business units is presented in the table below.

Table 6. Land Allocation to Business Units

Business Unit	Acres	Hectares
DTU – Training	12	5
DFU – Farm	56	23
CHU – Conference	7	3
LPU – Lucerne	1,273	515
Total	**1,349**	**546**

The proposed investments include costs for civil works for renovating and constructing buildings and facilities for students, a guesthouse for the conference facility and staff houses. Financial projections (see annex 3) are in constant accounting terms; all amounts are in Euros unless stated otherwise and exchange rates used are: 1 EUR = KES 116 and 1 KES = 0,00862 EUR.

The business plan costing does not include the upgrading of the access road to DTI. Ideally this road should be upgraded, which would increase investments considerably. As there other businesses using the same road, the road could be improved as a joint effort, which is something that can be explored.

In order to achieve better insight in the costs, benefits and profitability of the DFU, internal supply prices have been set for animal feed from the forage production sub-unit to the overall DFU. In the Consolidated Projection these internal supply prices are excluded. Most of the overhead and administration costs are included in the Dairy Training Unit.

4.2 Dairy Training Unit (DTU)

The training programme and methodology have already been described in detail in 3.6. In this section the focus is on the financial analysis of DTU, and the business and financial details are elaborated for all the training courses, management overhead, mini dairy, laboratories, as well as the dormitories, classrooms, staff houses and catering for students and lecturers. For detailed financial projections of the DTU, see annex 3.

Practical training facilities need to be located nearby the student's facilities, without the need for students to travel to facilities elsewhere. As part of the investments proposed, there are two practical training facilities identified: a dairy farm (see 4.3) and a mini dairy plant (500 litres per day), including laboratories. The mini dairy will not operate as a commercial dairy processing unit because this may be conflicting with the training needs and the commercial interest of the processing industry, which is an important stakeholder. The dairy products produced by the mini dairy will be used only for internal consumption.

The table below gives an indication of the different training courses and the fees proposed.

Table 7. DTU Training Fee Structure (in KES)

Type of Course	Fees / Student			Remarks
One Year Certificate	90,000			Incl. Accommodation
Two Year Certificate/ Diploma	140,000			Incl. Accommodation
Short Courses (20 students)	**3 day**	**5 day**	**10 days**	
Residential standard courses	10,000	15,000	28,000	Incl. Accommodation
Tailor made residential	15,000	22,000	42,000	Incl. Accommodation
External standard courses*	8,000	12,000	22,000	Excl. Accommodation
External tailor-made*	12,000	18,000	33,000	Excl. Accommodation

* teachers' subsistence allowance not included

The table below illustrates the projections for the students' numbers for the next 5 years, with year 0 being the base year:

Table 8. DTU Number of Students - Long Term Courses

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5 & onwards
One year[1]	140	140	220	260	300	300
Two Years	56	56	56	88	104	120

[1] This number includes the first year students of the two-year course

The increase in student numbers are projected based on the history of the number of applicants over the last 3 years. Once the DTI has been renewed, state of the art practical training facilities are available, ICT infrastructure is in place, courses are officially accredited and DTI has its marketing and promotion campaign up and running, the student numbers are expected to increase considerably. Considering the size of the dairy industry and the huge skilled labour gap as identified in the LNA, the growth estimate in student numbers is conservative.

Investments

The total initial investment for the DTU is EUR 2.2 million. The table below shows a breakdown of the major elements.

Table 9. DTU Investments

Item	Investment (EUR)
Land	-
Civil Works (including project engineering)	1,233,668
Inventory buildings	355,810
Equipment mini dairy + laboratory	434,803
Transportation	113,000
Others	68,550
Total	**2,205,832**

All required transportation is included in the DTU and covers student transportation (busses) and transportation needed for procurement and staff, both in terms of investments (vehicles) and fuel and maintenance costs.

To accommodate the increase in students to around 420, new dormitories and classrooms will be constructed for an additional 320 students (see annex 10), whilst the existing dormitory will be rehabilitated to cater for around 100 students. In addition, the existing kitchen, catering and recreational facilities will be renovated. Construction will commence in year 0, while rehabilitation of existing facilities is scheduled in year 1.

Table 10. DTU Costs of Civil Works

Building		m2/ unit	Tot m2	Cost KES/m2	Cost EUR/m2	Total KES	Total EUR
New dormitory			**3,636**	**14,906**	**129**	**54,200,000**	**467,241**
A.	Dormitory Male students (150)	12	1,818			27,100,000	233,621
B.	Dormitory Female students (150)	12	1,818			27,100,000	233,621
Renovation existing dormitory			**1,300**	**8,000**	**69**	**10,400,000**	**89,655**
C.	Dormitory Male Students (50)		950			7,600,000	65,517
D.	Dormitory Female Students (50)		350			2,800,000	24,138
Staff houses			**540**	**25,000**	**216**	**13,500,000**	**116,379**
E.	2 bedroom (3)	80	240				
F.	3 bedroom (3)	100	300				
Classrooms						**8,160,000**	**70,345**
G.	Renovation classrooms (5)	96	480	8,000	69	3,840,000	33,103
H.	New classrooms (3)	96	288	15,000	129	4,320,000	37,241
Kitchen/Recreation (Renovation)						**9,400,000**	**81,034**
J.	Kitchen (1)	800	800	8,000	69	6,400,000	55,172
K.	Recreation (1)	375	375	8,000	69	3,000,000	25,862
Total						**95,660,000**	**824,654**

Note: Renovation of existing administration block is not included

In addition to these costs, a total of EUR 355,810 will be invested in year 0 and 1 in inventory, which includes the all furniture, teaching equipment, kitchen, canteen and office hardware. Six new staff houses are included that can be rented out to lecturers who reside at the campus. The rent paid by the occupants is accounted as revenue (see section on DTU revenues).

A mini dairy, including laboratories, will be established in a single building complex (see annex 9) for training purposes. The mini dairy has a limited capacity of 500 to 1,000 kilogram of milk per day, and activities include the reception of raw milk, processing of pasteurised milk, butter, cheese, ice cream and yoghurt. The mini dairy is only operational on training days (150 - 200 days per years). The investment cost of the mini dairy is shown in table 13.

Table 11. DTU Civil Works Mini Dairy and Laboratories

Item	Surface area (m^2)	Total Costs (EUR)*
Mini dairy	1,239	
Offices	108	
Feed Laboratory	120	
Training Laboratory	120	
Training Laboratory	120	
Milk Testing Laboratory	120	
Lecture / Demonstration Room	168	
Entry / Dressing Room	80	
Microbiological Laboratory	390	
Veranda	423	
Septic Tank (2)	188	
Total	**3,076**	**397,795**

Note: Costs used are EUR 129 / m2 (KES 15,000 per m2)

The investment for laboratory equipment is approximately EUR 86,000 and this includes equipment for milk testing, microbiological analysis and feed analysis (see table below, for details reference is made to annex 7).

Table 12. DTU Laboratory Equipment - Summary

Item	Total Costs (EUR)
Milk testing	21,861
Microbiological testing	30,806
Feed analysis	39,700
Total	**92,367**

Table 13. DTU Investments Mini Dairy

Description	KES	EUR
Milk Reception	590,000	5,086
Electronic receiving unit	650,000	5,603
Dump Tank	180,000	1,552
Milk pump 0.75kW	130,000	1,121
Milk filter	105,000	905
Milk plate cooler	120,000	1,034
Milk storage tank 1000l	933,498	8,047
Milk pump	110,000	948
C. F. Pasteuriser 1000l/hr	2,803,385	24,167
Cream separator 1000l/hr	2,200,370	18,969
Homogenizer 1000l/hr	2,127,965	18,345
Buffer tank 500l	655,785	5,653
Milk pump 0.75kw	110,000	948
Pouch filler 400p/hr	850,000	7,328
Ageing vat 500l	1,807,232	15,580
Cream pump	423,030	3,647
Butter churn	1,138,045	9,811
Butter forming machine	873,230	7,528
Packing table	230,690	1,989
Butter trolley	242,254	2,088
Ageing vat 500l	2,198,340	18,951
Positive pump	352,820	3,042
Yoghurt cup filler 1000cph	1,990,687	17,161
Homogenizer 100l	1,053,893	9,085
Ageing vat 500l	695,687	5,997
Continuous freezer 180l	1,405,191	12,114
Candy lolly tank	1,391,490	11,996
Chocolate dip tank	655,990	5,655
Hardening cabinet	1,073,800	9,257
Cheese vat	1,213,705	10,463
Vacuum packing machine	205,751	1,774
Ice accumulator	2,400,641	20,695
Steam boiler	1,565,000	13,491
C.I.P. (manual)	840,329	7,244
Turnkey operation	3,998,860	34,473
Total	**37,322,668**	**321,747**

Operating costs
At full operation (year 6), the total annual operating costs of the DTU are estimated at around EUR 1.60 million (see table below).

Table 14. DTU Operating Costs

Item	Operating Costs (EUR)	Percentage
Salaries and Wages	736,982	46
Staff Development	29,479	2
Catering	688,966	43
Consumables and Raw materials	54,372	3
ICT (website, training modules, radio)	22,121	1
Others	67,680	4
Total	**1,599,754**	

Note: These are the operating costs at full operation (year 6).

Catering accounts are approximately 43% of the operational costs, based on the assumption that on average 480 people use the canteen (including students, staff and visitors) for 200 days in a year, with a cost of KES 800 per meal per person. Fifty per cent of these costs are charged to the students. Salaries and wages account for approximately 46% of the operating costs, and the proposed 30 lecturers account for 60% of these costs.

Working capital
Working capital requirements are based on operational costs of the DTU. One month of operational cost has been calculated as working capital, and at full operation EUR 133,313 is required.

Residual value
All investments are linearly depreciated in 5, 8, 12, 15, 20 or 25 years (see consolidated projection in section 4.6), with investments in year 0 and 1 depreciated as from year 1. For milk processing equipment, civil works and construction as well as for major equipment salvage, values of 10% of the original investment have been incorporated.

After the 16 years projection, residual values have been calculated for the remaining fixed assets not yet depreciated and include, when applicable, the pertaining salvage values. Furthermore, accumulated working capital at the end of the projected period is included in the total residual value. Total residual value at the end of the last year is almost EUR 815,400. This amount consists of EUR 682,000 for fixed assets, and around EUR 133,000 for accumulated working capital.

Revenues
The training fees applied are shown in the table below. The number of students for the annual courses is 300 for the one-year course and 120

students for the two-year course, totalling 420 students on average at the campus (at full operation year 6). The standard and tailor-made courses have an attendance rate of 20 students for each course.

Table 15. DTU Training Fee Structure

	KES / Student
Certificate / Diploma Courses	
1 year	90,000
2 year	140,000
Short Standard Residential courses	
3 days	10,000
1 week / 5 days	15,000
2 weeks / 10 days	28,000
Short Tailor-Made Residential Courses	
- 3 days	15,000
- 1 week (5 days)	22,000
- 2 weeks (10 days)	42,000
Short Standard External Courses	
- 3 days	8,000
- 1 week (5 days)	12,000
- 2 weeks (10 days)	22,000
Short Tailor-made External Courses	
- 3 days	12,000
- 1 week (5 days)	18,000
- 2 weeks (10 days)	33,000

The total DTU revenues are shown in the table below.

Table 16. DTU Revenues at Full Operation

Item	Revenue (EUR)	Percentage
Training Fees	651,034	41
Dairy Training Fund	561,879	36
Catering Fees	344,483	22
Staff House Rental	15,517	1
Government Funding	0	0
Donor Contribution	0	0
Total	**1,572,931**	

Training fees contribute 41% of the total revenue, and non-training revenues are generated by a Dairy Training Fund (41%), which is based the assumption that the dairy industry is prepared to put a training levy on processed milk of KES 0.128 per kilogram. The amount of processed milk at national level is set at 500 million kilograms in year 0, with an 3% annual increase.

Catering is charged at 50% of the costs to students, staff and visitors. Dairy products produced by the mini dairy are provided to the canteen, and serve no commercial purpose. During the first five years (year 0 – 4), it is assumed that the DTI receives government funding totalling EUR 1.9 million after the

SAGA status has been obtained. Furthermore it is envisaged that during the start-up phase of the project, donors will fund the large investments in infrastructure, equipment and machineries.

Cash Flow and IRR
The net cash flow per year before interest and taxes by the end of the forecast period is positive at EUR 60,000. Treated as a separate entity the DTU is projected to have an Internal Rate of Return (IRR) of 43%. It must be noted however that without the expected government funding the IRR over the forecast period will be minus 1.6%.

4.3 Dairy Farm Unit (DFU)

4.3.1. Introduction

The Dairy Farm Unit (DFU) comprises the dairy farm, a forage production sub-unit and a smallholder demonstration farm. These are presented below in the sections 4.3.2, 4.3.3 and 4.3.4. The forage production sub-unit is designed to supply animal feed to the DFU only and will not be used for commercial purposes. For a detailed financial projection of the DFU see annex 3.

4.3.2. The Dairy Farm

The dairy farm is an important instrument for practical training, and will have to be located close to the campus. The farm must be able to facilitate training for several groups of students at the same time. The farm is designed for around 50 milking cows plus young stock. The stable design is based on zero grazing, with cattle kept in free walking stables with individual cubicles (see layout in annex 8). It is proposed to start with 50 pregnant pedigree Holstein Friesian (HF) heifers, procured locally. Assumptions for culling rates and calf mortality can be found in the table below.

Based on the assumptions shown in the table below, a milk production forecast is presented in annex 12, averaging 375,000 kilogram of milk in the sixth year.

Table 17. DFU Milk Production Assumptions

Average calving interval (days)	390
Average days in milk	320
Milk spoilage percentage	1.5
Milk Yield (kg)	
1st lactation	7,011
2nd lactation	7,410
3rd lactation	8,279

Table 18. DFU Assumptions for Culling Rates and Calf Mortality

	Percentage	Head
No. pregnant heifers imported		50
Abortions		
Abortion % - during transport	1	1
Abortion % - within 3m of arrival	3	2
Culling rates		
Lactation 1	7	3
Lactation 2	9	4
Lactation 3	16	7
Lactation 4	22	9
Lactation 5	26	10
Lactation 6	18	7
Lactation 7	10	4
Lactation 8	8	4
Calf mortality		
0-3 months*	5	6
3-6 months	1	1
6-12 months	1	1
12-16 months	1	1
Pregnant – 27 months	1	1

*Inclusive of abortions

The table below presents the total animal feed requirements, specified in forage and raw materials for production of dairy concentrate feed.

Table 19. DFU Animal Feed Requirements

Feed Type	Feed Requirement Kg Dry Matter / head						
	Lactating	Dry	Calves 0-3m	Calves 4-6m	Calves 7-12m	Heifers 13-15m	Heifers - pregnant
Alfalfa	1.95	0.00		0.40	1.00	1.00	1.00
Maize silage	7.80	3.40		1.00	1.00	1.00	2.10
Rhodes grass hay	1.95	1.70	1.00	0.40	1.00	1.00	1.00
Napier grass hay		5.00					
Oats straw	0.50	0.00					
Total Fodder	**12.20**	**10.10**	**1.00**	**1.80**	**3.00**	**3.00**	**4.10**
Maize grain	3.40	0.00	0.75	1.00	1.00	1.50	1.00
Wheat Bran	1.70	1.70		0.00	1.00	1.00	1.00
Wheat Pollard							
Soya bean meal	1.70	0.00	0.75	1.00	1.00	0.50	
Sunflower cake	0.90	0.00				0.50	1.00
Lupine seed meal	0.90	1.70					
Limestone	0.06						
Sodium Bicarbonate	0.12						
Mineral Mix	0.19	0.20		0.03	0.03	0.05	0.07
Tot Concentrates	**8.97**	**3.60**	**1.50**	**2.03**	**3.03**	**3.55**	**3.07**

Milking will be carried out in a 2-row herringbone-type milking parlour, with a total capacity of 12 cows, with 2 rows for 6 cows each. The parlour will have an automated cluster removal system to avoid "blind milking", and milk is cooled at site in a separate milk storage room, which includes a hot water system for the Cleaning In Place (CIP) equipment. Milking is done twice daily and high yielding milk cows can be kept separate in the stable.

All female young stock is kept at the farm for replacement of the lactating herd. Surplus heifers are sold at market prices (see table below), and bull-calves are sold within a week after birth.

Table 20. DFU Herd Development

	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6
Cows in Lactation	47	42	47	51	51	44
Dry Cows	0	2	2	0	0	9
Lactating + Dry Cows	**47**	**44**	**49**	**51**	**51**	**52**
Total Culling	3	4	6	9	11	12
Sales Pregnant Heifers	0	0	11	10	11	4
0-3 months	1	0	1	8	15	17
4-6 months	6	10	17	16	9	2
7-12 months	16	10	6	1	2	3
13-15 months	0	1	0	1	8	15
Pregnant – 27 months	0	21	21	22	18	18
Total Young Stock	**23**	**43**	**45**	**49**	**51**	**54**
Total Herd	**70**	**87**	**93**	**99**	**102**	**107**

The site where the farm is located includes storage for fodder and feed ingredients for the preparation of dairy concentrates. Manure is collected

manually and stored in the underground pit. The manure is mixed with rainwater and collected with a vacuum-tanker, which transports it to the agricultural fields for fertilization.

The dairy farm employs five staff, including a farm manager who is also accountable for the forage production sub-unit. The number of employees is kept low, with the assumption that students will participate in the day-to-day activities as part of the vocational training programme.

Investments

The total investment for the DFU, including the forage production sub-unit, is shown in the table below. The costs for stables and other facilities (feed store etc.) are significant for a dairy farm with 50 milk cows plus young stock. However, consideration is given to the key purposes of the farm design, e.g. training and the demonstration of good dairy farming practices to several groups at the same time.

Table 21. DFU Investments

Item	Investment (EUR)
Land	-
Civil Works (including engineering)	329,970
Procurement of Heifers	107,759
Equipment	98,418
Farm Machinery	51,724
Others	13,534
Total	**601,405**

The Holstein-Friesian heifers will be procured locally, each valued at EUR 2,155. The costs of equipment include a milking parlour, milk cooling, a water-well and feed mixing equipment. Investments for farm machinery include a tractor, trailers and manure handling equipment. Costs of the civil works for the DFU are shown in the table below.

Table 22. DFU Civil Works

	M	EUR/m	m2	KES/m2	EUR/m2	EUR Total
Milk Cow Stable			475	13,000	112	53,233
Young stock Stable			475	13,000	112	53,233
Walkway and Handling Area			222	7,000	60	13,397
Utility Buildings			360	18,000	155	55,862
Milking Area			432	15,000	129	55.862
Hay Storage			200	13,000	112	22,414
Feed Store and mixing area			200	13,000	112	22,414
Manure storage			84	7,000	60	5,069
Manure digester			60	7,000	60	3,621
Manure effluent			47	7,000	60	2,836
Fencing stables	1,041	20				20,529
Fencing cubicles	644	20				12,880
Engineering						8,621
Total Dairy Farm						**329,970**

Operating costs

At full operation from year 6 onwards, around 70% of the operating costs are animal feed costs, see table below. Animal feed is supplied by the forage sub-unit at an imaginary cost.

Table 23. DFU Operating Costs

Item	Operating Costs (EUR)	Percentage
Animal Feed	139,336	69
Salaries and Wages	40,058	20
Others	21,620	11
Total	**201,013**	

Revenues

The DFU revenues consist of milk and livestock sales. Based on the assumptions mentioned above a six-year milk production forecast is shown in annex 12. The price for fresh milk is set on KES 34 per kilogram. At full production capacity the total revenue reaches EUR 131,000 in year 6.

Table 24. DFU Animal Sales Revenues

	EUR/Hd	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6
Pregnant heifers		0	0	11	10	11	4
	2,759	0	0	30,345	27,586	30,345	11,034
Culled cows		3	4	6	9	11	12
	474	1,195	1,668	2,769	4,049	5,137	5,702
Bull calves		25	25	25	25	25	25
	151	3,772	3,772	3,772	3,772	3,772	3,772
Total Animal Sales		**4,966**	**5,440**	**36,885**	**35,407**	**39,253**	**20,508**

Working capital
Working capital requirements of the DFU have been calculated as one month of operational costs. At full operation approximately EUR 16,800 is required as working capital.

Residual value
All investments are linearly depreciated in 5, 8, 12, 15 or 20 years. The value of the herd is in general not depreciated but is based on numbers of animals and current market prices. Due to the fact that opportunity costs for cattle and especially for pregnant heifers differ in value of the pregnant heifers, the herd is re-valued conform the current opportunity costs for high quality cattle. This re-valuation incorporates a book value loss of almost EUR 25,000 in year 1, the year the heifers arrive on site (see also annex 3). Investments in year 0 and 1 are depreciated as from year 1. For farm machinery, civil works and construction as well as for major equipment salvage values of 10% of the original investment have been incorporated.

After the 16 years projection, residual values have been calculated for the remaining fixed assets not yet depreciated and include when applicable, the pertaining salvage values. Furthermore, accumulated working capital as well as the herd value at the end of the projected period is included in the total residual value. Total residual value at the end of the projected period is almost EUR 410,000, including EUR 271,000 for fixed assets, EUR 122,000 for herd value and almost EUR 16,500 for accumulated working capital.

Cash Flow and IRR
The net cash flow before interest and tax remains negative for the entire forecast period. This is mainly due to the high costs of feeding. Treated as a separate entity the cash flow of the DFU is projected to have an IRR of -17 % before interest and taxes (the net cash flow is minus EUR 67,000 by the end of the forecast period).

4.3.3. Forage Production

Based on the calculated feed requirements and production levels per hectare, the total area needed for the production of roughage is approximately 17 hectares (43 acres) at full production. The assumptions for forage production and the crop plan are presented in the tables below. For detailed financial projections see annex 3.

Table 25. DFU Forage Production - Land Required

	Year						
Land areas (ha)	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Land cleared	10.1	4.1	1.2	0.7	0.3	0.8	0.0
Ready for cultivation	10.1	14.7	15.9	16.6	16.9	17.7	17.7
Alfalfa	1.6	2.2	2.5	2.6	2.6	2.8	2.8
Maize silage	3.2	4.5	4.8	5.0	5.0	5.2	5.2
Rhodes grass	4.2	6.3	6.9	7.2	7.4	7.8	7.8
Napier grass	0.0	1.0	0.9	0.9	1.0	1.0	1.0
Oats straw	0.6	0.8	0.8	0.9	0.9	0.9	0.9
Total cultivated	9.6	14.7	15.9	16.6	16.9	17.7	17.7

Table 26. DFU Forage Production - Total Feed Requirements

	Min. Requirements (MT Dry Matter)						
Crop	**Yr0**	**Yr1**	**Yr2**	**Yr3**	**Yr4**	**Yr5**	**Yr6**
Alfalfa (2.2 MT DM/cut)	0	28	38	43	45	46	49
Maize silage (15.0 MT DM/cut)	0	96	134	144	150	151	156
Rhodes grass hay (7.0 MT DM)	0	29	44	49	51	51	55
Napier grass hay (14.0 MT DM)	0	0	14	13	13	14	13
Oats straw (14.7 MT DM	0	6	7	7	8	8	8
Total MT	**0**	**159**	**237**	**255**	**266**	**270**	**281**

The annual production level is set by the demand of the DFU; in the financial projection an imaginary price is charged to the DFU. The forage unit includes a sprinkler irrigation system with aluminium pipes.

Investments

A total investment of almost EUR 288,724 is required for establishing the forage production sub-unit, the largest part is taken up by the procurement of tractors and irrigation system. The total investment per category is shown in the table below.

Table 27. DFU Forage Production - Investments

Item	**EUR**
Land	-
Civil Works	31,034
Irrigation Set Complete	39,655
Farm Machinery	218,034
Others	-
Total	**288,724**

Operating costs

Most of the operating costs consist of salaries and wages, see table below. In total 6 fulltime employees are assigned to the fodder production sub-unit, including a supervisor and tractor driver. It is assumed that both the DFU and

the fodder production sub-unit share much of the labour peaks together with the labour resources assigned to them (including students, as part of their vocational training programme).

Table 28. DFU Forage Production - Operating Costs

Item	Operating Costs (EUR)	Percentage
Salaries and Wages	21,600	45
Fuel irrigation pumps	11,492	24
Others	14,749	31
Total	**47,841**	

Revenues
The revenues consist of forage sales to the Dairy Farm Unit, which are set at an imaginary price. The price is on average EUR 220 per tonne dry matter for lucerne, maize silage and grass hay.

Working capital
Working capital requirements are based on operational costs for the sub-unit, which is on average EUR 3,986 per month.

Residual value
All investments are linearly depreciated in 5, 8, 9, 10, 12, 15 or 20 years. For civil works and construction, back-up generator and company car salvage values of 10% have been incorporated. Total residual value at the end of the projected period is about EUR 270,125, consisting of EUR 266,445 for fixed assets and EUR 3,986 for accumulated working capital.

Cash flow and IRR
The net cash flow of the FPU is positive as from the second year. In the 10th and 11th year it shows a negative flow due to reinvestments. During the last years of the projection, the net cash flow is almost EUR 15,000. If the forage production sub-unit is treated as a separate entity, the IRR is 0.7%.

4.3.4. Smallholder Demonstration Farm

It is proposed that the current farm buildings of DTI will be leased out at a nominal fee to a farmer, to operate as a smallholder farm on a commercial basis. This sub-unit will play a significant role in the practical dairy training as a smallholder demonstration unit.

The farmer will be free to operate the farm on commercial terms as his own dairy enterprise, but will have to comply with the standards imposed by DTI. In return, the farmer will receive practical training and on-the-job coaching by DTI on best practices in smallholder dairy farming, and is required to make

the premises available for demonstration and practical training for DTI's students.

4.4 Conference Hall Unit (CHU)

The Conference Hall Unit (CHU) will run commercially as a separate unit, with its own commercial manager. The conference hall, which includes an office, kitchen and dining facilities is currently under construction (financed by an IFAD project), and has an estimated capacity of 100 people.

In order to be able to run the conference facility on a commercial basis, it is proposed to build guesthouse facilities, something that is not foreseen under the current project. It is proposed to build accommodation for 70 people, in two quality standards: 30 single rooms and 20 double rooms. See details in the table below.

Table 29. CHU Revenues Assumptions

	Rent/day (EUR)	Occupancy (%)
Conference Hall (100 persons)	1,034	50
Single Room Accommodation	52	70
Double Room Accommodation	78	60

Investments

The total investments for the Conference Hall Unit are shown in the table below. The inventory of buildings includes conference and guesthouse furniture, kitchen hardware and office hardware.

Table 30. CHU Investments

Item	Investment (EUR)
Land	-
Civil Works *	269,952
Civil Works - engineering	3,017
Inventory Buildings	136,700
Transportation	20,000
Total	**429,669**

*not including the investments in the conference hall

The inventory of the buildings includes conference and guesthouse furniture, kitchen hardware and office hardware.

Table 31. CHU Guesthouse Civil works

	No.	Total m2	KES/m2	EUR/m2	Total KES	Tot. EUR
Single Room	30	1,074	16,450		17,661,178	152,252
Double Room	20	831	16,425		13,653,217	117,700
Total		**1,905**	**16,439**	**142**	**31,314,396**	**269,952**

Operating Costs

Most of the operating cost for the guesthouse is allocated to consumables, including laundry and other consumables. This is largely based on the assumption of a cost of EUR 20 per person for 100 guests per year times 150 days/yr. This amount may vary as there is no information available to verify this data.

Table 32. CHU Operating Costs

Item	Operating Costs (EUR)	Percentage
Salaries and Wages	98,537	17
Consumables (bed linen, consumables)	300,000	51
Catering	162,000	28
Others	22,586	4
Total	**583,105**	

The total numbers of employees is 20, and includes a fulltime manager, assistant manager, ICT, cleaning, catering and maintenance staff and security. It is assumed that administrative tasks are carried out by the administration under the DTU. Catering costs are based on EUR 8 per meal for an average of 100 guests for 180 days per year. In addition, costs for kitchen utensils are included as well.

Working capital

Working capital requirements are based on operational cost of the CHU, which is on average EUR 48,592 per month (at full operation).

Revenues

The main revenues for CHU derive from renting out the conference hall and guesthouse as shown in the table below. The occupancy percentages are estimations, with the remark that the guesthouse can be rented out to attendees of short courses organized at DTI, if available.

Table 33. CHU Rates per Day

Description	No.	Occupancy rate	KES	EUR
Conference Hall	1	50%	120,000	1,034
Single Room	30	70%	6,000	52
Double Room	20	60%	9,000	78

It is assumed that the CHU generates revenues of approximately EUR 925,000 per year at full operation. Of this amount, 20% is generated by the conference hall, while 80% is generated by the guesthouse.

Residual value
The total residual value of the CHU is around EUR 264,000. This amount consists of EUR 215,500 for fixed assets (including land) and EUR 48,600 for working capital.

Cash flow and IRR
As from the second year of the business plan the CHU shows a positive cash flow, which is EUR 340,000 by the end of the forecast period. Treated as a separate business unit the IRR is 71% before interest and tax, which is not considering the investments made in the conference facility itself.

4.5 Lucerne Production Unit (LPU)

The forage production sub-unit of the DFU will not require all of the available agricultural land to grow fodder crops. In order to utilise the remaining land, it is suggested to establish a commercial lucerne farm. Lucerne (Latin name: *Medicago Sativa*), also called Alfalfa, is a perennial plant cultivated as a high-protein fodder crop due to its nitrogen-fixing ability. Lucerne has proven to be a good commercial crop to be grown in the area around Naivasha.

There are several large-scale lucerne farms in the direct vicinity of DTI under pivot irrigation. The demand for lucerne is high, both in the domestic market and internationally. Therefore the production of lucerne is expected to be a lucrative business. Although not part of the core (training) business of DTI, the establishment of the LPU is an appealing option to create an additional revenue stream for DTI.

The Lucerne Production Unit (LPU) is integrated in this proposal as a separate business unit of DTI, but ideally the whole enterprise is outsourced to a professional commercial party that is familiar with cultivating lucerne, on a lease or profit sharing basis. A total of 264 hectares (652 acres) is proposed in to be used under the lucerne production plan.

The irrigation system includes 5 pivot systems, with water supplied by a nearby stream. A dam and pump stations will be established to pump the water to the pivots, which are electrically driven; generators provide electricity backup.

Investments
The total investment for the LPU is shown in the table below. A total of 5 centre irrigation pivots will provide irrigation during the dry season, and the

total area is under cultivation is 264 hectares (3 plots of 66 ha and 2 plots of 33 ha). This requires an investment of EUR 841,213 in hardware such as centre pivots, boreholes, pumps and pipes. Investments for civil works consist of a fodder store and roads.

Table 34. LPU Investments

Item	Investment (EUR)
Land	-
Civil Works	150,000
Dam (for Irrigation)	29,630
Irrigation Equipment	841,213
Farm Machinery	480,241
Generators	44,444
Total	**1,545,529**

Operating Costs

The largest percentage of the operating costs is for fuel needed to operate the irrigation machinery (42%), and is based on the assumption the irrigation system operates 180 days per year, for 8 hours a day, using 15 litres fuel per hour on average. Salaries and wages consist of 28% of the total operational costs. The LPU will need 40 employees and most of them (30) are casual labourers and security guards.

Table 35. LPU Operating Costs

Item	Operating Costs (EUR)	Percentage
Salaries and Wages	192,179	28
Fuel for irrigation	287,299	42
Seeds, fertilizer, etc.	143,880	21
Others	56,619	8
Total	**684,615**	

Working capital

Working capital requirements are based on operational cost of the lucerne production, which is on average around EUR 57,051 per month (as from year 6 onwards).

Residual value

The residual value of the LPU is almost EUR 5.2 million, which is mainly land value of EUR 4.9 million; the remainder consist of fixed assets of machinery and working capital.

Revenues

The sale price of lucerne is set at EUR 227 per tonne dry matter, which is based on a farm gate price of KES 350 /18kg bale of 85% dry matter, plus a 15% price increase (due to increasing market demand). Harvest yields of

lucerne are assumed to be 2.2 tonnes of dry matter per cut, multiplied by an estimated 8 cuttings per year. At full operation the annual revenue is approximately EUR 1 million (year 6 onwards).

Cash flow and IRR

In the third year the LPU shows a positive net cash flow of almost EUR 360,000 before interest and tax, and remains positive the remaining forecast period. The IRR for the LPU, treated as a separate business unit, is 17% before interest and tax.

4.6 Consolidation of Financial Analysis

In this section, the financial projections for each business unit are consolidated to provide an overall picture of investments, operational costs, profitability and cost recovery. Detailed consolidated financial projections can be found in annex 3.

Consolidated cash flow

Investments of the individual units were discussed in the previous sections. In the table below a summary of investments and working capital requirements are presented.

Table 36. Consolidated Investments and Working Capital

Business Unit	Investments	Working Capital[1]	Total
DTU	2,205,832	133,313	2,339,145
DFU[2]	890,129	20,738	910,867
CHU	429,669	48,592	478,261
LPU	1,545,529	57,051	1,602,580
Total	**5,071,159**	**259,694**	**5,330,853**

[1]Working capital at full operation (year 6)

[2]DFU including the forage production sub-unit

Funding

It is assumed that funds required during the first two years, in the start-up period, will be covered by equity and long-term loans on a 70/30 % ratio. It is projected that the loan is used to finance the LPU (EUR 1.5 million). For this loan an interest rate of 10% per annum in constant terms has been applied with a grace period of one year and full repayment of the loan in year three.

Profit and loss and flow of funds

As from year 0 a profit of EUR 592,000 is projected before interest and tax, while the profit for year 1 is projected at EUR 1.5 million. In subsequent years the profit is on average EUR 650,000. Government corporate income tax is calculated at 0% of the profit.

Consolidated Cash Flow and IRR

Together with the proposed funding, the consolidated cash flow before interest and tax, results in a positive flow of funds in year 2. Surplus in the accumulated cash flow after interest and tax is only registered in year 8 of the forecast period.

The consolidated cash flow yields a positive IRR of 21%. The IRR after interest and taxes is 15%. Cash flow deficits only occur in year 0, after which they remain zero in the second year, due to the maximum repayment that is applied. In the third year the loan is fully repaid and a positive cash flow of approximately EUR 220,000 remains. The cash flow to equity is projected at 31%.

It has to be noted that this IRR has been calculated under the assumption that the Government will continue funding DTI for a period of at least five years, and that a training levy is applied to the milk that is processed in the country. Without these funding sources, DTI will be able to operate at a cost-recovery basis, with an IRR of +2% after interest and tax.

Table 37. Consolidated Internal Rate of Return

Business Unit	IRR
DTU	43%
DFU	-17%
DFU – fodder sub-unit	1%
CHU	73%
LPU	17%
Total before Interest and Tax	**20%**
Total after Interest and Tax	**15%**

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

General

C1. The dairy sector is the largest agricultural sub-sector in Kenya in terms of contribution to GDP and employment. The Kenya Government's Vision 2030 recognises the dairy sector as one of the key sectors for economic growth, food security and nutrition.

C2. The dairy industry in Kenya is private sector driven, dynamic and on a strong growth path with large investments across the value chain.

C3. There is a strong need for practically skilled labour in the dairy sector, not only in Kenya but in the neighbouring countries as well.

C4. Skilled labour needs include well-trained technical staff for dairy farm management as well as milk collection, bulking, testing, processing and marketing.

C5. The Dairy Training Institute in Naivasha has a well-known name for practical dairy training in East Africa; this reputation can be build upon. DTI is one of very few institutes in Kenya with the mandate to carry out technical dairy training, and the employability of DTI graduates is high.

C6. Under the current institutional setup, DTI is part of the government, and as such is restrained in operating in an efficient and effective manner. To alter this, DTI will have to become less dependent on the Government, either as a semi-autonomous or as a fully autonomous institute.

C7. The legal and policy framework in Kenya is in support of the transformation of DTI into a more autonomous institute.

C8. Under the condition that DTI reduces its dependence on the government, and has a transparent and effective governance and management structure, dairy processors are willing to participate and invest in a national dairy training institute.

DTI's Training Program and Facilities

C9. In order to provide quality training and deliver highly skilled graduates, the DTI facilities and training curricula need to be improved.

C10. The conference facility could be an important asset to DTI, but no guesthouse has been included in the building plans financed by the IFAD project.

C11. The assessment of the labour needs in the dairy sector showed a gap between competences provided in the certificate courses at DTI and current labour market needs, with skills in communication, IT, and business lacking.

C12. The main dairy processors emphasize the need for improved dairy farm management skills; the current long-term training program in DTI focuses mainly on milk processing rather than milk production.

C13. Training programs are currently not in line with competency and ICT based learning approaches.
C14. The land around DTI is expansive, has high agricultural potential, and is currently not in use. The land ownership issue and current land disputes make it difficult to utilize all available land. This needs to be resolved by the ministry as soon as possible.

Financial

C15. Under the proposed business plan, financial calculations indicate that DTI can operate in a profitable manner.
C16. In total EUR 5.3 million investment is needed for all four business units, of which the Dairy Training Unit requires EUR 2.3 million, the Dairy Farm Unit EUR 0.9 million, the Conference Hall Unit EUR 0.5 million, and the Lucerne Production Unit EUR 1.6 million.
C17. A Dairy Training Fund, financed through a levy of KES 0.128 per kg of raw milk processed, would yield to EUR 0.6 million per year at an estimated total annual processed milk volume of 500 million kilogram. This is a very important instrument through which dairy training could be funded in Kenya.
C18. The estimated government contribution to the Dairy Training Unit during the 5-year transition period totals EUR 1.9 million.
C19. The consolidated IRR for all four business units is 21% (before interest and tax), with the IRR for the DTU 43%, the DFU -17%, the CHU 73% and the LPU 17%.
C20. The consolidated IRR will drop to +2% without both the Dairy Training Fund and the government contribution.
C21. The IRR of the Dairy Farm Unit is negative 17%, which is mainly due to the high costs of feed, which is an area that needs careful consideration.
C22. The revenue of the Conference Hall Unit is generated for 80% from rent of the guesthouse, the remaining 20% from rent of the conference hall.
C23. Lucerne production under irrigation promises to be a very profitable business opportunity, due to increasing demand locally as well internationally.

5.2 Recommendations

General

R1. Before the business plan can be implemented, the legal transformation of DTI into a (semi) autonomous institute will have to be completed. The on-going application process for the SAGA status should be finalized as soon as possible; it should be explored whether the application has to be renewed because of the newly appointed cabinet (see page 18).
R2. Before land-dependent business units like the dairy farm or the lucerne production unit can be implemented, the land disputes will have to be resolved (see page 20).

R3. A management board should be established as per SAGA / TVET guidelines, which would include key stakeholders like the Ministries, Kenya Dairy Board, farmers' organizations and dairy processors.

R4. The management board should review and approve this business plan if in agreement, after which fundraising can be initiated for the business plan.

R5. The proposed organogram (see page 22) should be a guide for new staff recruitment, and so is the proposed number of staff and remuneration on page 23. Some of the current staff will need additional training and new staff might need to be hired (see page 29).

R6. An interim manager with international experience and networks in practical dairy training should be appointed for two years to support DTI with both international and local fundraising, establishment of international linkages and implementation of the business plan.

R7. DTI should have a regional mandate for dairy technical training, targeting neighbouring countries like Tanzania, Uganda and Rwanda (page 17).

R8. Units like the conference facility and the dairy farm should be operated as commercial units, separate from the training unit

R9. DTI should be operated under the conditions stipulated in the TVET Act.

R10. DTI should seek partnership with a range of national and international stakeholders, e.g. internationally with the Dairy Campus, Dairy Training Centre and CowSignals in the Netherlands and at national level with future employers in the dairy industry like processors, dairy societies, farmers, input suppliers and service providers.

R11. Dairy Training Centre Netherlands could play an important role in quality assurance and development of internationally recognized training programs and approaches (see page 31), possibly in a franchise model.

R12. It is recommended to establish four DTI business units: the Dairy Training Unit, the Dairy Farm Unit, the Conference Hall Unit and the Lucerne Production Unit, to be operated as separate business centres.

R13. The maps produced under a topographical survey which was recently carried out (see pages 64 and 65) should be used for planning purposes as well as for initiation of the application of the title deeds.

Training Program

R14. The long-term training should include a general one-year certificate course, including topics from across the dairy value chain; this general first year should be the first year of the two-year certificate course offered (see page 24).

R15. The second year of the two-year course should have two specializations: dairy farm management and milk collection, processing and marketing. The two-year certificate course can potentially be transformed to a diploma course in the near future (see page 24).

R16. Curricula should be developed in close collaboration with all stakeholders, in particular with the dairy processors and other future employers of DTI graduates; the curricula will aim to work towards certain market-conform job profiles (see page 24).
R17. The curriculum will have a modular approach, especially in the second year. These modules can be used for the short courses as well (see page 24).
R18. A major focus of DTI's training should be on standard and tailor-made short courses, responding to market needs (see page 24).
R19. DTI and the Kenya Dairy Board should collaborate in designing specialized courses for milk testers, transporters, personnel of milk collection centres and other key personnel in the dairy value chain. KDB could make this course a prerequisite for licensing skilled personnel, including mandatory refresher courses (see page 27).
R20. Innovative training methodologies, with a focus on 'learning by doing', competency based learning and an ICT-based approach will be adopted (see page 28).
R21. A monitoring and evaluation framework should be set up to monitor the quality of training, and an alumni organization will facilitate the traceability of graduates.
R22. A detailed marketing plan for DTI's products should be elaborated.

Training Facilities

R23. The existing classrooms and dormitory should be renovated and new additional dormitory facilities should be established to cater for a total of around 420 students in the regular long-term courses (see page 36).
R24. A new dairy processing facility, including laboratory facilities should be established (see 36).
R25. The dairy processing facility should be operated as a training unit and not run on a commercial basis.

Dairy Farm

R26. A new dairy farm should be constructed (see page 42), inclusive of a forage production sub-unit.
R27. The dairy farm and the forage production sub-unit should be operated as separate business centres.
R28. A dairy entrepreneur will run the smallholder demonstration farm as a commercial entity. In return of having access to practical training and the use of the existing DTI farm infrastructure, the farmer will provide access to the smallholder dairy enterprise for training of DTI students.

Conference Hall Unit

R29. The conference facility, currently under construction, should be operated commercially as a separate business centre.

R30. Investments need to be made in a guesthouse in order to make the Conference Hall Unit more marketable and profitable. The guesthouse can be used for short courses at DTI as well.

R31. The conference facility will be marketed for seminars and workshops to other organisations.

R32. CHU rental prices and occupancy rates as applied in this business plan are based on assumptions that need further market research for validations.

Lucerne Production Unit

R33. The Lucerne Production Unit should be entirely operated as a separate commercial entity, or leased to a private investor, with or without a profit sharing arrangement.

ANNEX 1: WORK PLAN

Below follows a summary of the steps for implementation of the business plan, which do not necessarily have to be taken in this order:

0. **Precondition 1: SAGA / TVET status resolved**
   Precondition 2: Land ownership resolved

1. **Establish Management Board**
2. **Review / approval business plan**
3. **Fund Raising**
4. **Establish organizational structure**
   - Accept and implement new organizational structure.
   - Accept new charter for staff terms and conditions of service.
   - Recruit Staff.
5. **Establish partnerships**
   - International, e.g. DTC Netherlands.
   - Regional, e.g. East Africa.
   - National: ministry, KDB, processors and other employers, KARI, other training institutes, farmers' training centres.
6. **Curriculum development**
   - Develop profession and skill profiles.
   - Develop demand-driven competence based training program in cooperation with major stakeholders, in particular with the private sector.
   - Establish certification and accreditation procedures for training courses.
7. **Improve and develop Dairy Training Unit**
   - Building new dormitory and renovation of existing dormitory
   - Renovation of staff houses / lecture halls
   - Build milk processing and laboratory facilities and procure equipment
8. **Set up and implement marketing plan**
9. **Develop Dairy Farm Unit**
   - Contracting and construction of buildings.
   - Explore leasing option.
   - Procure equipment.
10. **Build a guesthouse for Conference Hall Unit**
    - Contracting and construction.
11. **Develop Lucerne Production Unit**
12. **Explore other potential revenues**

ANNEX 2: STAFFING / REMUNERATION

Remuneration New DTI				15%						
Position in New DTI	**Job group**	**Nr of employees**	**Gross Salary KES / mnth**	**Additional %**	**New DTI gross sal/mnth KES**	**Avg Gross sall / month KES**	**plus 1 mnth leave allowance KES**	**and % correction KES**	**EUR**	**Total Gross Sal /mnth KES**
Dairy Training Unit (DTU)	1	2	3	4	6	7	+25%		8	5
Managing Director	S	1	270,990.00	40,648.50	311,638.50	337,608.38		337,608.38	2,910.42	337,608.38
Dean of Studies & Students	Q	1	180,405.00	27,060.75	207,465.75	224,754.56		224,754.56	1,937.54	224,754.56
Adminstrative Manager	P	1	155,841.00	23,376.15	179,217.15	194,151.91		194,151.91	1,673.72	194,151.91
Hd Accountant	N	1	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	152,513.36
ICT/Communication/ PR Officer	N	1	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	152,513.36
HR Officer	N	1	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	152,513.36
Procurement Officer	N	1	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	152,513.36
Lecturers Dairy Farm Management	N	12	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	1,830,160.31
Lecturers Dairy Processing Management	N	12	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	1,830,160.31
Lecturers Basic Sciences	N	6	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	915,080.16
Logistics Officer	N	1	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	152,513.36
Marketing Officer	N	1	97,935.00	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	152,513.36
Store Keeper	L	1	62,385.00	9,357.75	71,742.75	77,721.31	19,430.33	97,151.64	837.51	97,151.64
Laboratory Technician	H	1	36,993.00	5,548.95	42,541.95	46,087.11		46,087.11	397.30	46,087.11
Milk Processing Operator/Chief Driver	H	2	36,993.00	5,548.95	42,541.95	46,087.11		46,087.11	397.30	92,174.23
Security (incl DFU & FPU)	H	5	36,993.00	5,548.95	42,541.95	46,087.11		46,087.11	397.30	230,435.56
Driver	H	2	36,993.00	5,548.95	42,541.95	46,087.11		46,087.11	397.30	92,174.23
Clerical officer I	G	1	31,956.00	4,793.40	36,749.40	39,811.85		39,811.85	343.21	39,811.85
IT Technician (also assigned to CHU)	K	0.5	50,000.00	7,500.00	57,500.00	62,291.67	15,572.92	77,864.58	671.25	38,932.29
Cleaner/ Cooks	F	8	24,120.00	3,618.00	27,738.00	30,049.50		30,049.50	259.05	240,396.00
		59.5								**7,124,158.69**
										€ 61,415.16
Dairy Farm Unit (DFU)										
Farm Manager	P	1	155,841.00	23,376.15	179,217.15	194,151.91		194,151.91	1,673.72	194,151.91
Head of Operations	L	1	62,385.00	9,357.75	71,742.75	77,721.31	19,430.33	97,151.64	837.51	97,151.64
Tractor Driver	H	1	36,993.00	5,548.95	42,541.95	46,087.11		46,087.11	397.30	46,087.11
Skilled Labour (milker/ feed preparation)	E	2	20,000.00	3,000.00	23,000.00	24,916.67		24,916.67	214.80	49,833.33
		5								**387,224.00**
										€ 3,338.14
Forage Production Unit (FCU)										
Head of Operations	L	1	62,385.00	9,357.75	71,742.75	77,721.31	19,430.33	97,151.64	837.51	97,151.64
Tractor Driver	H	1	36,993.00	5,548.95	42,541.95	46,087.11		46,087.11	397.30	46,087.11
Mechanic	H	0	36,993.00	5,548.95	42,541.95	46,087.11		46,087.11	397.30	-
Casual Labour	D	4	17,055.00	2,558.25	19,613.25	21,247.69		21,247.69	183.17	84,990.75
		6								**228,229.50**
										€ 1,967.50
Conference Hall Unit (CHU)										
Conference hall Manager	P	1	155,841.00	23,376.15	179,217.15	194,151.91		194,151.91	1,673.72	194,151.91
Ass Mng	M	1	83,760.00	12,564.00	96,324.00	104,351.00	26,087.75	130,438.75	1,124.47	130,438.75
IT Technician (also assigned to DTU)	K	0.5	50,000.00	7,500.00	57,500.00	62,291.67	15,572.92	77,864.58	671.25	38,932.29
Cleaners / cooks / servants	F	15	24,120.00	3,618.00	27,738.00	30,049.50		30,049.50	259.05	450,742.50
Security	H	3	36,993.00	5,548.95	42,541.95	46,087.11		46,087.11	397.30	138,261.34
		20.5								**952,526.79**
										€ 8,211.44
Lucerne Production Unit										
Production Manager	P	1	155,841	23,376.15	179,217.15	194,151.91		194,151.91	1,673.72	194,151.91
Admin manager	N	2	97,935	14,690.25	112,625.25	122,010.69	30,502.67	152,513.36	1,314.77	305,026.72
Head of Operations	L	2	62,385	9,357.75	71,742.75	77,721.31	19,430.33	97,151.64	837.51	194,303.28
Tractor driver	G	4	31,956	4,793.40	36,749.40	39,811.85		39,811.85	343.21	159,247.40
Mechanic	G	1	31,956	4,793.40	36,749.40	39,811.85		39,811.85	343.21	39,811.85
Security	H	15	36,993	5,548.95	42,541.95	46,087.11		46,087.11	397.30	691,306.69
Casual labour	D	15	17,055	2,558.25	19,613.25	21,247.69		21,247.69	183.17	318,715.31
		40								**1,902,563**
										€ 16,401.41
		131								

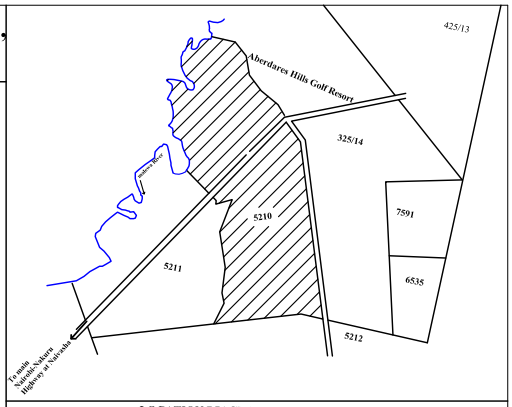
ANNEX 3: FINANCIAL PROJECTION

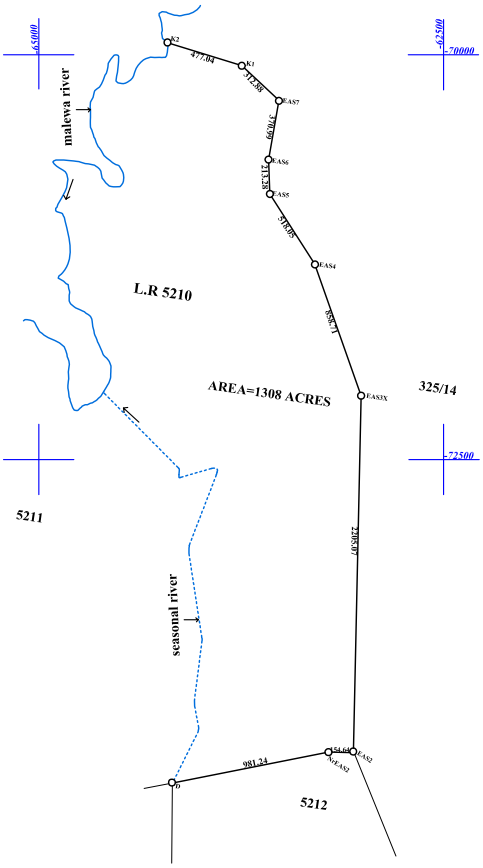
The following annexes are attached to this report in pdf:

Annex 3-1 DTU Financial Projection
Annex 3-2 DFU Financial Projection
Annex 3-3 DFU Forage Production sub-Unit Financial Projection
Annex 3-4 CHU Financial Projection
Annex 3-5 LPU Financial Projection
Annex 3-6 Overall Consolidated Projection

ANNEX 4: SITE SURVEY PLAN DTI

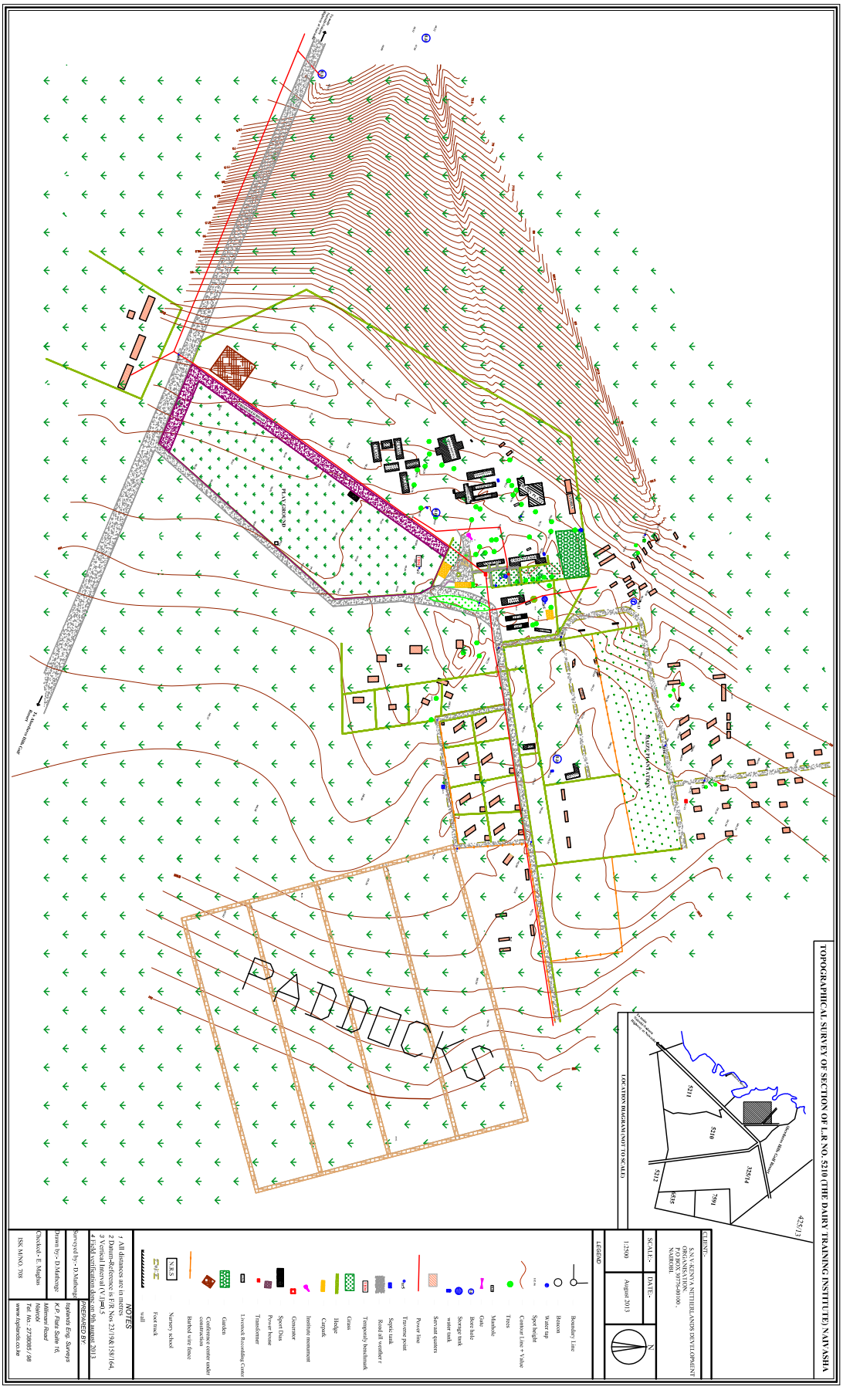
RE-SURVEY OF L.R NO.5210,DAIRY TRAINING INSTITUTE, STATE DEPARTMENT OF LIVESTOCK.





CLIENT:-	SCALE:-	DATE:-		NOTES:-	PREPARED BY:-
S.N.V-KENYA NETHERLANDS DEVELOPMENT ORGANISATION. P.O BOX 30776-00100 , NAIROBI.	1:2500	August 2013	N	1) All distances are in metres 2) Datum-Reference is F/R Nos 23/19&158/164,	TOPLANDS ENGINEERING SURVEYS K.P. Flats Suite 16. Milimani Road Nairobi Tel. No.: 2738085 / 98

ANNEX 5: TOPOGRAPHICAL DIAGRAM DTI BUILDINGS



ANNEX 6: DAIRY PROCESSORS' QUESTIONNAIRE

A.	**BACKGROUND INFORMATION**				
1.	Business Name:				
2.	Respondent	Name			Gender
3.	Owners name (if not same with respondent)	Name			Gender
4.	Size of business (milk intake per day)				
5.	Areas where the firm operate				
6.	Processed/marketed Products				
7.	Locations of Business				
8.	Membership to KDPA				
B.	**LABOUR OUTLAY (Professionals and Technical)**				
9.	Source of hired labour – List				
10.	Professions requirement – Number, level and skills				
11.	Those currently employed	PhD/MSc	BSc	Diploma	Certificate
12.	Future requirement – next 5 years or other plan	PhD/MSc	BSc	Diploma	Certificate
13.	How many other (non-professional/ technical) workers and in what areas				
14.	Which institutes in Kenya and outside offers Dairy processing/technology and or Animal production related training (list)				
15.	How often do you recruit new technical staff (staff turn-around)				
16.	Do new recruits straight from training meet your need or they require internship/on the job training				
17.	What would you recommend to be done at training for the recruits to be ready for the job on hiring				
18.	Do you recruit DTI trained staff				
C.	**TRAINING NEEDS**				
19.	Are you familiar with Dairy professional/technical training institutes in Kenya				
20.	Which ones do you know and what level of training do they offer				
21.	Are you familiar with DTI and its training curriculum?				
22.	Are you satisfied with what they offer or would you want some changes. If so what changes				
23.	Indicate your priorities on the skills you require for your facility/business				
24.	Are there skills you or the industry would require but are not available from the current training institutes				
25.	Does your firm/business participate in offering internship to trainees from DTI and other training institutions				
26.	How often do you have interns and do you have future plans on how you would want to deal with interns				
27.	Any general comments on the current skills training and suggestions				
D.	**DTI CURRENT OWNERSHIP, MANAGEMENT STRUCTURE, CAPITALIZATION AND FUNDING**				
28.	Who owns and runs DTI and how is it managed?				
29.	Are you familiar with the current DTI status and would you want changes				

30. What management structure and changes would you want to see happen	
31. Are you familiar with any Semi Autonomous Government Agency in Kenya and would you want DTI to be modelled around that	
32. Would you support changes that would make the restructured DTI be managed by the main stakeholders (mainly Processors)	
33. Do you think the changes you would like can happen to DTI or you would rather there is established a new/private dairy training institution	
34. Are you or your firm willing and ready to contribute – time and finance – for the management of new DTI	
35. Any suggestion on how the structure and how you would want new DTI managed	
36. Any suggestion on how DTI can be managed as a business – i.e. be able to generate its own self sustaining resources	
37. Should DTI target training needs for Kenya dairy industry only or should it position itself to serve needs beyond the borders	
38. If it has to position to serve needs beyond the borders, should it target East Africa, the whole of African or what is your opinion?	
39. Any other comment(s)	

Interviewer's name:

Notes (observations and comments) by the interviewer/enumerator

ANNEX 7: LABORATORY EQUIPMENT

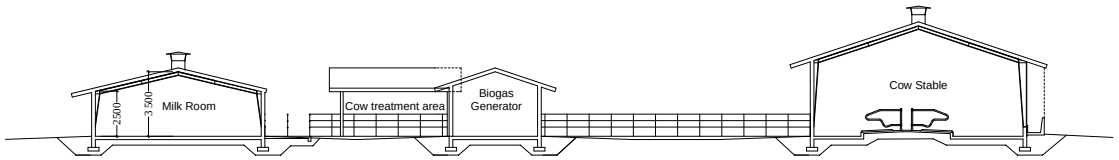
No	EQUIPMENT & REAGENTS	Unit	Qty	Unit	Totals (EUR)	
Milk testing						
1	LactoScope (LactoScope filter)		2		-	4,200
2	Specific gravity					
	- Lactodensimeter (calibrated 20 °C)		20	Unit	-	1,100
	- Measure glass 500 ml		20	Pcs	400	-
3	pH:					
	a. pH meter	Mettler Toledo 7 easy pH kit type s20K	8		-	6,914
	b. Probe electrode	Mettler toledo inlab expert ME51343101	5		-	950
	c. Sampling bottle @ 150 ml	-	30		75	
	d. Buffer pH 7.0 @ 250 ml	Merck 109439.1000	Set		13	
	e. Buffer pH 4.0 @ 250 ml	Merck 109435.1000	Set		13	
	f. KCL (KCl 3M)		Set	Litre	18	
4	Total Solid (Dry matter)					
	Krus Porselin		20	Pcs	440	-
5	Protein (backup & calibration)					
	Kjeldahl Destruction & Distillation unit		2	Unit	-	4,100
	Flask kjehldahl 250 ml		30	Unit	245	-
	Erlenmeyer 250 ml		40	Unit	74	-
	Tablet kjehldahl		Set		34	
	Boric Acid		Set		101	
	H2SO4 95%		Set		28	
	Indicator Metil Red:				-	
	1.Bromocresoll Green		Set		20	
	2. Methylene blue		Set		20	
	HCL 35% (for HCl 0,1 N)		Set		12	
	Burette 25 ml		Set		25	
6	Fat (backup system & calibration)				-	
	1. Centrifuge Gerber		1	Pcs	350	
	2. Isoamyl Alcohol		Set	Litre	90	
	3. Test tube Butyrometer	Iwaki	100	Pcs	1,333	
	5. Rubber Butyrometer	Iwaki	100	Pcs	113	
	6. Pipet 10.75 ml	Iwaki	50	Pcs	354	
	7. Pipet Volume 10 ml	Iwaki	50	Pcs	105	
	8. Pipet Skala 5 ml	Iwaki	50	Pcs	169	

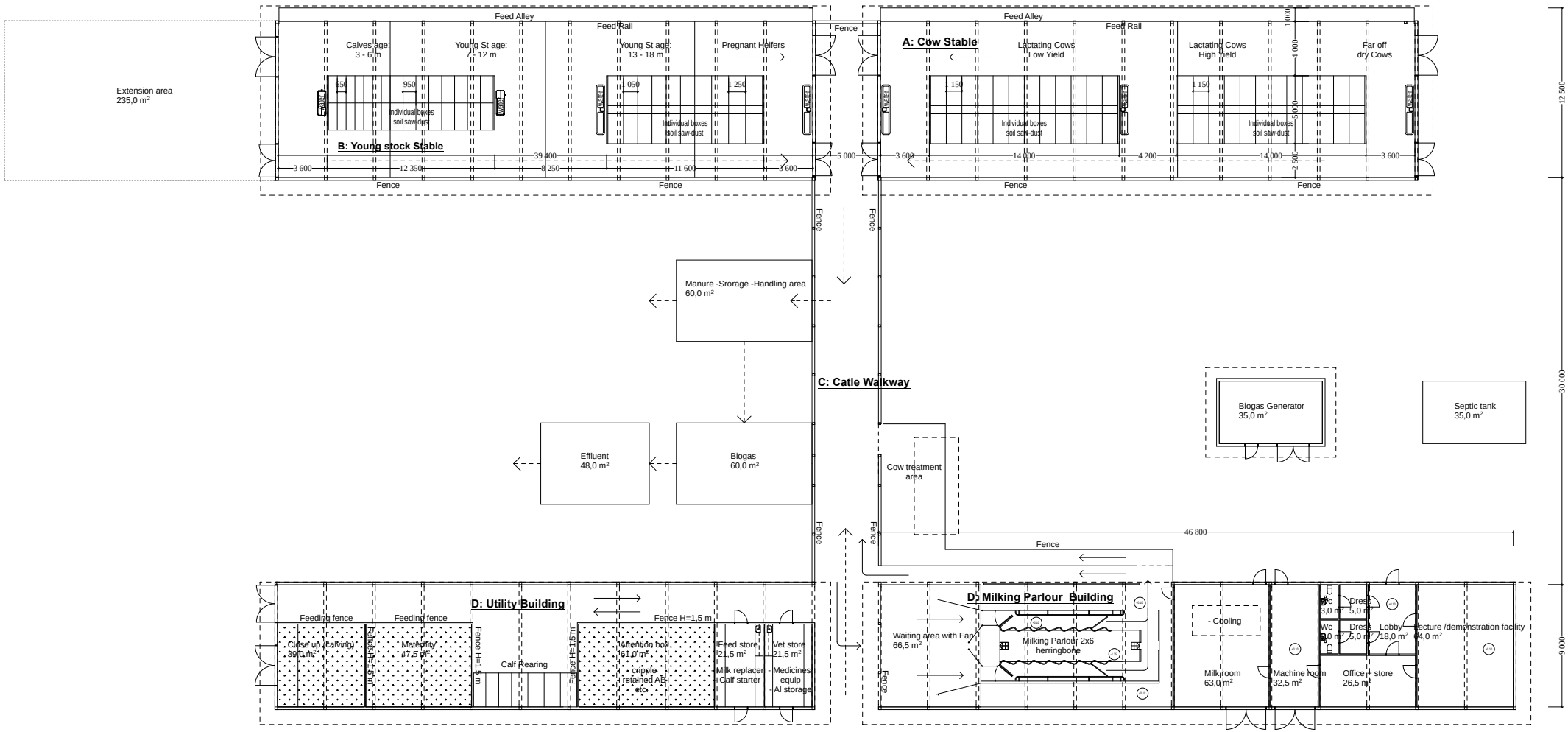
	9. Test tube rack Butyrometer		10	Unit	104		
7	Antibiotic Residue				-		
	- Rapid milk beta-lactam Detection		Set	Unit	208		
	- Delvotest		Set	Unit	254		
				Total	**4,597**	**17,264**	**21,861**
Microbiology							
1	Equipment:				-	-	
	Autoclave		1	Unit	-	3,750	
	Incubator (30°C, 35°C, & 55°C)		1	Unit	-	2,083	
	Oven Sterile		2	Unit	-	8,333	
	Water Bath		3	Unit	-	1,200	
	Thermolyne		1	Unit	-	450	
	Gas burner Bunsen		10	Pcs	170		
	Fume hood/cupboard		1	Set		8,000	
2	Media Agar:				-	-	
	TPC; PCA (Plate Count Agar)	Merck 1.05463.0500	Set	Litre	46		
	Yeast & Mould		Set		-		
	- Oxytetracycline-Glucose Yeast Extract Agar	Oxoid CM0545	Set	Litre	85		
	- OGYE Selective Supplement	Oxoid CM0546	Set	Litre	96		
	Bacillus: Glucose-Caseinpepton-Agar	Merck 1.10860.0500	Set	Litre	99		
	Transferpette 1 ml	Brand	10	Litre	947		
	Blue tube 500pcs/pack	Brand 702521	100	Litre	1,000	-	
	Tube Sterile 4 ml (100 pc/ pack)		4	Litre	75	-	
	Sterikon (for testing autoclave)		Set	Litre	4		
3	Consumables & EQUIPMENT						
	Petridish 80x15mm		200	Pcs	225	-	
	Laminar Air Flow (LAF)		1	Pcs	-	2,500	
	Magnet Stirrer		20	Unit	60	-	
	Reign tube 15 ml		300	Pcs	375	-	
	Erlenmeyer bottle 500 ml		40	Pcs	525	-	
	Aluminium Foil		Set	Pcs	3		
	Alcohol 96%		Set	Litre	8		
	Alcohol 70%		Set	Litre	33		
	Test tube racks		10	Litre	29	-	
	Vial sterile for sampling		Set	Pcs	10		
	Pipet Tetes (Pasteur 2.5 ml) @ 1Pack (100 pcs)		20	Pcs	183	-	
	Bottle sampling 150 ml		200	Pcs	300	-	
	Salmonella (XLD Media Agar) oxoid CM 0469	OxoidCM 0469	Set	Litre	77		

	Staphylococcus (Vogel Jonsen Agar)oxoidCM 0641	OxoidCM 0641	Set	Litre	96		
	Potassium tellurite solution 3.5 % oxoid SR030J	Oxoid SR030J	Set		42		
				Total	**4,489**	**26,317**	**30,806**
Feed analysis							
1	Kjeldahl analysis for crude protein		2	Unit		4,000	
2	Soxhlet analysis for crude Fat		2	Unit		7,600	
3	Crude Fibre analysis		1	Unit		11,600	
4	Dry Matter / Dry oven		2	Unit		7,500	
5	Microscopes		10	Unit		4,000	
6	Laboratory utilities / miscellaneous		1	Set		5,000	
				Total	**0**	**39,700**	**39,700**
GRAND TOTAL							**92,367**

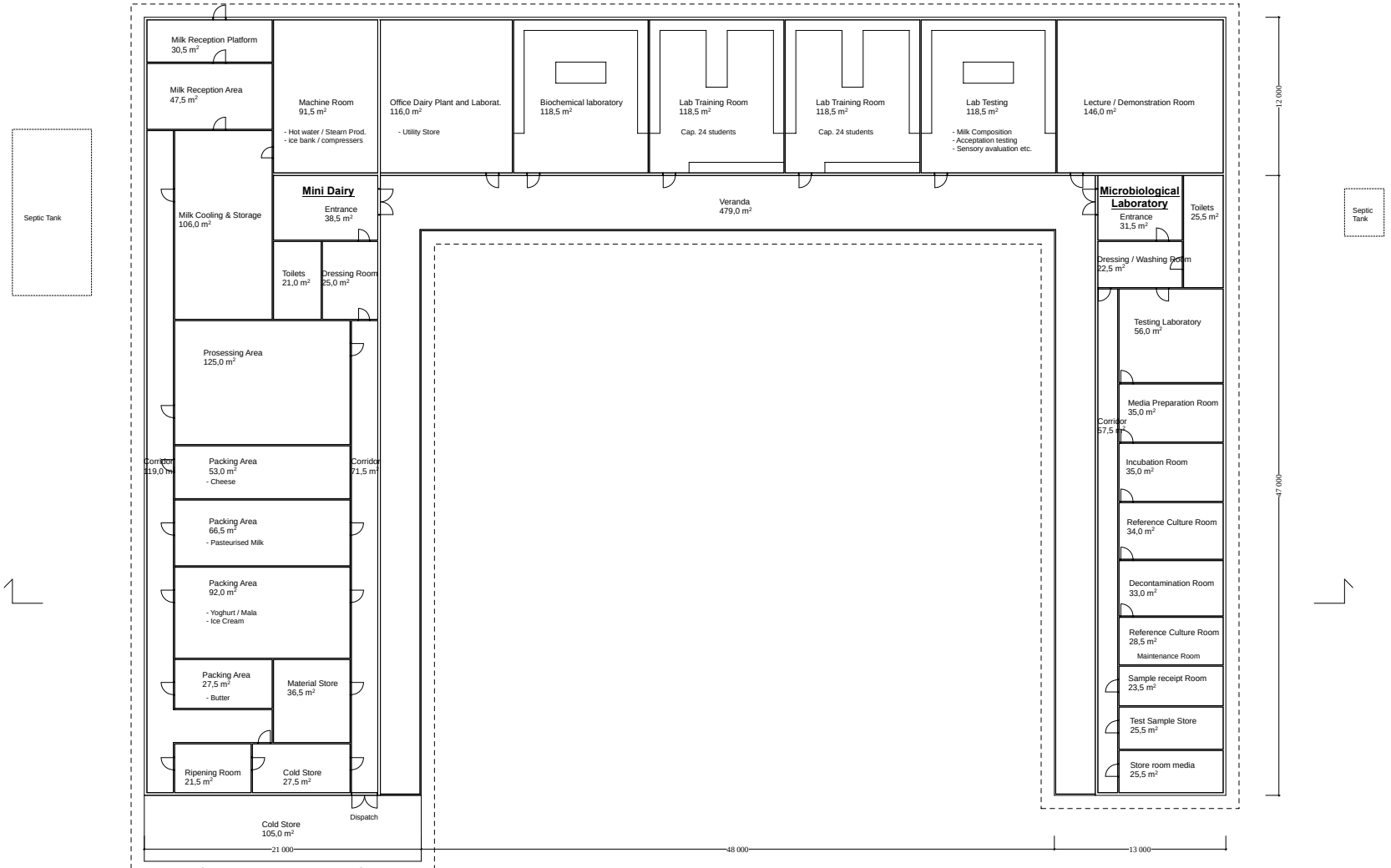
Indicative budget prices

ANNEX 8: LAY-OUT DAIRY FARM



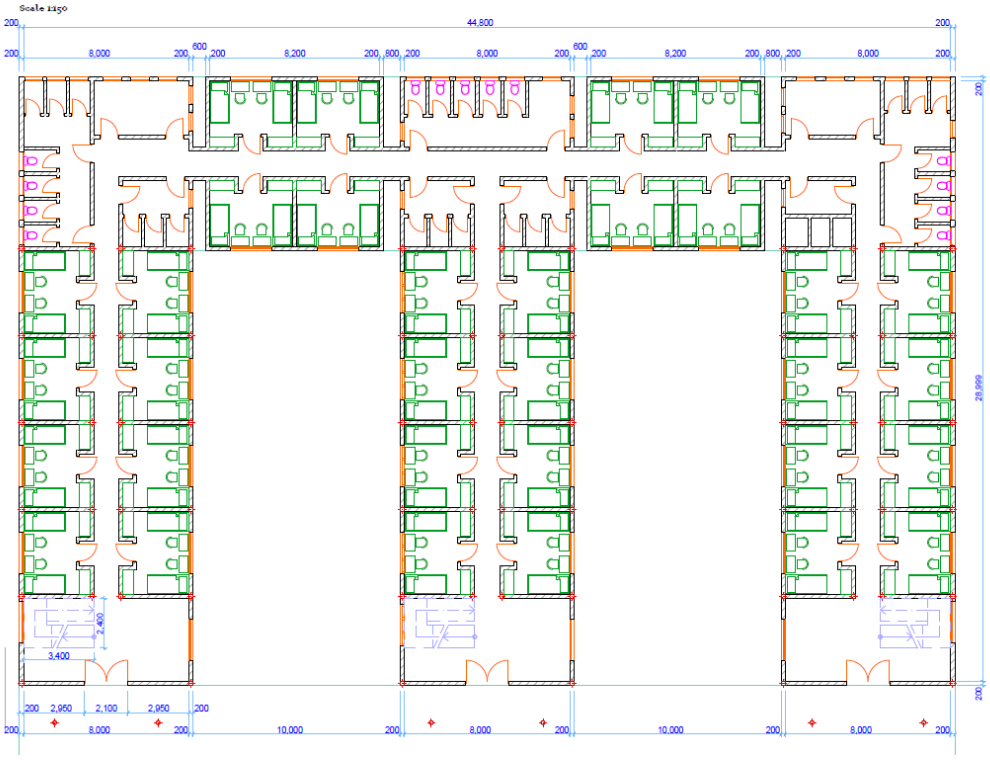


ANNEX 9: LAY-OUT MINI DAIRY AND LABORATORIES



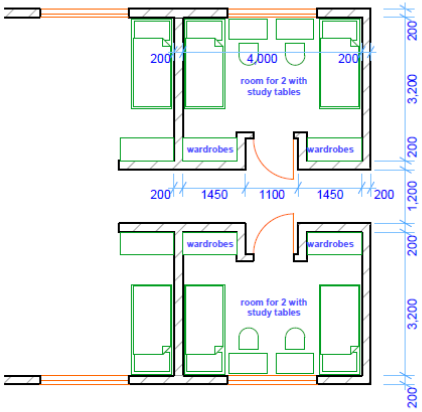
ANNEX 10: LAYOUT DTU DORMITORY

Proposed Domitory
Ground Floor Layout Plan
Scale 1:150

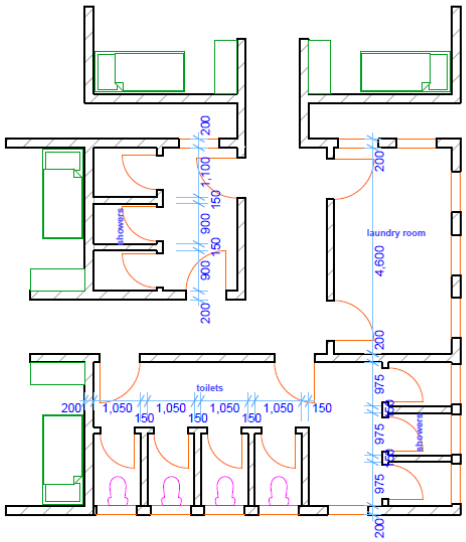


Notes
>double storey option
>ground floor plan
>scale 1:150
>capacity= 150pax
>floor area=909m²

Blow Ups(Domitory)
Scale 1:100



typical room design

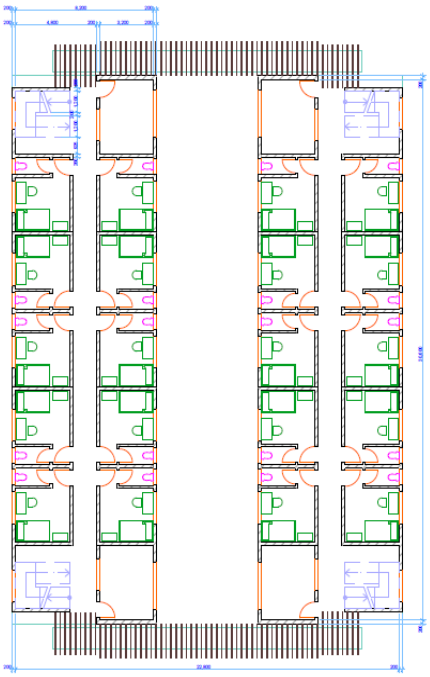


typical washroom design

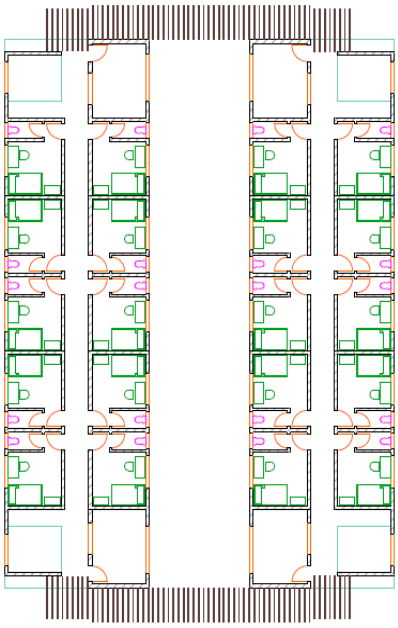
ANNEX 11: LAYOUT CHU GUESTHOUSE

Proposed Hostels(Conference facility)

Ground Floor layout, single occupancy model



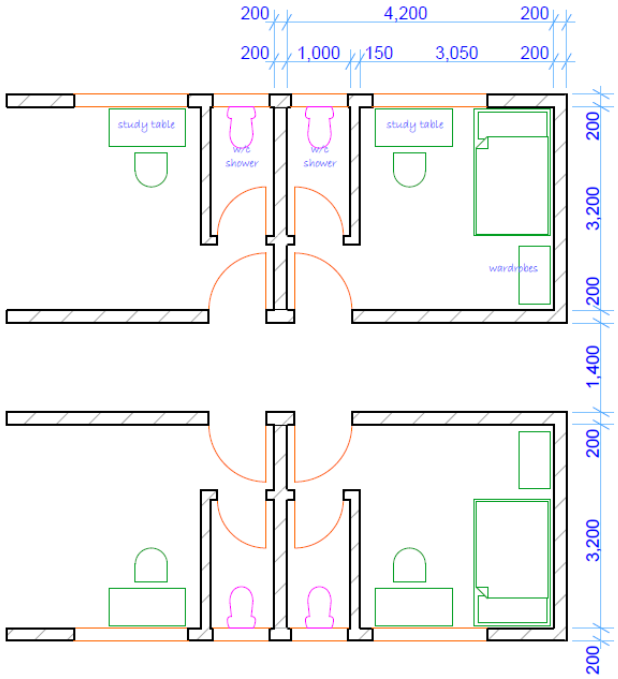
First Floor layout, single occupancy model



Notes
>single, self contained rooms
>double storey option
>capacity>40pax
>floor area>
scale> 1:200

Proposed Hostel(Conference Facility)

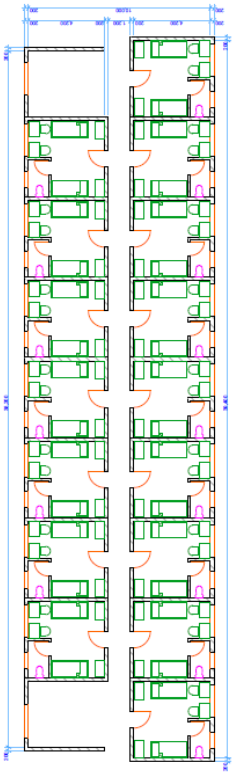
single room occupancy model blow up
Scale 1:75



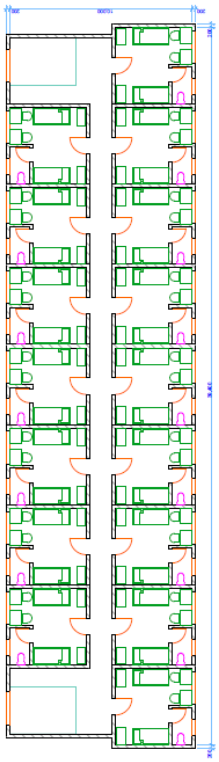
Proposed Hostels(Conference Facility)

double occupancy self contained rooms

ground floor



first floor

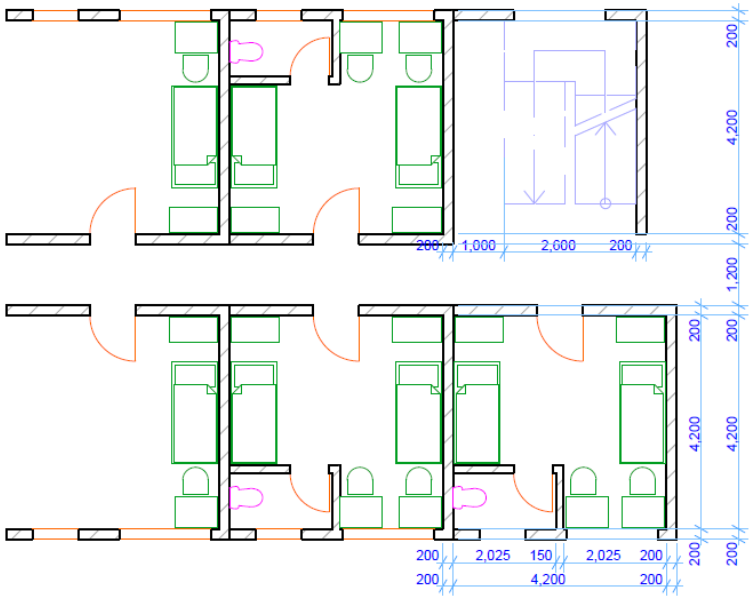


Notes

>double, self contained rooms
>double storey option
>capacity>60pax
>floor area>
scale> 1:200

Proposed Hostels(Conference Facility)

double occupancy rooms blowup
Scale 1:100



ANNEX 12: DFU MILK PRODUCTION FORECAST

COWS IN PRODUCTION DIM= 320 CI= 390 COWS IN PRODUCTION

Year		Yr1												Yr2											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Calvings	1	-	-	-	12	12	12	12	-	-	-	-	2	-	-	-	-	11	11	11	11	-	-	-	-
	2	-	-	-	-	12	12	12	12	-	-	-	-	2	-	-	-	-	11	11	11	11	-	-	-
	3	-	-	-	-	-	12	12	12	12	-	-	-	-	2	-	-	-	-	11	11	11	11	-	-
	4	-	-	-	-	-	-	12	12	12	12	-	-	-	-	2	-	-	-	-	11	11	11	11	-
Pregnant	5	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2	-	-	-	-	10	10	10	10
	6	-	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2	-	-	-	-	10	10	10
	7	-	-	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2	-	-	-	-	10	10
	8	-	-	-	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2	-	-	-	-	10
	9	-	-	-	-	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2	-	-	-	-
	10	-	-	-	-	-	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2	-	-	-
	11	-	-	-	-	-	-	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2	-	-
Dry	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2	-
	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	11	11	11	-	-	-	-	2
Cows in lactation		**-**	**-**	**-**	**12**	**23**	**35**	**47**	**47**	**46**	**46**	**46**	**47**	**47**	**47**	**35**	**24**	**24**	**24**	**34**	**45**	**45**	**45**	**42**	**42**

MILK PRODUCTION (Kg.) MILK PRODUCTION (Kg.)

1	-	-	-	5,259	5,259	5,259	5,259	-	-	-	-	898	-	-	-	-	4,943	4,943	4,943	4,943	-	-	-	-
2	-	-	-	-	6,954	6,954	6,954	6,954	-	-	-	-	1,187	-	-	-	-	6,606	6,606	6,606	6,606	-	-	-	-
3	-	-	-	-	-	8,912	8,912	8,912	8,912	-	-	-	-	1,521	-	-	-	-	8,592	8,592	8,592	8,592	-	-	-
4	-	-	-	-	-	-	11,420	11,420	11,420	11,420	-	-	-	-	1,949	-	-	-	-	11,175	11,175	11,175	11,175	-	-
5	-	-	-	-	-	-	-	11,433	11,433	11,433	11,433	-	-	-	-	1,999	-	-	-	-	11,184	11,184	11,184	11,184	-
6	-	-	-	-	-	-	-	-	9,545	9,545	9,545	9,311	-	-	-	-	1,669	-	-	-	-	9,337	9,337	9,337	-
7	-	-	-	-	-	-	-	-	-	7,968	7,968	7,968	7,773	-	-	-	-	1,393	-	-	-	-	7,794	7,794	-
8	-	-	-	-	-	-	-	-	-	-	11,147	11,147	11,147	10,874	-	-	-	-	1,949	-	-	-	-	10,829	-
9	-	-	-	-	-	-	-	-	-	-	-	5,553	5,553	5,553	5,417	-	-	-	-	971	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	4,522	4,522	4,522	4,522	-	-	-	-	810	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	2,592	2,592	2,592	2,592	-	-	-	-	464	-	-	-
Total (kg)	-	-	-	5,259	12,214	21,125	32,545	38,719	41,309	40,365	40,092	34,876	30,182	25,062	14,480	9,113	9,203	12,942	22,090	32,286	38,367	40,752	39,490	39,144	
Minus 1.5.% loss*	-	-	-	5,180	12,031	20,809	32,057	38,138	40,689	39,760	39,491	34,353	29,729	24,686	14,263	8,976	9,065	12,748	21,758	31,802	37,792	40,141	38,898	38,557	
Day production	**-**	**-**	**-**	**173**	**388**	**694**	**1,034**	**1,230**	**1,356**	**1,283**	**1,316**	**1,108**	**959**	**882**	**460**	**299**	**292**	**425**	**702**	**1,026**	**1,260**	**1,295**	**1,297**	**1,244**	
Volume per year												**262,508**												**308,414**	
Vol avg per day											Avg day	955											Avg day	845	
Max (as from yr 2	1,707	kg/day	Yr 6 M2																						
Min (as from yr 2)	287	kg/day	Yr3 M3		**1.50**	% * = Milk loss (incl Mastitis)																			

MILK DELIVERY (Lt.)

Monthly productio	-	-	-	5,034	11,692	20,222	31,153	37,063	39,543	38,639	38,378	33,385	28,891	23,990	13,861	8,723	8,810	12,389	21,145	30,906	36,727	39,009	37,801	37,470
Day production	-	-	-	168	377	674	1,005	1,196	1,318	1,246	1,279	1,077	963	857	447	291	284	413	682	997	1,224	1,258	1,260	1,209
Volume per year												**255,110**												**299,722**

COWS IN PRODUCTION

Yr3												
J	F	M	A	M	J	J	A	S	O	N	D
1	2	3	4	5	6	7	8	9	10	11	12
2	-	-	-	-	10	13	12	12	2	-	-
-	2	-	-	-	-	10	13	12	12	2	-
-	-	2	-	-	-	-	10	13	12	12	2
-	-	-	2	-	-	-	-	10	12	11	11
-	-	-	-	2	-	-	-	-	10	12	11
10	-	-	-	-	2	-	-	-	-	10	12
10	10	-	-	-	-	2	-	-	-	-	10
10	10	10	-	-	-	-	2	-	-	-	-
10	10	10	10	-	-	-	-	2	-	-	-
-	10	10	10	10	-	-	-	-	2	-	-
-	-	10	10	10	10	-	-	-	-	2	-
-	-	-	10	10	10	10	-	-	-	-	2
-	-	-	-	10	10	10	10	-	-	-	-
44	**43**	**43**	**32**	**22**	**22**	**25**	**37**	**48**	**50**	**49**	**47**

COWS IN PRODUCTION

Yr4												
J	F	M	A	M	J	J	A	S	O	N	D
1	2	3	4	5	6	7	8	9	10	11	12
-	2	1	-	-	-	8	13	12	13	5	-
-	-	2	1	-	-	-	8	13	12	13	5
-	-	-	2	1	-	-	-	8	13	11	12
2	-	-	-	2	1	-	-	-	8	13	11
11	2	-	-	-	2	1	-	-	-	8	13
11	11	2	-	-	-	2	1	-	-	-	8
12	11	11	2	-	-	-	2	1	-	-	-
9	12	11	11	2	-	-	-	2	1	-	-
-	9	12	11	11	2	-	-	-	2	1	-
-	-	9	12	11	11	2	-	-	-	2	1
-	-	-	9	12	11	11	2	-	-	-	2
-	-	-	-	8	12	10	10	2	-	-	-
2	-	-	-	-	8	12	10	10	2	-	-
46	**47**	**47**	**47**	**38**	**26**	**24**	**27**	**35**	**47**	**51**	**51**

MILK PRODUCTION (Kg.)

913	-	-	-	-	4,789	5,985	5,536	5,536	1,024	-	-
-	1,220	-	-	-	-	6,554	8,122	7,529	7,529	1,354	-
-	-	1,587	-	-	-	-	8,781	10,769	10,009	10,009	1,735
-	-	-	2,065	-	-	-	-	11,086	13,604	12,630	12,630
-	-	-	-	2,132	-	-	-	-	11,607	14,109	13,110
9,337	-	-	-	-	1,780	-	-	-	-	9,690	11,779
7,794	7,794	-	-	-	-	1,486	-	-	-	-	8,089
10,829	10,829	10,829	-	-	-	-	2,065	-	-	-	-
5,259	5,259	5,259	5,259	-	-	-	-	1,036	-	-	-
-	4,390	4,390	4,390	4,390	-	-	-	-	865	-	-
-	-	2,516	2,516	2,516	2,516	-	-	-	-	495	-
34,132	29,493	24,581	14,229	9,038	9,085	14,025	24,504	35,956	44,637	48,286	47,342
33,620	29,050	24,213	14,016	8,903	8,949	13,814	24,137	35,416	43,967	47,562	46,632
1,085	**1,038**	**781**	**467**	**287**	**298**	**446**	**779**	**1,181**	**1,418**	**1,585**	**1,504**
											330,279
										Avg day	905

MILK PRODUCTION (Kg.)

-	943	384	-	-	-	3,959	6,204	5,393	5,842	2,237	-
-	-	1,291	508	-	-	-	5,418	8,406	7,311	7,905	2,971
-	-	-	1,729	591	-	-	-	6,610	10,475	9,032	9,792
2,223	-	-	-	2,317	757	-	-	-	8,857	13,856	11,893
13,110	2,214	-	-	-	2,426	776	-	-	-	9,273	14,339
10,944	10,944	1,849	-	-	-	2,025	648	-	-	-	7,741
9,833	9,136	9,136	1,543	-	-	-	1,691	541	-	-	-
13,932	16,156	15,182	15,182	2,159	-	-	-	3,102	757	-	-
-	5,292	6,475	5,990	5,990	1,043	-	-	-	1,178	377	-
-	-	4,418	5,406	5,000	5,000	871	-	-	-	984	315
-	-	-	2,532	3,098	2,866	2,866	499	-	-	-	564
50,043	44,686	38,734	32,889	19,155	12,093	10,498	14,460	24,053	34,420	43,663	47,615
49,292	44,016	38,153	32,396	18,868	11,911	10,340	14,243	23,692	33,904	43,008	46,901
1,590	**1,572**	**1,231**	**1,080**	**609**	**397**	**334**	**459**	**790**	**1,094**	**1,434**	**1,513**
											366,725
										Avg day	1,005

32,673	28,232	23,530	13,621	8,652	8,696	13,425	23,456	34,418	42,728	46,222	45,318
1,089	1,008	759	454	279	290	433	757	1,147	1,378	1,541	1,462
											320,971

47,903	42,775	37,078	31,483	18,336	11,576	10,049	13,842	23,024	32,948	41,796	45,579
1,597	1,528	1,196	1,049	591	386	324	447	767	1,063	1,393	1,470
											356,389

COWS IN PRODUCTION

Yr5												
J	F	M	A	M	J	J	A	S	O	N	D
1	2	3	4	5	6	7	8	9	10	11	12
-	-	2	2	-	-	-	6	12	12	12	8
-	-	-	2	2	-	-	-	5	11	11	11
5	-	-	-	2	2	-	-	-	5	11	11
12	5	-	-	-	2	2	-	-	-	5	11
11	12	5	-	-	-	2	2	-	-	-	5
12	11	12	5	-	-	-	2	2	-	-	-
7	12	10	11	5	-	-	-	2	2	-	-
-	7	12	10	11	5	-	-	-	2	2	-
-	-	7	12	10	11	5	-	-	-	2	2
-	-	-	7	11	10	11	5	-	-	-	2
1	-	-	-	6	11	10	10	5	-	-	-
2	1	-	-	-	6	11	10	10	5	-	-
-	2	1	-	-	-	6	11	10	10	5	-
48	**46**	**47**	**48**	**47**	**40**	**29**	**25**	**26**	**33**	**44**	**51**

MILK PRODUCTION (Kg.)

-	-	943	736	-	-	-	2,897	5,656	5,724	5,606	3,613
-	-	-	1,291	979	-	-	-	3,419	7,139	7,206	7,038
3,831	-	-	-	1,729	1,263	-	-	-	4,581	9,471	9,520
12,928	4,941	-	-	-	2,317	1,631	-	-	-	6,138	12,570
12,300	13,361	4,999	-	-	-	2,426	1,678	-	-	-	6,427
11,918	10,268	11,154	4,173	-	-	-	2,025	1,401	-	-	-
5,828	9,272	7,894	8,634	3,484	-	-	-	1,691	1,169	-	-
-	10,693	15,489	13,292	14,327	4,860	-	-	-	3,102	1,631	-
-	-	4,062	6,421	5,317	5,833	2,244	-	-	-	1,178	413
-	-	-	3,391	5,335	4,533	4,964	1,993	-	-	-	984
180	-	-	-	1,732	2,846	2,598	2,607	1,142	-	-	-
46,986	48,535	44,541	37,937	32,903	21,652	13,862	11,200	13,309	21,715	31,230	40,564
46,281	47,807	43,873	37,368	32,409	21,327	13,654	11,032	13,110	21,390	30,762	39,955
1,493	**1,707**	**1,415**	**1,246**	**1,045**	**711**	**440**	**356**	**437**	**690**	**1,025**	**1,289**
											358,968
										Avg day	983

COWS IN PRODUCTION

Yr6												
J	F	M	A	M	J	J	A	S	O	N	D
1	2	3	4	5	6	7	8	9	10	11	12
1	-	-	2	2	0	-	-	4	11	11	14
8	1	-	-	2	2	0	-	-	4	11	11
11	8	1	-	-	2	2	0	-	-	4	11
11	11	8	1	-	-	2	2	0	-	-	4
11	11	11	8	1	-	-	2	2	0	-	-
4	10	10	10	8	1	-	-	2	2	0	-
-	4	10	10	10	8	1	-	-	2	2	0
-	-	4	10	10	10	8	1	-	-	2	2
-	-	-	4	10	10	10	8	1	-	-	2
2	-	-	-	4	9	9	10	8	1	-	-
2	2	-	-	-	4	9	9	10	8	1	-
-	2	2	-	-	-	4	9	9	10	8	1
-	-	2	2	-	-	-	4	9	9	10	8
51	**48**	**45**	**46**	**47**	**46**	**41**	**32**	**27**	**28**	**31**	**44**

MILK PRODUCTION (Kg.)

454	-	-	943	1,045	162	-	-	1,811	4,925	5,155	5,684
4,834	600	-	-	1,291	1,401	214	-	-	2,460	6,664	6,954
9,285	6,294	769	-	-	1,729	1,828	275	-	-	3,267	8,804
12,504	12,177	8,197	986	-	-	2,317	2,387	352	-	-	4,323
12,891	12,770	12,634	8,275	982	-	-	2,426	2,469	361	-	-
4,510	9,907	9,805	9,692	6,908	820	-	-	2,025	2,061	301	-
-	3,765	8,067	8,297	8,023	5,816	820	-	-	1,691	1,721	301
-	-	6,908	13,836	13,362	12,811	8,393	820	-	-	3,102	2,637
-	-	-	2,624	5,622	6,122	5,815	4,278	795	-	-	1,178
680	-	-	-	1,775	4,210	4,804	4,900	3,702	795	-	-
564	390	-	-	-	1,017	2,394	3,223	3,148	2,461	795	-
45,723	45,903	46,380	44,653	39,008	34,089	26,586	18,307	14,303	14,755	21,006	29,882
45,037	45,214	45,685	43,983	38,423	33,577	26,187	18,033	14,088	14,534	20,691	29,434
1,453	**1,615**	**1,474**	**1,466**	**1,239**	**1,119**	**845**	**582**	**470**	**469**	**690**	**949**
											374,885
										Avg day	1,027

44,977	46,460	42,636	36,315	31,496	20,726	13,269	10,721	12,740	20,787	29,895	38,829
1,499	1,659	1,375	1,211	1,016	691	428	346	425	671	996	1,253
											348,851

43,767	43,940	44,397	42,744	37,340	32,631	25,449	17,525	13,691	14,124	20,108	28,604
1,459	1,569	1,432	1,425	1,205	1,088	821	565	456	456	670	923
											364,320

ANNEX 13: DFU FEED REQUIREMENTS

ANNUAL DAIRY FEED REQUIREMENT

Total feed ration kg (DM) Project year:	1							Requirements:										
	Dairy cows Lactation	Dry cows Dry period	0-3m Calves	4-6m Calves	7-12m Calves	13-15m heifers	pregnant Heifers	kg per day: Totals in DM	Ton/year Totals in DM	% loss feeding	% loss ensiling/conserv	ton dm to be Harvested/Procured:	% DM	ton product gross weight to purchase	Yield/cut ton dm/ha	nr of cuttings	Total Acres needed	total hectare needed:
Herd count	29	0	6	6	3	0	11											
FORAGES																		
Alfalfa	57	-	-	2	3	-	11	73	27	0.04	0	28	86	32	2.17	8	4	**1.6**
Maize silage	227	-	-	6	3	-	23	258	94	0.02	0	96	32	301	15.00	2	8	**3.2**
Rhodes grass hay	57	-	6	2	3	-	11	78	29	0.02	0	29	90	32	7.00	1	10	**4.2**
Napier grass hay	-	-	-	-	-	-	-	0	0	0.02	0	0	90	0	14.00	1	0	**0.0**
Oats straw	15	-	-	-	-	-	-	15	5	0.05	0	6	33	17	9.00	1	2	**0.6**
															Total area needed to cultivate forages:		**25**	**10.1**
GROUND MATERIALS											% loss milling							
Maize grain	99	-	4	6	3	-	11	122	45		0.02	46	89	51				
Wheat bran	49	-	-	-	3	-	11	63	23		0.02	24	89	26				
Wheat pollard	-	-	-	-	-	-	-	0	0		0.02	0	91	0				
Soya bean meal	49	-	4	6	3	-	-	62	23		0.02	23	89	26				
Sunflower cake	26	-	-	-	-	-	11	37	14		0.02	14	89	16				
Lupin seed meal	26	-	-	-	-	-	-	26	10		0.02	10	88	11				
limestone	-	-	-	-	-	-	-	0	0		0.02	0	88	0				
sodiumBicarbo	-	-	-	-	-	-	-	0	0		0.02	0	88	0				
Mineral mix	6	-	-	0	0	-	1	7	2		0.02	2	95	3				
Total concentrates	**256**	**-**	**8**	**11**	**8**	**-**	**34**	**318**	**116**					133				

Total feed ration kg (DM) Project year:	2							Requirements:										
	Dairy cows Lactation	Dry cows Dry period	0-3m Calves	4-6m Calves	7-12m Calves	13-15m heifers	pregnant Heifers	kg per day: Totals in DM	Ton/year Totals in DM	% loss feeding	% loss ensiling/conserv	ton dm to be Procured:	% DM	ton product gross weight to purchase	Yield/cut ton dm/ha	nr of cuttings	Total Acres needed	total hectare needed:
Herd count	38	8	5	5	10	5	8											
FORAGES																		
Alfalfa	74	-	-	2	10	5	8	99	36	4%	0%	38	86	44	2.17	8	5	**2.2**
Maize silage	296	26	-	5	10	5	17	359	131	2%	0%	134	32	418	15.00	2	11	**4.5**
Rhodes grass hay	74	13	5	2	10	5	8	118	43	2%	0%	44	90	49	7.00	1	15	**6.3**
Napier grass hay	-	39	-	-	-	-	-	39	14	2%	0%	14	90	16	14.00	1	3	**1.0**
Oats straw	19	-	-	-	-	-	-	19	7	5%	0%	7	33	22	9.00	1	2	**0.8**
															Total area needed to cultivate forages:		**36**	**14.7**
GROUND MATERIALS											% loss milling							
Maize grain	129	-	4	5	10	8	8	164	60		2%	61	89	69				
Wheat bran	64	13	-	-	10	5	8	101	37		2%	38	89	42				
Wheat pollard	-	-	-	-	-	-	-	0	0		2%	0	91	0				
Soya bean meal	64	-	4	5	10	3	-	86	31		2%	32	89	36				
Sunflower cake	34	-	-	-	-	3	8	45	16		2%	17	89	19				
Lupin seed meal	34	13	-	-	-	-	-	47	17		2%	18	88	20				
limestone	2	-	-	-	-	-	-	2	1		2%	1	88	1				
sodiumBicarbo	5	-	-	-	-	-	-	5	2		2%	2	88	2				
Mineral mix	7	2	-	0	0	0	-	9	3		2%	4	95	4				
Total concentrates	**340**	**28**	**8**	**10**	**30**	**19**	**24**	**460**	**168**					192				

Total feed ration kg (DM) Project year:	3							Requirements:										
	Dairy cows Lactation	Dry cows Dry period	0-3m Calves	4-6m Calves	7-12m Calves	13-15m heifers	pregnant Heifers	kg per day: Totals in DM	Ton/year Totals in DM	% loss feeding	% loss ensiling/conserv	ton dm to be Harvested/Procured:	% DM	ton product gross weight to purchase	Yield/cut ton dm/ha	nr of cuttings	Total Acres needed	total hectare needed:
Herd count	39	7	6	5	10	6	20											
FORAGES																		
Alfalfa	75	-	-	2	10	6	20	113	41	4%	0%	43	86	50	2.17	8	6	**2.5**
Maize silage	301	23	-	5	10	6	42	386	141	2%	0%	144	32	449	15.00	2	12	**4.8**
Rhodes grass hay	75	12	6	2	10	6	20	130	48	2%	0%	49	90	54	7.00	1	17	**6.9**
Napier grass hay	-	34	-	-	-	-	-	34	12	2%	0%	13	90	14	14.00	1	2	**0.9**
Oats straw	19	-	-	-	-	-	-	19	7	5%	0%	7	33	22	9.00	1	2	**0.8**
															Total area needed to cultivate forages:		**39**	**15.9**
GROUND MATERIALS											**% loss milling**							
Maize grain	131	-	5	5	10	9	20	179	65		2%	67	89	75				
Wheat bran	66	12	-	-	10	6	20	113	41		2%	42	89	47				
Wheat pollard	-	-	-	-	-	-	-	0	0		2%	0	91	0				
Soya bean meal	66	-	5	5	10	3	-	88	32		2%	33	89	37				
Sunflower cake	35	-	-	-	-	3	20	58	21		2%	21	89	24				
Lupin seed meal	35	12	-	-	-	-	-	46	17		2%	17	88	20				
limestone	2	-	-	-	-	-	-	2	1		2%	1	88	1				
sodiumBicarbo	5	-	-	-	-	-	-	5	2		2%	2	88	2				
Mineral mix	7	1	-	0	0	0	1	11	4		2%	4	95	4				
Total concentrates	**346**	**24**	**9**	**10**	**29**	**22**	**61**	**501**	**183**					210				

Total feed ration kg (DM) Project year:	4							Requirements:										
	Dairy cows Lactation	Dry cows Dry period	0-3m Calves	4-6m Calves	7-12m Calves	13-15m heifers	pregnant Heifers	kg per day: Totals in DM	Ton/year Totals in DM	% loss feeding	% loss ensiling/conserv	ton dm to be Harvested/Procured:	% DM	ton product gross weight to purchase	Yield/cut ton dm/ha	nr of cuttings	Total Acres needed	total hectare needed:
Herd count	41	7	6	4	12	6	19											
FORAGES																		
Alfalfa	79	-	-	2	12	6	19	117	43	4%	0%	45	86	52	2.17	8	6	**2.6**
Maize silage	316	24	-	4	12	6	40	403	147	2%	0%	150	32	469	15.00	2	12	**5.0**
Rhodes grass hay	79	12	6	2	12	6	19	136	50	2%	0%	51	90	56	7.00	1	18	**7.2**
Napier grass hay	-	36	-	-	-	-	-	36	13	2%	0%	13	90	15	14.00	1	2	**0.9**
Oats straw	20	-	-	-	-	-	-	20	7	5%	0%	8	33	24	9.00	1	2	**0.9**
															Total area needed to cultivate forages:		**41**	**16.6**
GROUND MATERIALS											**% loss milling**							
Maize grain	138	-	5	4	12	9	19	187	68		2%	69	89	78				
Wheat bran	69	12	-	-	12	6	19	118	43		2%	44	89	49				
Wheat pollard	-	-	-	-	-	-	-	0	0		2%	0	91	0				
Soya bean meal	69	-	5	4	12	3	-	93	34		2%	34	89	39				
Sunflower cake	36	-	-	-	-	3	19	59	21		2%	22	89	25				
Lupin seed meal	36	12	-	-	-	-	-	49	18		2%	18	88	21				
limestone	2	-	-	-	-	-	-	2	1		2%	1	88	1				
sodiumBicarbo	5	-	-	-	-	-	-	5	2		2%	2	88	2				
Mineral mix	8	1	-	0	0	0	1	11	4		2%	4	95	4				
Total concentrates	**364**	**26**	**9**	**9**	**35**	**21**	**59**	**522**	**191**					219				

Total feed ration kg (DM) Project year:	5							Requirements:										
	Dairy cows Lactation	Dry cows Dry period	0-3m Calves	4-6m Calves	7-12m Calves	13-15m heifers	pregnant Heifers	kg per day: Totals in DM	Ton/year Totals in DM	% loss feeding	% loss ensiling/conserv	ton dm to be Harvested/Procured:	% DM	ton product gross weight to purchase	Yield/cut ton dm/ha	nr of cuttings	Total Acres needed	total hectare needed:
Herd count	40	7	6	5	12	6	21											
FORAGES																		
Alfalfa	78	-	-	2	12	6	21	120	44	4%	0%	46	86	53	2.17	8	6	**2.6**
Maize silage	313	25	-	5	12	6	45	407	148	2%	0%	151	32	473	15.00	2	12	**5.0**
Rhodes grass hay	78	13	6	2	12	6	21	138	50	2%	0%	51	90	57	7.00	1	18	**7.4**
Napier grass hay	-	37	-	-	-	-	-	37	13	2%	0%	14	90	15	14.00	1	2	**1.0**
Oats straw	20	-	-	-	-	-	-	20	7	5%	0%	8	33	23	9.00	1	2	**0.9**
															Total area needed to cultivate forages:		**42**	**16.9**
GROUND MATERIALS											**% loss milling**							
Maize grain	136	-	4	5	12	9	21	188	69		2%	70	89	79				
Wheat bran	68	13	-	-	12	6	21	121	44		2%	45	89	51				
Wheat pollard	-	-	-	-	-	-	-	0	0		2%	0	91	0				
Soya bean meal	68	-	4	5	12	3	-	93	34		2%	35	89	39				
Sunflower cake	36	-	-	-	-	3	21	61	22		2%	23	89	25				
Lupin seed meal	36	13	-	-	-	-	-	49	18		2%	18	88	21				
limestone	2	-	-	-	-	-	-	2	1		2%	1	88	1				
sodiumBicarbo	5	-	-	-	-	-	-	5	2		2%	2	88	2				
Mineral mix	8	1	-	0	0	0	2	11	4		2%	4	95	4				
Total concentrates	**360**	**27**	**8**	**10**	**38**	**21**	**66**	**530**	**193**					222				

Total feed ration kg (DM) Project year:	6							Requirements:										
	Dairy cows Lactation	Dry cows Dry period	0-3m Calves	4-6m Calves	7-12m Calves	13-15m heifers	pregnant Heifers	kg per day: Totals in DM	Ton/year Totals in DM	% loss feeding	% loss ensiling/conserv	ton dm to be Harvested/Procured:	% DM	ton product gross weight to purchase	Yield/cut ton dm/ha	nr of cuttings	Total Acres needed	total hectare needed:
Herd count	40	7	5	6	13	13	23											
FORAGES																		
Alfalfa	79	-	-	2	13	13	23	130	47	4%	0%	49	86	57	2.17	8	7	**2.8**
Maize silage	315	24	-	6	13	13	48	419	153	2%	0%	156	32	488	15.00	2	13	**5.2**
Rhodes grass hay	79	12	5	2	13	13	23	147	54	2%	0%	55	90	61	7.00	1	19	**7.8**
Napier grass hay	-	36	-	-	-	-	-	36	13	2%	0%	13	90	15	14.00	1	2	**1.0**
Oats straw	20	-	-	-	-	-	-	20	7	5%	0%	8	33	24	9.00	1	2	**0.9**
															Total area needed to cultivate forages:		**44**	**17.7**
GROUND MATERIALS											**% loss milling**							
Maize grain	137	-	4	6	13	19	23	202	74		2%	75	89	84				
Wheat bran	69	12	-	-	13	13	23	129	47		2%	48	89	54				
Wheat pollard	-	-	-	-	-	-	-	0	0		2%	0	91	0				
Soya bean meal	69	-	4	6	13	6	-	97	36		2%	36	89	41				
Sunflower cake	36	-	-	-	-	6	23	66	24		2%	24	89	27				
Lupin seed meal	36	12	-	-	-	-	-	49	18		2%	18	88	21				
limestone	2	-	-	-	-	-	-	2	1		2%	1	88	1				
sodiumBicarbo	5	-	-	-	-	-	-	5	2		2%	2	88	2				
Mineral mix	8	1	-	0	0	1	2	12	4		2%	4	95	5				
Total concentrates	**363**	**26**	**7**	**12**	**39**	**45**	**70**	**562**	**205**					235				