WITFOR2005 - AGRICULTURAL COMMISSION

PROJECT PROPOSAL

For the development and implementation of:

A CATTLE FARM MANAGEMENT SYSTEM (CFMS)

To enhance the managerial and financial skills

of

Traditional Livestock Farmers and others

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PREAMBLE

1. For the sake of **readability** some technical and other details have been left out. After the WITFOR conference the **complete report** is available to **interested parties.**
2. Also for readability the information in the Summary is only partly repeated in the following text.
3. Although the system is practically implementable there is much **scope for further research**. This is mentioned in the report, but further research should be separately planned and budgeted for.

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SUMMARY

The **Cattle Farm Management System (hereafter CFMS**), is a sophisticated planning system for **practical on-farm** use, to assist cattle farmers with **animal production**, **marketing and pasture management** to solve the following problems:

- What is the **right age** to market animals
- What is the **best weight** for marketing
- **When** must animals be marketed and **how many** at a time
- How and what must animals be **fed** for optimal **growth and fattening**

in order to get **maximum profit**.

Heart of the System

The above questions, which every cattle farmer is aware of, will be **answered** by developing a computer system based on:

- All **farming factors of interest**: rainfall, available grazing, nutritional values, feed to meat conversion, animal growth curves, feed and meat prices **(forecast**), and many more.
- A basic CFMS, resulting from a pilot project, which is based on a **mathematical model** of beef cattle production.
- **Agricultural research.**

Face of the System

The CFMS has been designed for cattle farmers of different backgrounds, but especially focuses on **those farmers** who never had the **opportunity** of **professional education**.

Therefore the CFMS uses **innovative computer game** features to make it suitable and **understandable** for **less-educated users**:

- On- screen information will be mostly **graphical** and **symbolic,** like a **motor vehicle dashboard**, and also **animated**: 'Marketing' is presented by a number of trucks, each one representing a number of cattle, who are visibly walking and loaded on the trucks. An **rain meter icon** will show rainfall, etcetera.

- Verbal information will eventually be done by **two-way audio I/O**. The system **talks to the farmer** and **the farmer talks back** to the system. A **speech system** will be developed both in English and for each area in an African language, such as Tswana, Sepedi, Xhosa, Zulu

In general the system may be considered as a **farming management game** with **realistic data**, resulting in significant **profit increase**: a game which the farmer likes to play.

Extensive **literature and Internet search** has not revealed any comparable system and it is fair to claim that the envisaged system is **unique** and a **first in the world**.

User Target Groups

The main user target groups are:

- **Traditional livestock farmers**
- **Emerging black cattle farmers**
- **Agricultural Colleges**

In Southern Africa (the SADEC countries) the development and modernisation of livestock farming currently gets much attention, especially with respect to **commercial viability.**

The envisaged CFMS with its emphasis on enhancing the **financial and managerial skills of emerging farmers** may be a great **benefit** in this respect.

In a follow-up stage the system may be adapted to **goat and sheep farming**.

Operation of the System

The CFMS will be primarily used to attend to the first two of the above user groups. For this purpose an **Operating Unit** will be founded which will employ and train a team of **Field Operators.** Equipped with a **computer** and a motor vehicle each one will then regularly visit those users and assist them with **farm management and planning**. This is an ongoing activity.

System Development

The development will start with a **demonstrable system** as its basis. This system is the result of a formerly completed pilot project, which contains many of the features, but in a simplified form and was meant for demonstration purposes only.

The system can be used as a **stand-alone system** which, after a **minimum of training**, can be used by any computer-literate farmer or agricultural student and also for research institutes and, for example, government institutes in order to assess a farm's potential

Project Development Team

The CFMS will be developed by a **multi-disciplinary** team of specialists from the fields of **agriculture** (research and practical), **information technology** (programming, data base, internet), **mathematics** (linear programming, risk and sensitivity analysis), **education** (perception techniques, language, training) and **graphic arts** (symbols, icons, graphics, display)

Preliminary discussions on this project have been held already with scientists from the University of Botswana (College of Agriculture), the University of Pretoria and the Botswana Agricultural Research Council.

Project Costing and Dates

The **development of the CFMS**, which will result in a **practical** and **usable** system, will take **sixteen months** to complete.

The development costs are estimated at **E575,000** (five hundred seventy thousand Euro) in order to successfully produce a **complete, reliable and operational** system.

See Attachment 1 for specified **time, cost and manpower** estimates.

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WHY A CATTLE FARM MANAGEMENT SYSTEM (CFMS)

Since time immemorial cattle farms all over the world are managed on the basis of **intuition, experience and common sense**. Currently **no rational planning system** for on-farm use exists to calculate an optimal herd composition and a **feed** and **marketing strategy for maximal profit**. Consequently **inefficient farming methods** are still everywhere applied.

Some of the reasons why a CFMS for on farm-use has **never been realised** are the following:

- Notwithstanding the **abundance of agricultural research** results world-wide available only very little reaches the farm directly.

- Only a few agricultural scientists are aware of the **potential of mathematical optimising techniques.**

- Many farmers have a resistance towards paperwork and intensive calculations**.**

- Contrary to general belief **rational planning** of a beef cattle farm is **unbelievably complicated** (see attachments 2, Schematic Model of a Beef Cattle Farm, and 3, Comparison of **Cattle Farming and Manufacturing**).

From these attachments is clear that **no-one**, how gifted arithmetically and how financially proficient, can calculate an **optimal marketing and managing strategy** for maximal profit **without information technology and mathematics.**

The modernisation of cattle farming worldwide requires **high management skills** and increased **financial awareness**: beef prices, for example, do not depend on local rainfall anymore, but are dictated by international price fluctuations. But **animal production** still depends mainly on **rainfall and temperature patterns!**

Consequently there is a hard **economic need** to consider farming as a **business enterprise** only. This applies to all types of farmers.

Because of the currently available **information technology** the time and circumstances are now right to **implement more efficient farming techniques** aiming at an economically healthy and viable farming community which can withstand temporary setbacks.

A system, which assists farmers to use the available grazing efficiently by:
- marketing animals at the **right time,** the **right age** and the **right weight**,
- preventing under- and **overgrazin**g and
- preventing **soil erosion** under **drought** and other climatic conditions,

such a system may be a great **agricultural benefit** to developing countries.

SYSTEM OBJECTIVES

MAIN OBJECTIVES.

The main objective is to develop a CFMS for **practical and on-going use** by cattle farmers farming in many different circumstances. The reason why one such system can cater for all these groups (although with different input for each farm) is the **common nature of all cattle farming** and the common problems occurring

USER TARGET GROUPS

- **Traditional livestock farmers and communities**.
  The Field Operators will assist and advise these farmers with planning and in general **educate** them to farm more professionally and become **business-minded** and **financially aware**.

- **Individual (emerging) black cattle farmers**.
  This growing group of farmers will generally be assisted by **Field Operators** operating the system and regularly visiting the farms. When **proficient** with the system most of them will be able to operate it themselves.

- **Agricultural colleges and other learning institutions**.
  As a subject in the **curriculum** the system will be an important educational tool by teaching the cattle-farming students rational planning techniques, especially the **financial aspects.**

- **Government departments, research institutes and financial institutions.**
  Especially those who must **decide** on cattle farm **viability** within the framework of land development may use CFMS in order to make **decisions on investments, loans**, etc. The use of a CFMS producing convincing results may be imperative for these **policy-makers**.

OTHER OBJECTIVES **(Partly Optional, depending on Research Outcomes)**

Apart from the objectives described above, several modules or **subsystems** may be added to the system to **greatly enhance its efficiency**. These objectives comprise the following:

- **Internet linking**.
  The Internet will be used to extract relevant data such as feed and meat prices (**forecast**), etc.

- **Livestock diseases and vaccination.**
  Through the Internet the system will produce information on tick-born and other diseases and also on **vaccination and dip programmes.** Government animal health programmes can be easily **communicated** to the farmers in this way.

- **Performance selection.**
  The system will not only calculate the **number** of animals from each group to market, but also recommend **which** animals to select for culling and marketing and advise on the selection of bulls. This aspect needs **research** in order to function **optimally**

- **Pasture management.**
  CFMS will calculate and recommend an **optimal stocking rate,** thus preventing **overgrazing.** For **optimal** pasture management **further research** is desired**.**

- **Accounting.**
  The system uses many financial factors (interest rate, inflation) and **calculates** current and projected cash flow, income, costs and profit. Concerned parties, such as Government Departments and loan supplying institutions may **fruitfully** use a farm's **planning results**.
  Note that the CFMS is a **planning system** which looks forward, and is essentially **not an accounting system,** which looks backward.

GENERAL SYSTEM DESCRIPTION

Note: See the **Summary** for a basic description.

The proposed CFMS rests on two, equally important, legs:

The heart of the system:

An integrated **mathematical model** of a beef cattle farm. With this model linear programming, sensitivity analysis, risk analysis and other methods will be applied on a **knowledge-base** comprising **all relevant farming data**, from rainfall patterns, grazing capacity, feed conversion, animal mass and growth data, to seasonal meat prices.

The face of the system:

The system will be user-friendly in a modern sense and will cater especially for **less-educated** cattle farmers: **See Summary**

KEY ACTIVITIES

1. Cattle farm modelling

The system will have a **high mathematical** content. The existing mathematical model will be used as the basis.

The following distinctive segments must be considered and integrated at some stage. Several of these segments contain time-consuming **research aspects** and part of their outcome may be implemented at a later stage, while the system is operating

- **Herd structure**.
  The relations between the different animal groups is a **linear model**. The number of age groups determines the total number of variables and equations
- **Animal features.**
  Mass and growth curves, feed intake, feed conversion ratio, meat prices.
- **Rainfall - soil and grass types - grazing capacity**
  Rainfall and temperature are the predominant factors determining the quantity and quality of available grazing. Their predictability must be determined as well as the effect and time-lag on the seasonal grazing capacity.
- **Fodder planning** (This has been called crystal-ball gazing).
  When grazing shortages may occur the system must decide whether to temporary reduce the herd or to buy feed and how this feed must be optimally distributed among the different animal/age groups.
- **Financial aspects:** Interest rates, cash flow.
- **Sensitivity and risk analysis**
  These are activities of a mathematical nature to ensure reliability.

2. Farm & Animal Data Base

From the abundance of agricultural data available only significant data will be selected: from rainfall, soil and grass types, nutritional values, **animal mass** and **growth** to **graded-meat prices** for different breeds and all age groups. A **regularly updated database** will be established.

3. Symbolic and graphical information handling

- **On-screen information** will be mostly **graphical and symbolic**, like a motorcar dashboard. A 'cow'-symbol may represent ten cattle units.
- **Printer output** will also be mostly symbolic and graphical .

4. Audio information handling

All help files and other information will be audio-recorded and presented: The system **talks** to the farmer in **farmer-oriented vocabulary** (to start with Tswana/Sepedi). Optionally the system will be two-way audio: the system asks questions and the farmer **talks back** by **answering these questions**.

5. On-farm experimenting, verifying and testing

This is a major and time-consuming activity and is done for:

- Usability - User-friendliness is imperative as stressed elsewhere.
- Practicality - Data and variables must be relevant and of **practical use**. The farmer's experience will be exploited. .
- Confidence - The farmer must eventually **believe** in the results, which can only be realised if the system gives reliable results.

Initially the **farm circumstances** (seasonal rainfall, soil, carrying capacity and animal figures) may be drawn (estimated) on site by **inspection** and oral information.

The current herd structure should give useful data to start with. This information will gradually be refined to sufficiently **accurate farm data.**

Note: This on-farm testing process is also important for designing a **training program** for the **Field Operators**. When the system is **operational** such a training program will then be in place.

6. Determine system specifications

This activity is mainly concerned with the specifications for the participants and the system programmers and consists of the three segments: system **user-specifications**, system **functional specifications** and system **technical specifications**.

7. System programming

THE DEVELOPMENT TEAM **See also Summary and Attachment 1.**

It is proposed that the project commences with a Working Group with the following tasks:

1. Find the expertise (who will do what)
2. Make agreements with participants and contractors in terms of costs and time.
3. Appoint a Project Manager.

Representatives of the main participants will form a Project Steering Committee who will meet regularly to assure a **smooth flow of operations** and to see to it that the **allocated funds** are spent **adequately**.

It is proposed that 10 to 15% of allocated funds are **startup-funding** for the Working Group to fulfill it tasks and also for writing the system specifications in order estimate time and costs accurately (see Attachment 1).

OUTCOME AND BENEFIT

ANTICIPATED OUTCOME

The final outcome will be the CFMS system as described in this report.

There is **no uncertainty** that such a system will be realised. Note that a demonstrable system, although a basic one, has been **realised already**.

Several aspects must be determined precisely, such as **parameter sensitivity** and to what extent **risk** must be implemented in order to assure **reliability**. These are part of the **research components** of the project.

As stated before, a rational planning system for on-farm use, which calculates a marketing strategy for maximal profit **nowhere exists** (Ask anyone: 'Where can I buy such a system?'). Another novelty is the use of **computer game features** and to apply this to a rational farming planning system with **sophisticated scientific content**. Audio-and symbolic presentations are two of those features.

BENEFIT TO DEVELOPING COUNTRIES

A successfully implemented CFMS will affect both **human** and **farming** factors in the developing countries favourably:

As for the **human factors**, the CFMS may be a great **benefit,** especially with regard to:

- Enhancing **management skills** by getting experience with the CFMS, which calculates the right time and the **animal's right age** and **weight** for marketing.
- Creating wealth by calculating a management strategy for **maximal profit**.
- Education by using the system as a tool for agricultural **training and education**, consequently being a macro-economic benefit in the long term.

As for the **farming factors** the CFMS will affect cattle farming in various degrees, such as:

- Prevent soil erosion by calculating an **optimal stocking rate** in order to prevent overgrazing and waste of grazing land.
- Healthier livestock by advising on **dipping** and **vaccination**, hence minimising **dead** through tick and other **diseases.**

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