STANDARDISED METHODS FOR IMPROVING FARM DECISIONS- A DECISION SUPPORT SYSTEM FOR POULTRY PRODUCERS

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Abstract

The need for better farm decisions is not a new problem. However, in recent years this problem has become even more important, particularly for capital intensive farming.

In this paper we present very briefly the standardised methods used for improving farm decisions and we insist on a Decision Support System for poultry producers.

More specifically, firstly we present the Operational Research methods used mainly at farm level in order to assist the farmers and the decision makers in improving their decisions. Secondly and more widely we present a Decision Support System for poultry producers which is currently implemented in co-operation with the Department of Agricultural Economics of Thessaloniki University in Greece and the Hungarian Management Consulting Company EUROPARITAS.

1. Standardised methods for farm improving

One of the main characteristics of the last two decades is the wide application of Operational Research methods in farm management and farm decision making. Almost all Operational Research methods have been applied with much success to several fields of agricultural economics to assist the farmers and farm decision makers in improving their decisions. Among these, an outstanding position possess the methods of Mathematical Programming, like Linear, Parametric Linear, Integer, Mixed Integer, Goal Programming and Quadratic Programming and quite recently Multiobjective Programming and Data Envelopment Analysis. On the other hand we have seen many applications, especially at farm level, of other Operational Research methods such as Replacement Theory, Stock Control Theory, Game Theory, Simulation, etc..

All these methods have given successful solutions to problems related to farm management and farm decision making. More specifically, we have seen Linear

Programming models applied to farm planninge, to the reorganisation of available farm resources and to minimum cost ration. Parametric Programming has assisted us in investigating the influence of optimum solutions to the variation on the prices, yields and gross margins or on quantities of available resources. Integer and Mixed Integer have solved problems referred to farm planning with activities restrained to take only integer or both integer and continuous values as in the case of livestock activities, machinery, buildings etc.. Quadratic programming has given solutions to problems related to farm planning taking into account the variance of total gross margins. Goal Programming has come to complete the above mentioned Mathematical Programming Models and has been applied to cases where predetermined objectives exist either in the level of achieved outcome or in the quantities of available resources. Multiobjective Programming is a very good expansion of Goal Programming models and has given sufficient solutions to farm decision making when more than one objectives are to be satisfied simultaneously as in the case of the simultaneous minimisation of variable costs, the maximisation of gross margin, the minimisation of feeding cost, etc.. Lastly, very recently, Data Envelopment Analysis has appeared as a very good scientific tool for comparing and maximising the relative efficiency of farm enterprises which use the same resources and produce the same outputs but in different levels.

At the same time, Game Theory has given us models for farm planning and farm decision making in the cases where situations of conflict exist. Replacement theory has been applied to situations where the objective was to find the optimum selling time (the case of livestock enterprises) or the optimum replacement time (the cases of orchards, machinery, etc.). Stock Control Theory has been applied successfully to the planning and control of stock (feedstuffs, livestock, etc.).

Simulation models have also been applied, mainly during the last decade, to help managers and producers simulate their farms, do sensitivity analysis on various technical and economic parameters of the farms and make relative decisions.

The question which is raised is whether the producers can set up or at least apply by themselves these complicated models in their farms. It is well known that farmers reject what they cannot understand. If we exclude the big farms and agribusiness which possibly employ specialists or some small livestock farms which usually use commercial computer packages for minimum cost ration, then it is obvious that the majority of the farms cannot apply the above mentioned models and thus the gain for the individual farms is minor.

During the last few years the use of Operational Research models at the farm level has expanded thanks to the role that Decision Support Systems (DSS) have started to play. In fact, together with the great development of personal computers (high speed and big memory capacity) all the above models may reach the farmer's door.

Decision Support Systems have been proved very good farm decision making tools. They can include all the suitable and necessary Operational Research models and they run automatically in the personal computers assisting farmers in making themselves better decisions for their farms. They do not just constitute Management Information Systems but they are combined with them and proceed beyond them.

A DSS for poultry producers will be presented in the following sections. It is a DSS which is presently implemented with the co-operation of Department of Agricultural Economics of Thessaloniki University in Greece and EUROPARITAS.

2. A Decision support system for poultry producers

2.1. Introduction

The poultry enterprises both in Greece and Hungary are entirely different from the traditional family enterprises and today they have been developed to modern industrial units. In the past, the poultry enterprises were trying to overcome mainly technological problems. Nowadays, with the strong competition from the relative enterprises of the northern EC countries, they try to get reorganised on a more rational basis through better management and decision making.

A poultry enterprise has many different sectors and activities (hatchery, broiler production, processing, etc.) and presents many changes mainly to its animal population. This makes its management and decision making quite difficult. It is obvious then, that a better management and decision making in a poultry enterprise imposes the use of computerised management and decision support systems. Computer systems are already used in some poultry enterprises and processing units both in Greece and Hungary, but they should be expanded in order to support the phases of decision making and control. Especially in Hungary, the computer systems in use should be reorganised in the near future, firstly because the free market price system has been introduced and secondly because poultry business will be very important in the future, because of the export potential to the West and East countries.

The object of the common project between the Department of Agricultural Economics of Thessaloniki University and EUROPARITAS is the development of computerised Decision Support Systems (DSSs) for the integrated planning and control of poultry enterprises, of both meat and egg production, in Greece and Hungary.

The DSSs will assist the poultry producers in achieving optimal planning and control of the various production sectors of a poultry enterprise as well as of its auxiliary activities, and consequently optimal planning and control of the whole enterprise. The obvious results will be the increase of productivity of the available resources, the decrease of production costs and the increase of competitiveness of products (meat and egg) in the integrated EC market.

For the project implementation 2 teams, 1 Greek (Department of Agricultural Economics, Thessaloniki University) and 1 Hungarian (EUROPARITAS) are co-operating.

The two teams during the phase of exchanging scientists visited poultry enterprises and relative organisations, examined and investigated the production, processing and marketing conditions of poultry farms both in Greece and Hungary. They also co-operated on the methodology for carrying out the DSSs, the time-schedule and the work plan for each research team.

The total project was divided into two parts. A DSS for poultry meat producers and a DSS for egg producers. Presently, the DSS for poultry meat producers is implemented and tested on a sample of broiler enterprises.

2.2. Activities of a poultry meat enterprise

The activities of a poultry meat enterprise can be divided into the following sectors (chart 1):

1. Hatchery
2. Broiler production
3. Processing
4. Marketing
5. Auxiliary activities

The sector of hatchery refers to egg hatching and the production of chicks for broiler production. These activities are very specialised and they need special constructions and machinery (hen cages, incubators, fully controlled conditions, etc.) and specialised personnel. This is the reason that very few enterprises keep such departments. Most poultry meat producers buy the small chicks from other enterprises which are specialised in the chicks production.

The most important sector in poultry business is broiler production. This is made in the so called broiler-houses and begins with the placing of small chicks to them and ends with the catching of broilers for slaughtering or immediate selling in live weight. Taking into account that broilers need about 8 weeks (52-60 days) to be grown and that there is a one to two weeks idle time for cleaning and preparing a broiler-house and placing the new chicks in it, then 5-6 lots of broilers can be bred in each broiler house per year. The industrialised poultry meat enterprises reserve many broiler-houses with different ages of broilers. In this way they can control their production and can supply the market with broilers almost every week. The common practice for a poultry enterprise is to breed simultaneously at least 10 lots of broilers of different ages in different broiler-houses.

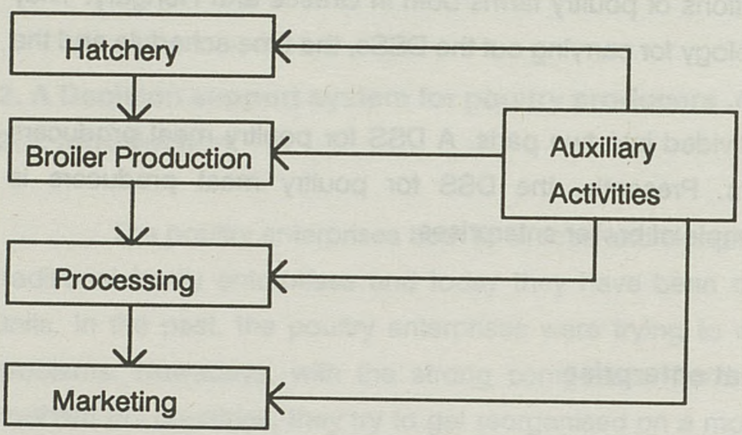

Chart 1 : The five sectors of a poultry meat enterprise

Processing includes slaughtering of broilers, cutting in pieces, packaging and freezing. This sector is not available in all poultry meat enterprises. Only some of medium size and the big enterprises have available slaughtering houses, packaging and freezing units. Some also big enterprises proceed to further processing and produce sausages, salami, etc.. The small enterprises or the enterprises which belong to poultry producers co-operatives, sell their broilers in live weight or send them to the slaughtering houses.

The sector of marketing includes all the activities which are related to the selling of broilers, live or processed. Some of the big enterprises, as well as some poultry producers co-operatives keep a distribution network for selling their products to the sellers or/and reserve own selling points.

Lastly, the auxiliary activities constitute a very important sector in the operation of a poultry meat enterprise. Among them are the feed stores, the silos, the milling and feed preparation units, the machinery unit, the transport unit, the repairing unit, the administration, etc..

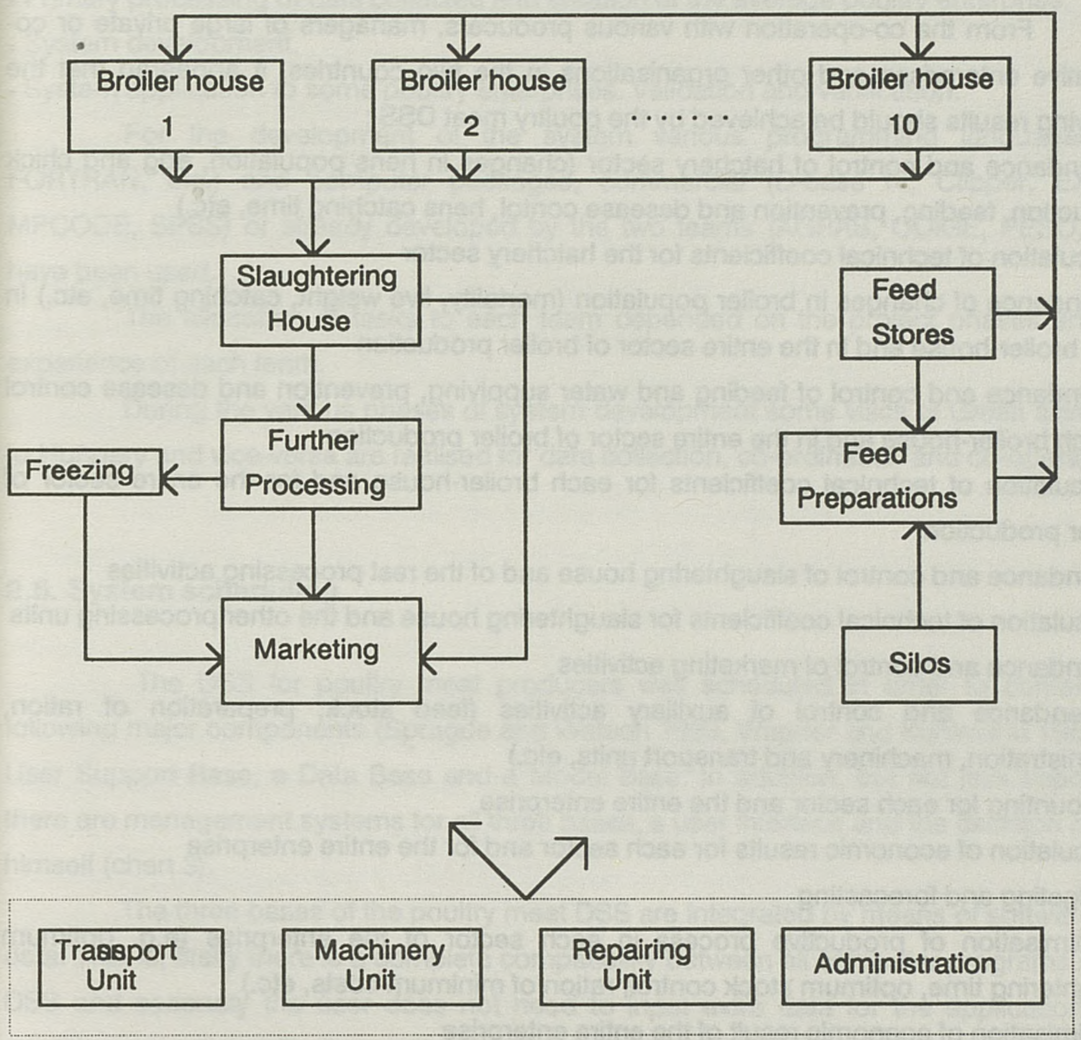

Chart 2 : Broiler production, processing, marketing and the auxiliary activities of a poultry meat enterprise

It is quite difficult to meet all the above sectors together in a poultry meat enterprise. The common practice in the small and medium size poultry enterprises is to find only the two sectors of broiler production and auxiliary activities. Some medium size enterprises keep also the sector of processing (slaughtering houses). In the big enterprises we can also meet the sector of marketing and very seldom the hatchery sector.

2.3. Desired results

From the co-operation with various producers, managers of large private or co-operative enterprises and other organisations in the two countries, it appeared that the following results should be achieved by the poultry meat DSS :

- Attendance and control of hatchery sector (changes in hens population, egg and chick production, feeding, prevention and desease contol, hens catching time, etc.)
- Calculation of technical coefficients for the hatchery sector
- Attendance of changes in broiler population (mortality, live weight, catching time, etc.) in each broiler-house and in the entire sector of broiler production
- Attendance and control of feeding and water supplying, prevention and desease control in each broiler-house and in the entire sector of broiler production
- Calculation of technical coefficients for each broiler-house and for the entire sector of broiler production
- Attendance and control of slaughtering house and of the rest processing activities
- Calculation of technical coefficients for slaughtering house and the other processing units
- Attendance and control of marketing activities
- Attendance and control of auxiliary activities (feed stock, preparation of ration, administration, machinery and transport units, etc.)
- Accounting for each sector and the entire enterprise
- Calculation of economic results for each sector and for the entire enterprise
- Budgeting and forecasting
- Optimisation of productive process in each sector of the enterprise (e.g. optimum slaughtering time, optimum stock control, ration of minimum costs, etc.)
- Optimisation of economic result of the entire enterprise
- Simulation of the entire enterprise and sensitivity analysis of the various parameters (technical and economic) on the economic result, etc.

2.4. Methodology

Based on the division of a poultry meat enterprise into the five before mentioned sectors and on the above desired results, the two teams decided on the following methodology for the development of the DSS for poultry meat enterprises :

- System scheduling, analysis of needs in hardware and software, plan of work

• Collection of technical and economic data from a sample of about 20 poultry enterprises and various relative organisations in Greece and Hungary.

• Primary processing of data collected and creation of the average poultry enterprise.

• System development.

• System application to some poultry enterprises. Validation and verification.

For the development of the system various programming languages (C, FORTRAN, etc.) and computer packages, commercial (D-base IV, Clipper, EXCEL, MPCODE, SPSS) or already developed by the two teams (AGRAS, ODIGE, PESO, etc.) have been used.

The allocation of tasks to each team depended on the project phases and the experience of each team.

During the various phases of system development some visits of Greek scientists to Hungary and vice-versa are realised for data collection, co-ordination and co-operation.

2.5. System scheduling

The DSS for poultry meat producers was scheduled in order to contain the following major components (Sprague and Watson 1983, Wagner and Kuhlmann 1989) : a User Support Base, a Data Base and a Model Base. In addition, but not less important, there are management systems for all three bases, a user interface and the decision maker himself (chart 3).

The three bases of the poultry meat DSS are integrated by means of software and data. That is, firstly there is a complete compatibility between all computer programs of the DSS and secondly the user does not need to input extra data for the application of a model, except the daily data and some specifications from the keyboard. In other words, all inputs in one program are stored in the Data Base and can be used by any other program requiring the same inputs. Except that, outputs from one program are also stored in the Data Base and can be used as inputs to other programs. This automatic linkage of all programs makes the DSS user friendly and widely accepted.

The Data Base is divided into five data sub-bases, one for each sector of a poultry enterprise. The Model Base includes all necessary and suitable models for achieving the desired results, as these were described in the previous section.

Since the DSS for poultry meat enterprises should be as general as possible in order to be applied to all poultry enterprises, small, medium and large size, it was scheduled and is programmed in different modules one for each sector. The modules of the three sectors Processing, Marketing and Auxiliary Activities are further divided in sub-modules. Each sub-module is used for a separate activity of the sector. For example the module of the sector of auxiliary activities includes sub-modules for the feed store, the silos, the feed preparation unit, the machinery unit, the administration, etc.. The modules and sub-modules work independently, but they obey the rule of total software integration. In this way, if a poultry enterprise does not keep one or more of the five sectors or does not keep some activities of one sector, the DSS for this special enterprise works with a reduced number of modules or sub-modules.

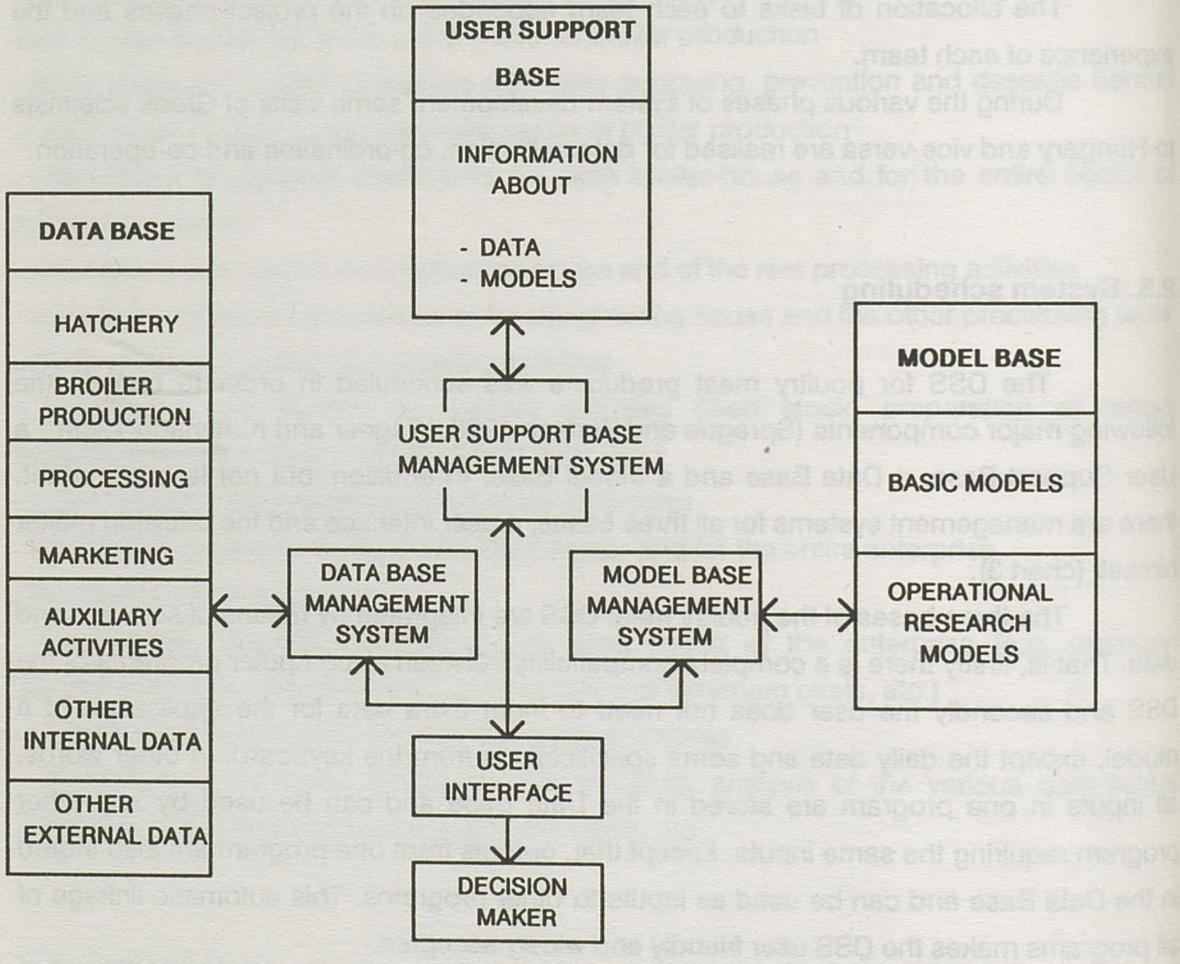

Chart 3 : The general concept of the poultry meat DSS

2.6. Database and database management system

The Data Base of the poultry meat DSS is used to store the data collected for various purposes such as financial data, production data, processing data, and so forth. The data stored can be gathered from the poultry enterprise itself or from external sources and they are of two kinds, the technical and economic ones. Among the most important technical data are those which refer to the daily changes in the broiler production sector (e.g. chick and broiler population, feeding of them, medicine, etc.). Some of the most important economic data stored are the prices of inputs (feed, medicine, etc.) and of the different kinds of produced products.

Because of the integrated approach followed, all data are stored using the same Data Base System. For example, the production data are not stored using a different system than the processing or marketing data.

More specifically, the Data Base of the poultry meat DSS is divided into 5 data sub-bases, one for each of the 5 sectors of a poultry enterprise. In these sub-bases the technical and economic data are stored.

Each data sub-base is further divided into two parts. The first part is used to store primary data of the enterprise. The second part is used for processed data by the system; that is, intermediate results, achieved by the processing of primary data by the various models of the Model Base. These intermediate results are used later by the models of the Model Base for further processing and final results.

The Data Base of the poultry DSS is operated automatically by the Data Base Management System. Thus, the data retrieval from the data sub-bases, their processing by the various models of the model base, the storing of the intermediate results to the data sub-bases, the retrieval and the further processing of them is done automatically by the Data Base Management System.

2.7. Model base and model base management system

The Model Base includes several kinds of models. These can be divided into two categories. The basic models and the Operational Research models. In the first category belong the various models used by the system for the calculation of technical coefficients and economic results, for budgeting, statistical analysis, graphic presentation, etc.. In the second category belong the Operational Research models, such as Linear Programming, Stock Control, Replacement and Simulation used for finding minimum cost ration, optimum quantities of feed stock, optimum slaughtering time, sensitivity analysis, etc..

Each model is included in the Model Base in the form of a computer program. The most important programs presented below are :

- INVENTOR to control the inventory of the enterprise and calculate the fixed costs
- HENS to store and control the daily technical data of hen-houses of the hatchery sector
- BROILERS to store and control the daily technical data of broiler-houses of the sector of broiler production
- CALC-COE to calculate the technical coefficients of each sector and of the entire enterprise
- CALC-ECO to calculate the economic results of each sector and of the entire enterprise
- STAT to do statistical analysis and graphic presentation of various parameters
- BUDGET for budgeting
- RATION to find the minimum cost ration
- STOCK to find the optimum feed stock for each kind of feed
- REPL to find the optimum slaughtering time for broilers
- SENS to simulate all the sectors and activities of the enterprise and do sensitivity analysis on the various parameters (technical and economic) of the enterprise.

More specifically, the program INVENTOR is used to control the inventory of the entrprise (fields, buildings, feeding, heating, water and cleaning equipment, other equipment and machinery, loans, etc.) and calculates the fixed costs. Thus, INVENTOR inputs the inventory data per sector and activity of the enterprise in the Data Base System, calculates the value and the depreciation of fixed assets, calculates the interest and the loans of the enterprise, etc..

The program HENS is used to store and control the daily changes in the hen-houses such as the changes in hens population, egg and chick production, feed and vitamins provided, prevention and desease control made, etc.. The input of the data takes place in the form of a long card which contains several fields as date, mortality, egg production, chick production, feed, medicine, etc.. There is one card for each hen-house.

The program BROILERS is used to store and control the daily changes in the broiler-houses such as the changes in broilers population (mortality, live weight), feed and vitamins provided, prevention and desease control made, etc.. The input of the data takes place again in the form of a long card which contains as fields the date, the mortality, the feed, the medicine, etc.. The card also contains some more information useful for the producer such as the name of the chicks provider, the race of chicks, the catching date, the live weight, etc.. There is again one card for each broiler-house (appendix 4).

The program CALC-COE is used to calculate the technical coefficients of every sector and of the entire enterprise. For this reason CALC-COE includes several sub-routines which can be selected from the menus of the Model Base Management System. Thus, CALC-COE calculates the technical coefficients of the broiler production sector, for example the mortality rate in each broiler- house per lot and year, the feed conversion rate per lot, broiler-house and year, the quantity of feed provided per lot, broiler-house, broiler, live weight, etc.. CALC-COE also calculates the technical coefficients of the other sectors of the poultry meat enterprise as for example the total number of broilers slaughtered and the corresponding meat produced per day, month and year, the quantities of each kind of feed used for the ration preparation, the labour used in the processing sector, the quantities of fuel and oil spent per month, year, truck, etc. (appendix 6).

The program CALC-ECO is used to calculate the economic results (expenses, gross margin and gross return, profits, return to labour, return to capital, etc.) of each sector and of the entire enterprise. CALC-ECO, in a similar way with the program CALC-COE, includes several sub-routines which can be selected from the menus of the Model Base Management System. Thus, CALC-ECO calculates the economic results of the broiler production sector as for example the variable expenses (chicks, cleaning, feed, heating, electricity, fuel, medicine, etc.), the gross return and the gross margin per lot, broiler-house, broiler, live weight, etc.. CALC-ECO also calculates the economic results of the other sectors of the poultry meat enterprise as for example the variable expenses and the total value of broilers slaughtered per day, month and year, the value of feed stock for each kind of feed in the feed store and silos, the labour expenses in the processing sector, the value of fuel and oil spent per month, year, truck, etc.. (appendix 5).

The program STAT is used to do statistical analysis and graphic presentation of various parameters. For example STAT can make comparisons and graphic presentation of the means or percentages of the various technical and economic parameters per lot, broiler-house, month, etc. (appendix 7).

The program BUDGET is used to make the budget of the entire enterprise and the projections of the financial position of the enterprise for the present and subsequent years.

The program RATION is used to find the minimum cost ration. It is a program based on a Linear Programming model the form of which is given in appendix 1. RATION finds the combination of feedstuffs which presents the minimum cost. The necessary data are stored in the sub-base of the sector of auxiliary activities and include about 200 feedstuffs (maize, wheat, soya beans, meat meal, etc.) and their contents in energy, fat, etc.. The corresponding problem is set up very easily by the decision maker who defines the kind and the number of both constraints and feedstuffs. RATION can set up and solve very quickly problems with up to 100 feedstuffs and 60 constraints.

The program STOCK is used to find the optimum feed stock for each kind of feed. It is a program based on a Stock Control model with deterministic and constant demand and orders satisfied on time (appendix 2).

The program REPL, based on a Replacement Theory model, is used to find the optimum number of lots of broilers must be bred in a broiler-house in one year and consequently the optimum slaughtering time of broilers for each lot. The model takes into account the live weight of broilers, the variable expenses (feed, heating and electricity, medicine, etc.), the prices of the poultry meat in the market, etc. (appendix 3).

The program SENS will be used to simulate all the sectors and activities of the enterprise and do sensitivity analysis on the various parameters (technical and economic) of the enterprise. Both the data and the intermediate results of the five sub-bases will compose the data of a simulation model, which is being developed and will be included into the Model Base. In this way the interactions between the various sectors and their influences to the entire enterprise will be seen, as well as the influence of different parameters of interest (as prices, technical coefficients) on the economic results.

All models and their corresponding programs can be used easily by the Model Base Management System. This is a very friendly system giving on line information about the purpose and the way of use of each model contained in the Model Base. The decision maker can receive more information concerning the usage of models, the data needed and the results achieved by the User Support Base and the User Support Base Management System.

2.8. User support base and user support base management system

Alongside the Model Base, the User Support Base is the most important part of the DSS when it comes to user acceptance.

The User Support Base contains all necessary information about the data, the models contained in the Model Base and their applications and the possible results of the DSS. It also contains information about the usage of data and models. All this information is kept in the User Support Base in a very simple and friendly way.

The user (producer or decision maker) gets every information through the User Support Base Management System in the form of a hypertext. So, he can get very quickly information about the content of the Data Base, the models in the Model Base, the way they can be used, etc. The User Support Base Management System is very simple and friendly. Everything is given and explained in the form of multiple screens and the user can get every information in an easy to understand way.

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Appendix 1

Description of the Linear Programming model for finding the minimum cost ration

The Linear Programming model used to find the minimum cost ration of the poultry meat enterprise has the following form :

$$\min Z = c_1x_1 + c_2x_2 + c_3x_3 + \dots\dots\dots + c_nx_n$$

subject to :

$$a_{11}x_1 + a_{12}x_2 + \dots\dots + a_{1n}x_n <=> b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots\dots + a_{2n}x_n <=> b_2$$

$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots$$

$$a_{m1}x_1 + a_{m2}x_2 + \dots\dots + a_{mn}x_n <=> b_m$$

$$x_1, x_2, x_3, \dots, x_n >= 0$$

where x_j, j=1,2,....,n represents the feedstuff j in kgrs (wheat, maize, meat meal, etc.)

c_j, j=1,2,....,n represents the cost of a kgr of the feedstuff j

b_i, i=1,2,....,m represents the minimum or the maximum quantity of ingredient i (energy, fat, etc.) required by the ration

a_{ij}, j=1,2,....,n, i=1,2,....,m represents the content of feed j in ingredient i

Z represents the minimum cost of one ton of the ration.

Appendix 2

Description of the stock control model for finding the optimum feed stock for each kind of stock

The stock control model is used to find the Economic Order Quantity for each kind of feed, the optimum time between two orders and the minimum cost of holding feed stock (stockholding cost plus ordering cost) for each kind of feed. The model is given by the following expressions :

$EOQ = \sqrt{2CD/BQ}$

$A = CD/Q + BQ/2$

$Amin = \sqrt{2CDB}$

$Topt = \sqrt{2C/BD}$

where D is the required or consumed quantity of feed in kgrs per unit of time (month or year)
Q is the quantity of feed in stock
EOQ is the Economic Order Quantity
C is the cost of placing an order which is independent of order size
B is the stockholding cost of a kgr of feed per unit of time
V is the value of a kgr of feed
I is the marginal cost (percentage) of invested capital in feed stock
CD/Q is the ordering cost of quantity Q per unit of time
Q/2 is the average level of stock
BQ/2 is the stockholding cost of quantity Q per unit of time
A is the total cost of holding the quantity Q of feed in stock
Amin is the minimum total cost
T=Q/D is the time between two orders
Topt is the optimum time between two orders

Appendix 3

Description of replacement model for finding the optimum broilers slaughtering time

The replacement model is used to find the optimum number of lots of broilers per broiler-house and year, as well as the optimum slaughtering time of broilers for each lot. It is based on the Harad model modified suitably for the poultry meat DSS and is given by the following expressions :

$$P_i = (p_i - p_o - d_i f_i) b_i / s_i - c_o \qquad (1)$$

$$c_i = c_o + (p_o + d_i f_i)(n_i - m_i n_i)$$

$$n_i = b_i z_i$$

$$p_i = k_i w_i$$

$$z_i = 1/s_i$$

$$b_i = 365/(i+10) \qquad (2)$$

where w_i is the live weight in kgrs of a broiler of i days age

f_i is the total quantity of feed consumed by a broiler up to the age of i days

b_i is the number of lots of broilers of i days age which can be realised in one year

s_i is the required number of squared meters of space for a broiler of i days age

z_i is tne number of broilers of i days age per squared meter of space

n_i is the number of broilers of i days age per squared meter per year

p_i is the value of a broiler of i days age

k_i is the price of a kgr of live weight of broilers of i days age

c_o are the fixed costs per squared meter per year

p_o is the value of a chick

d_i is the cost of a kgr of feed for broilers of i days age

m_i is the mortality rate of broilers of i days age

c_i is the total breeding cost of broilers of i days age per squared meter per year

P_i is the total breeding profit of broilers of i days age per squared meter per year

The maximisation of (1) results to the optimum slaughtering time of broilers. The optimum number of lots per broiler-house and year is given then by (2).

Appendix 4

A computer card for storing the daily data of a broiler-house

BROILER-HOUSE DATA

HOUSE NO. : 2
LOT NO. : 1

DATE OF PLACEMENT : 22/1/93
RACE : ROSS
NUMBER OF CHICKS : 15100
COST OF EACH CHICK: 58
HOUSE SIZE (SQ.M.): 1500
DATE OF CACHING : / /
CHICK PROVIDER : LALAGIANIS

DAY	DATE	FEED	MORTALITY	MEDICINE	VACCINE	COMMENTS
1	22/01/93	2000	10	40000	0	Disinfection 4 Kgrs
2	23/01/93	0	10	65000	150000	Straw 240 Kgrs
3	24/01/93	0	26	0	165000	Lime
4	25/01/93	2000	11	0	0	1 Kgr VITALYT
5	26/01/93	0	12	0	0	False Plague vaccine
6	27/01/93	0	28	0	0	Bronchitis vaccine
7	28/01/93	0	15	0	0	
8	29/01/93	0	10	0	0	
9	30/01/93	0	7	0	0	
10	31/01/93	3000	10	0	0	
11	01/02/93	0	14	0	0	
12	02/02/93	0	9	0	0	
.	/ /	.	.	.	.	
.	/ /	.	.	.	.	
.	/ /	.	.	.	.	
.	/ /	.	.	.	.	
70	01/04/93	0	9	0	0	

Appendix 5

Sample from the tables giving economic results of broiler production

Broiler-House: No. 1

Gross Return and Variable Expenses

Economic Results	Number of Lot 1	2	3	4	5	6	Average
I. Number of Chicks	24078	26060	25968	25893	25500	25069	25428
II. Gross Return (drs/1000 Broilers)							
1. Total Number of Broilers	944.90	939.70	935.50	918.20	934.60	942.30	935.87
2. Total Live Weight (Kgr)	1918.15	1898.19	1955.20	1909.86	1920.60	1908.16	1918.36
3. Selling Price (drs/Kgr l.w.)	190.40	190.40	190.40	190.40	190.40	190.40	190.40
Total Gross Return	365215.19	361416.14	372269.13	363636.58	365682.81	363321.00	365256.81
III. Variable Expenses (drs/1000 Broilers)							
1. Labour	16250	16250	16250	16250	16250	16250	16250
2. Chicks	52961.65	53421.95	53510.60	52934.23	54113.34	54559.17	53583.49
3. Feed	207636	213640	224094	238965	226016	223533	222314
4. Prevention and Desease Control	8290	9460	8370	9040	8790	8875	8804.17
5. Cleaning and Preparing of Houses	2790	2570	2600	2680	2660	2680	2663.33
6. Heating and Electricity	9480	5150	8450	14100	9295	7315	8965
7. Water Supplying	1750	2100	1750	1400	1750	1925	1779.17
8. Hired Machinery Labour	4520	4520	4520	4520	4520	4520	4520
9. Miscellaneous and Interest on Variable Capital	9516	9324	9570	9880	9572	9420	9547
Total Expenses	313193.65	316435.95	329114.60	349769.23	332966.34	329077.17	328426.16
IV. Gross Profits (drs/1000 Broilers)	52021.54	44980.19	43154.53	13867.35	32716.47	34243.83	36830.65

Appendix 6

Sample from the tables giving technical coefficients of broiler production

Broiler-House: No. 1

Technical and Economic Coefficients

Technical and Economic Coefficients	1	2	3	4	5	6	Average
	Number of Lot						
1. Mortality Rate (%)	5.51	6.03	6.45	8.18	6.54	5.77	6.41
2. Number of Breeding Days	58	58	57	59	58	58	58
3. Feed Consumed (Kgrs / Broiler)	4.84	4.90	5.07	5.37	5.05	4.87	5.02
4. Live Weight (Kgrs / Broiler)	2.03	2.02	2.09	2.08	2.06	2.03	2.05
5. Feed Conversion Rate (Kgrs of Feed / Kgr l.w.)	2.38	2.43	2.42	2.58	2.46	2.41	2.45
6. Selling Price (drs / Kgr l.w.)	186.70	186.70	189.20	190.40	191.70	196.70	190.23
7. Feed Cost (drs / Kgr)	42.90	43.60	44.20	44.50	44.80	45.90	44.32
8. Chick Cost (drs / Head)	56.05	56.85	57.20	57.65	57.90	57.90	57.26

Appendix 7

Sample from the charts giving the graphical representation of the mortality rate

Broiler - House: No. 4, Lot : No. 3
Mortality of Broilers Versus the Number of Breeding Days