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FARM MANAGEMENT INFORMATION SYSTEMS PLANNING AND DEVELOPMENT IN THE NETHERLANDS

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Introduction

In the early 1980s, most experts in agriculture were convinced that application of information technology (IT) would provide considerable opportunities for improvement in process control and farm management. Moreover, sharp reductions in hardware prices brought powerful IT-equipment within the means of the individual farmer. Nevertheless, the acceptance of IT-equipment and services was rather poor compared with the predictions (Zachariasse, 1990).

Information Technology Stimulating Plan (INS-Plan)

Several initiatives were taken in the Netherlands, as in other countries. To Dutch agriculture, the most important step in the application of IT came in 1984 when the so-called Information Technology Stimulating Plan (INSP) was launched by the Dutch Government. The objective was to promote advanced and appropriate use of computer science in all sectors of the economy to improve their international competitive position. The Minister of Agriculture took the initiative and responsibility for the execution of the INS-Plan in the agricultural sector. In his Strategic Plan 1984-1988 a major effort for coordination of IT in agriculture was outlined and supported by farmers, organizations, agribusiness and governmental institutions. The main objective of this plan was the active stimulation of the use of process and management hardware and software at the farm level. Applications for management support were to receive particular attention.

As a first step in the execution of the INS-Plan, the organizations of farmers and horticulturists set up five so-called branch organizations (dairy, pigs, poultry, horticulture, arable crops) and a national central organization (COAL) for overall coordination under the direction of the Landbouwschap (Agricultural Board). The main task of these branch organizations was to initiate, to coordinate, and to manage the development of management information systems in order to ensure the availability of uniform and coherent software for each major farm type and to stimulate the demand and use at farm level.

In order to avoid divergent developments in the different branches, a so called branch crossing element was identified. Farm accounting or bookkeeping was chosen as the branch crossing element in the agricultural INS-Plan, and it has been developed in close cooperation between the Union of Cooperative Agricultural Accounting Companies (VLB) and the Agricultural Economics Research Institute (LEI-DLO). By taking the accounting as the binding element, each branch could elaborate its specific field for the more technical aspects.

- 1) Paper presented at the 9th International Farm Management Congress, Budapest, July 1993.

The branch organizations started their, to my opinion very essential and successful, work by defining basis qualifications for management information systems:

1. uniform use of objective definitions, algorithms, coefficients, etc.;
2. independence of computer branch and software suppliers;
3. independence of process computers.

To meet the first point, a generally accepted concept of an information model for a farm business had to be developed as the basis of an overall design of a farm management information system. To meet the last two points, a normalization and standardization of technical aspects had to be performed.

Farm information models

In order to formulate the functional specifications for farm management information systems, the branch organizations together with agricultural research institutions and, later on, participants from industry, trading, and servicing companies started the development of global information models for each branch of agriculture. This was a consequence of the method selected for determining the information requirements per farm and per branch, the Information Engineering Method (IE) of James Martin Associates. This method was chosen and accepted by all parties concerned.

For the 10 main agricultural and horticultural branches information models were made. An information model is a description of the standard agricultural operation in a branch. The model describes the activities and data which are used to make management decisions. Three levels of decision making are covered by the model: the strategic, the tactical and the operational levels. The information model contains a so-called process model and a data model. The process model defines activities related to the three basic functions of planning, operation and control on the farm and the data flows between the processes at the farm level and with organizations outside the farm. The objective is not only to see what processes, relations and data flows there are, but also to determine what is already known and available for implementation and what aspects need further research. The data model gives a logical description of the data that needs to be retained for a shorter or longer period for the management of the farm. A data model concerns, therefore, the permanent, original data. The objective is to define all data and the relationships between data independantly of their use. This quarantees unique definitions of the data, which are described in terms of entity types, attributes, and relationships.

The development of the information models was divided into two stages. In the first stage the activities and data are described in a global way (global information model) and in the second stage in a more detailed way (detailed information model). In the global stage, the farm as a whole is considered, while in the detailed stage groups of strong coherent processes and data (so-called clusters) are defined and worked out seperately, usually with the help of technical specialists. So far no computer programs are made, but emphasis is placed on the agreement about content of calculating rules and definitions of processes and - most important - of data.

Standards for communication

The branch organizations are playing an important role as well in the additional agreements on technical specifications like standardized electronic data exchange protocols and communications techniques for communications of computers inside and outside the farm. For a large part, these activities were put in so-called demonstration projects. In these demoprojects, the main aims are to get coherence and standardization of existing IT-implementations and activities and to develop new initiatives together with the business "environment" of the farm, a.o. videotex systems. In 1990 two new organizations has been established. One for the realization and promotion of Electronic Data Interchange (EDI) in order to improve the communication within a product column and one for the realization of an open Agricultural Communication Network.

Evaluation INS-plan period 1984-1991

At the end of the INS Plan period 1984-1988 a national evaluation committee of non agriculturists reached the following conclusions:

1. The implementation of management and communication systems in the primary sector is still at the beginning of the life cycle.
2. The strong integrated approach on the demand side has created a good starting position for further IT-implementation in the future.

The commission made the following recommendations:

1. The stimulating policy should be continued with more attention given to concrete projects and results.
2. Extra attention should be given to joint research by agricultural and IT-specialists.
3. Projects which cover the complete product column (so-called product chain approach) should be initiated.

These conclusions were widely accepted and the Government provided subsidies for continuation of the INS-Plan for an other three years, so until the end of 1991. When this second stage was finished, an intensive evaluation (Klink, 1991) learned with respect to the state of the art in 1991:

1. A limited number of IT-applications shows an autonomous growth in number of users. Exceptions are pig breeding and some parts of glasshouse horticulture.
2. Intensive guidance for analysis of computer output is needed and is expected to be a critical success factor for expansion of IT-use.
3. Available management information systems meet to a fair extent the farmers needs, but there are still quite a lot of questions left, performance of agricultural research is expected to be critical for further development.

4. The need for a clear settlement on roles of governmental and/or private organizations for further IT-activities in order to prevent divergence and overlapping.

Adjustment in IT-policy and organizational structure after 1991

This evaluation study gave several recommendations and stated that the governmental IT-stimulation should be replaced by an IT-policy. On request of the National Council for Farm Business Development (LR, 1991) a special working group has outlined such a coordinated IT-policy for the 1990s. The framework set out by this working group means:

- integration of IT-policy in general agricultural policy, that is what role can IT-applications play in the fulfilment of general policy goals in the field of environmental issues, etc.;
- main focus of attention at farm level will be continued, but in a much more explicit combination with the other parts of the product column;
- reconsideration of the organizational structure of IT-institutions, like branch organizations, EDI/Network organizations etc.;
- provision of very few governmental funds for the activities in the years ahead.

This has led to the formulation of a coordinated IT-policy, after 1991 with the following core:

1. provision of conditions to promote the IT-implementation and use in combination with the realization of a modern electronic communication in the total product column (product chain approach);
2. development and implementation of knowledge intensive systems to be provided by agricultural research in cooperation with the software companies;
3. creation of a permanent IT-infrastructure on organization (incl. financing) for:
 - standardization, especially for EDI-application
 - innovation of and through software and hardware
 - an open agricultural data communication-network.

With respect to point 3 the Government and representatives of the agricultural sector agreed on the establishment of a new national Agro Telematics Centre (ATC). The new ATC started on January 1th, 1992. The objective is that all 5 branch organizations will merge together with the former - national central organizations for coordination (COAL) and the rather new EDI/Agro Network organization into this new centre. By merging all these activities a better proposition is provided for continuation on longer term and for more branch crossing and product chain aspects. The tasks of this new centre are generally not of a commercial but of an ideal character and are concentrated on:

1. Standardization
 - 1.1 EDI-and network standards
 - 1.2 maintenance and management of information models
 - 1.3 development and management of standards for electronic data exchange protocols and communication standards

- 1.4 registration and quality control of software.
2. IT-development
 - 2.1 provision of IT-expertise
 - 2.2 stimulation of implementation and use
 - 2.3 knowledge based system development.
3. Projects
 - demo projects for new applications
4. Management of an Agricultural Network Organization
 - support for establishment of EDI/Network applications.

The establishment of this new Agricultural Telematics Centre, that will be located at Wageningen, guarantees a good follow-up for the development and implementation of IT-technology and applications in the agricultural sector in the Netherlands.

State of the art and future developments of Farm Management Information Systems Planning

To discuss the actual situation and future developments in this part the just mentioned tasks of the new ATC will be taken as sequence.

EDI - and networkstandards

Because of the increasing impact of data communication throughout the whole product column c.q. agricultural sector, a EDI-Agro Platform was established in June 1990. This organization coordinates and promotes some specific points of interest in the field of data communication of all parties in the agricultural sector: primary farms, trade, industry, servicing organizations and government. During the INS-Plan period 1984-1991 some EDI-projects were initiated by the branch organizations. Some of them has proven to be successful already (EDI-Pigs, EDI-Flower). Standards resulting from the EDI-projects were given under management and maintenance of the EDI-Agro Platform. (3 men personnel, 30 mainly big companies and organizations as members).

At the end of 1990 it was established that the different network projects from the branch organizations needed urgently a common organization in order to assure continuation of the development in the years ahead. The idea was that by combining interests the pre-operational period expenses may be minimized and choices on network supplier, user administration and extension to (new) members may be made better. As stated before, this work on EDI-and network standards and facilities has become part of the new Agro Telematics Centre at Wageningen (Open Agricultural Network). In the agricultural sector in The Netherlands there is a rapid growing awareness of the competitive potentials of EDI and networks.

Present and future use and development of information models

In the evaluation study (Klink, 1991) it was stated that in spite of the use of the IE-methodology, the development of the branch models has led to some unnecessary differences in results, mainly caused by differences in starting points. It is one of the elements that has led to the recommendation for a broader branch crossing approach, like was done in the

branch crossing model on accounting. This has to be realised in the coming period for maintenance and further development. The state of detailing and completion is different for the branch models. The models for pig and dairy farming and for accounting are the most completed and detailed, while in most horticultural branches the activities have been kept at more global descriptions. The general attitude is that they provide for all branches the aimed level for having a common base for further development.

Generally spoken, the datamodel is used most extensively. If available, in most cases they are provided by the ATC as a standard data dictionary in electronic form.

In research the information model is used as basis for allocating and defining of the exact object of investigation. This concerns the process model and - in particular - the data model as well. This is the case in the defining of projects for development of management information systems, but also for other purposes. An example is that agriculture in the Netherlands will have to meet more restrictions and constraints in the field of environmental control. One of the big issues in this matter is to get reliable technical and administrative systems. An intensive combination in the registration of technical and financial data may provide such a reliable basis. Therefore, such a system is being worked out as follow up of the branch crossing model for accounting (Poppe, 1991). As far as now can be analysed, a considerable productivity in administration may be brought about in this way. An interesting side aspect is that the audit for environmental aspects may be done in the same way and by same institution as for accounting. There are also opportunities to provide in this way a basis for the administrative control in so-called product chains. More and more people get aware of the potential opportunities of the information model. The rate of use of the information model, however, may be extended quite a lot.

This will need a critical assessment of these information models. Are they really representing the occurrence and flow of the information at each individual farm or group of farms? To get an insight in the relation between the real situation at individual farms and branch information models, in 1991 a new project has started to look after the empiric validation, applicability, stability and usefulness of the actual information models in agricultural business and in intensive interorganizational data exchange (Beers, 1991).

Standards for electronic data exchange protocols and communication standards

The branch organizations, especially the one for dairy farming TAURUS, has always stressed the importance of general accepted and applicable standards for communication inside and outside the farm. Some agreements were reached on connection of process and management computers inside the dairy farm. To get agreement in all branches is expected to be still a long way because of opposite interest of different parties. Much easier will be the settlement of standards for communication outside the farm.

Registration and quality control of software

The information model and technical standards will provide a perfect basis for certification of software. Some attempts were made, but so far certification has proven to be a time intensive and therefore expensive activity. Nevertheless, it may be worthwhile to do because certified implementation of uniform definitions, standards and calculating rules will be necessary for an effective and efficient extension, guidance, farm comparison, data exchange and interconnection of systems. To date some 7

managementsystems on pig breeding are controlled and certified on the uniform use of standards and calculation rules by COAS (Control on agricultural software).

Stimulation of implementation and use of IT

The implementation and use of IT-applications in agriculture continues to be at a lower level and rate than was expected (Table 1).

Table 1. Estimation of the number of micro computers (incl. management systems)

	Number of specialized 1) farms (x 1000)	1986	1988	1990	1992
Dairy farming	36.2	60	400	1100	2700
Pig farming	4.3	160	700	2500	3700
Poultry farming	1.3	20	150	270	480
Arable farming	9.9	60	260	900	1100
Horticulture	16.1	100	1000	1500	2050
	67.8	400	2510	6270	10030

1) Farms (24 nge) Source: ATC

In pig farming, the pig breeding farms are using the most IT-applications as micro computers (incl. management systems). From all sows in pig farming about 75% is "managed" in a management system. In horticulture, the climate conditioned holdings (9400) use far the most of the listed 2050 in table 1. In particular in dairy farming, the rate of implementation is surprisingly low. Quite a lot of dairy farmers, however, are yet in an earlier stage of the growth path to an own operated computer and management system (Table 2).

Table 2. Participants in centralized farm management services (1992)

	Number of participants		
	1987	1989	1992
Dairy farming			
milk-feed program	8000	8000	7300
bull selection program	-	7000	6200
techn.financial registration program	5000	3000	2500
Pig farming			
management breeding	2000	2200	3100
techn.financial registration program	5000	4000	6600

Source: ATC

The implementation and use of communication services and media shows a rapid progress. Started mostly by the demo projects of the branch organizations some 10.000 farms are involved (4400 in dairy farming, 260 in pig farming, 1000 in arable farming and 4800 in horticulture). In particular, electronic mail is quite popular among farmers for exchanging ideas, advertizing for buying and selling, etc. In horticulture the videotex systems of the auctions, which give on very short term the results of the auctioned products that morning, are widely used (3900). In spite of disappointing experiences in some other countries, the officials in the Netherlands are rather optimistic about the future use of VTX-systems. In the new Open Agricultural Network of the ATC participating organizations and companies will provide part of their services through VTX.

As stated before, the evaluation study on the INS-Plan shows the continuing need for promotion of IT implementation and guidance for the use at farm level. In particular, the guidance by an extension officer for explanation of the computer output to the farmer was stressed in the evaluation study as a very critical success factor. My personal view, however, is that the slowing-down in the developments might be attributed most to the still existing lack in user-friendly management systems for planning and evaluation. Most of the management systems to date have registration as main function and I do think that this is not very interesting to the farmer. To my view it is most promising when farmers are involved in the development of software and when they discuss results in study group (quality circles) of colleagues, may be guided by an extension officer.

Knowledge based system development

In the evaluation study on the INS-Plan the role of agricultural research was stressed and found critical for future development. The National Council for Agricultural Research (NRLO) asked a team of Wageningen Agricultural University to make a study for a research agenda for socio-economic aspects of IT (NRLO, 1991). The agenda showed four themes:

1. Goals and decision process of farmers in order to get a better fit of information supply o.a. by management information systems.
2. Integration and deepening of management information systems. In particular (a) the integration of management information system components, (b) the user-friendliness and men-machine interface of these systems, (c) opportunities to support the management for planning and evaluation should be studied more intensively.
3. The use of IT for product chain approach (f.e. separation of flows of information and physical products) and governmental measures (= restrictions) in the field of environment, food security and animal welfare needs additional research.
4. Assessment of effects of IT on labour quality and requirements, environment, income, farm size and employment.

Partly because of limited funds, a project on the first theme will start in 1993 (Beers, 1993) and will concentrate on development of research methods to detect how farmers deal with goals and decision making in their enterprises.

Wageningen Agricultural University, Department of Farm Management and the Agricultural Economics Research Institute are of the main centres for the development of knowledge based systems and study and develop, partly in close cooperation:

- economic simulation models to support tactical decisions on dairy cattle and swine breeding farms (TACT-systems, Dijkhuizen and Jalvingh, 1990 and Zaalmink, 1991);
- economic expert systems for swine breeding herds (Huirne, 1990) and dairy farming (Hennen, and De Hoop, 1991 and Schakenraad, 1991);
- management information system for dairy farming;
- profitability of management information systems in livestock farming.

It is proposed to separate the work and roles of the scientific centres and the software companies a.o. by coordination by the new Agricultural Telematics Centre at Wageningen. The scientific centres should proceed to prototypes of management information systems, while the software companies should prepare these prototypes or parts of them into user-ready systems.

Demo-projects of new applications

In the past period the activity of the branch organizations to initiate demonstration projects for new applications, has proven to be important and successful. Quite a lot of new applications were initiated in such projects, in particular the data communication project may be mentioned. For the years ahead this activity will be continued by the ATC.

Conclusions and recommendations

In the Netherlands a strongly coordinated approach is going on for implementation and use of IT in agriculture. The coordination activity takes time and money, is not easy but seems to pay. After a period of seven years of considerable support and guidance by the government and farmers organizations, the government has transferred the initiative to the agricultural sector. A lot of important basic concepts and institutions are worked out, and are established; now the application and transfer to the sector becomes more and more important. In an evaluation study it was stated that agricultural research will (continue to) play a critical role in the adoption of IT. Nevertheless the rate of IT-application is below the expectations, a promising future remains. Appropriate socio-economic research on the content of management information systems and the attitude and behaviour of farm managers is necessary.

As the development and application of IT is executed in several countries, it might be very attractive to learn from each other and to cooperate in projects and programmes. For instance, Poppe, (1991) has made a comparison of farm accounting software in USA, Germany and The Netherlands. The study allocates strong and weak points in all systems. A combination of strong points through international cooperation may provide advantage to all. A multi-country workshop on "Farm Information Systems: Current States and Future Direction" initiated by Prof. S.B. Harsh, Michigan State University and Prof. R.P. King, University of Minnesota has been the interesting platform in May 1993 for discussing the state of the art and

developments in USA, Germany and The Netherlands.

I hope that my paper also has contributed to the international cooperation in the field of IT-development and application. I thank you very much for the opportunity to present my paper in your Congress.

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