

their business electronically with both buyers and suppliers.

Conclusion

The agricultural industry in the UK has a proud record for innovativeness and the adoption of new technology. At a time in Europe when overproduction will bring even more in the way of restrictions on

volumes of production and hence output, and on production practices and hence efficiency of production, it is vital for farmers to manage their businesses more effectively. In this situation information, knowledge, communication and the ability to model live systems and to use decision support aids all assume a much higher degree of importance. Increasingly business between farmers

and their buyers and suppliers will be conducted electronically and this will allow important business information to be captured and used. This is where information technology comes into its own as a tool which farmers and growers can use to survive in the future.

Agro Informatics in Italy: a survey

M. Balestrieri

Università di Padova
Dipartimento Territorio e
Sistemi Agro-forestali
Via Gradenigo, 6
35100 Padova
Italy
e-mail: agra02@unipd.vx.bitnet
Fax: +39 49 8070285
Tel: +39 49 8071341

Foreword

Agro informatics could be defined as the complex of software procedures designed to be used specifically by public and private individuals and organizations operating in the agro-food sector. If we widen the definition to include the people and physical structures involved, the agro informatics business becomes quite large in economic terms and at the same time it becomes more difficult to depict and estimate the complex as a whole. To analyze the heterogeneous agro informatics sector in Italy, a description was made of the main organizations involved in the developmental and implemental processes. The role of each organization and its main software production was defined. The picture depicted is sufficiently complete but definitely not exhaustive.

Detailed information of agri-software production in Italy, that has long been unavailable, can now be found in two catalogues comprising public bodies (INEA, 1991b) and private (INEA, 1991a) companies; although not complete, lacking for example programs not specifically developed for Personal Computers or process control software, this initiative shows how research and business forces present in this field are active and dynamic and that significant advances have been realized in the sector.

The prospects for development of agro informatics have also been considered, taking account of the effects of three main factors: the end user, software and hardware technology and regulations.

In interpreting this survey, the reader should know that the author's knowledge of agro informatics is mostly related to managerial applications of computer science in farming rather than to process control, hence the scope of the report will be somewhat limited. In reality it is debatable whether process control software, developed for agro-food sector activities, should be included in agro informatics or not, given that it necessarily forms part of the hardware components.

Moreover, it should be pointed out that the sections dealing with agro informatics at local level are largely restricted to the Veneto Region, the area where the author works and which is best known to him.

Public Organizations

Italian agricultural policy issues are regulated by the Ministry of Agriculture and Forestry and by the country's 21 administrative Regions. The main role played by the Italian Ministry of Agriculture and Forestry (MAF) is in guiding and co-ordinating agricultural policy activities. SIAN (the National Agricultural Information System) (AGRISIEL, 1988) was set up in 1984 (Act 194 of June 4) as a support for the Ministry in carrying out this work.

■ SIAN consists of nine subsystems and it represents the aggregation point of all the economic, financial, productive and legislative databases related to the Ministry of Agriculture and Regions. It is accessible through the Ministry itself, the

Regions and agricultural trade unions and was realized by AGRISIEL (a state owned software company) set up by FINISIEL (the largest Italian software house) specifically for this task in cooperation with the three major Italian Trade Unions in 1986.

Of course several other programs have been developed by MAF on subjects such as remote sensing by satellite, agro-meteorologic sensing systems, etc..

■ **ENEA** (Ente Nazionale per l'Energia Atomica e le Energie Alternative), the National Agency for Atomic and Alternative Energy, is another institution operating in the field of agro informatics (ENEA-Renagri, 1989) mostly on specific projects such as an expert systems for plant protection and fertilization (Pagano, 1988).

■ **INEA** (Istituto Nazionale di Economia Agraria), the National Institute of Agricultural Economics, founded in 1928, promotes and executes research in agricultural economics and policy. It is involved in managing the Italian network of agricultural accounting. Besides these statutory roles it is strongly involved in software production both for its institutional function and for extension services support. It is also involved in editing an agricultural software catalogue in which most of the personal computer programs are described and catalogued according to their functions. A complete line of accountancy programs has also been developed for any kind of farming activity. INEA is organizing a research task-force on Expert Systems applications in agriculture and is a reference point for most of agricultural software activities in Italy and editor of a very updated agricultural data banks catalogue (INEA and CNR, 1991).

■ **ISMEA** (Istituto per Studi Ricerche ed Informazioni sul Mercato Agricolo), the Institute for Studies, Research and Information on the Agricultural Market, founded in 1987 from the fusion of two existing institutions, provides information services for agro-food sector industries. It is very active in developing on-line communication techniques for the exchange of market information among its subscribers. It is also responsible for medium term forecast in the Italian agro-food sector through the use of a computerized model (MEISA). After a short review of national organizations, the main institutions operating at local level are described below.

Each Region has its own 'Ente di Sviluppo Agricolo' (Regional Agency for Rural Development) which is responsible for extension services, research activities on local productions, scientific collaboration with other institutions in Italy and abroad, etc.. At regional level the organization could play a decisive role in guiding the implementation of software procedures for use within the organizations for their own institutional functions and for external field operators (farmers, extension service centres).

■ **AGRIVIDEOTEL VENETO**, is a telematic service developed by ESAV (Venetian Rural Development Agency), Department of Agriculture of Venetian Region and a private company for implementation details. The service is available to users via VIDEOTEL, an on-line communications network operated by SIP (the Italian State Telephone company). It consists of general information about agriculture (agricultural press review, agro meteorology, phytopathological issues, market news, training courses, etc.) and more specialized services, such as fertilization expert systems, management support for nurseries and flower enterprises, observatory of production costs, and so on.

The Veneto Region Department for agro-meteorology has recently published a catalogue of their software, edited by the 'Centro sperimentale idrologia e metereologia' (1989). It describes five major software procedures for dealing with agrological, meteorological and hydrological problems. Some programs are also used for processing data collected by satellite.

Another example of local organization with an active role in promoting agro informatics is C.R.P.A., founded at Reggio Emilia in 1971 (Emilia Romagna Region), a consortium of the Region, local Municipality, Province and Chamber of commerce. The aim of this organization is to promote research activities and their diffusion among producers, trade unions and public administrations with the massive use of information technologies (CRPA, 1990). There are other institutions of this kind, such as, CSI-PIEMONTE in northern Italy (Regione Piemonte) and FORMEZ in the South (Regione Campania).

In agro informatics, Universities are limited by their own institutional role, i.e. education rather than software production. Only recently have Italian Universities and private companies started to work more closely. Of course

the University has a propelling role in developing new ideas and projects in the agro informatics community but it has neither the capacity nor the objective of producing software for the market. High quality products are often the result of collaboration with private companies. Some examples of operative procedures or program prototypes produced in the ambit of Padova University are mentioned in the bibliography (Balestrieri, 1985, 1988a/b).

Private companies

In analyzing the role played by private companies in agro informatics, a distinction should be made between 'ad hoc' software-houses and companies operating in the agro-food sector with their own software production sections. The level of software produced is, in the former case, connected with the level of investment in the field made by customers and in the latter case, with expenditure on R&D since internal software development is generally funded by this kind of expenditure. Many factors affect these levels of investment (technological state of the art, economic trends, legislation, etc.) and they will be described in the following section of this paper.

According to the INEA-edited software catalogues (editions 1988, 1989 and 1990) the total number of private companies operating in agro informatics, in the Personal Computer field, ranged from 167 to 229 in 1990 (the number of public programs, officially listed for first time in 1990, was 119).

The number of companies and individuals operating in the field of commercial software production was quite stationary and in 1990 was 106. These bodies are mainly located in northern Italy where richer Italian agriculture can be found - richer both from the point of view of farmer's income and from that of data processing necessities.

Only a few companies are representatives of foreign software houses and only a few also offer a complete, differentiated range of products while the majority of companies offer their customers just one or two programs.

What emerges from the INEA census is that the structure of the agricultural software supply industry in Italy is very segmented and fragile. This fact is another indication of the lack of a co-ordinating agency operating in this field. Other considerations illustrating the present state of the agri-software

industry in Italy, as well as its potential for development, can be found in the section below.

Prospects for Development

Many factors should be considered in forecasting the development of a complex sector such as agro informatics. As a matter of fact three factors should be evaluated: the end-user, software production and regulation.

A first set of considerations concern the demand side of the market: the end user. Data intensive activities took greater advantage than others of the diffusion of personal computers. In fact most of the PC applications in agriculture are devoted to productive processes like dairy-cow and livestock breeding, greenhouse management, etc.. As is obvious economic problems or success in these sectors will deeply influence the future developments of agro informatics. With regard to applications of informatics to agricultural mechanization (agricultural robotics), it should be noted that their costs are very high and could only be faced by large-scale productive structures.

Finally, in the near future, the rise of a new generation of end users, who are better informed about computer science, along with the constantly decreasing costs of hardware, let us envision a wider spreading of agro informatics. From the point of view of software production (the supply side of agri-software market), the emergence and consolidation of two software technologies will surely affect the diffusion of agro informatics in the near future: Expert Systems and Object oriented techniques. Expert Systems, programs able to provide answers to end-user problems of choice in a similar manner to human consultants and experts, and Object Oriented Programming techniques, that will provide a shorter (and therefore cheaper) software production cycle, allowing efficient delivery of applications with more effective user interfaces. Of course legislative aspects are very relevant to the development of agro informatics as in any other economic field, both directly, in the sense of providing direct help to the agri-software industry, and indirectly, through the regulations or the incentives imposed on the agri-software end users. With regard to regulations, several laws allow the end-user some facilities in buying and using computer equipment and programs, but none of these is so specific

to be considered relevant for the development of agro informatics. In other words, given the lack of a driving force in the field, there is also a lack of appropriate regulations to stimulate it. No incentive is provided to the agri-software industry directly. An example of how regulations can indirectly affect diffusion of agro informatics is described below. In Italy farming enterprises are not taxed on profits but on a fixed basis strictly connected with the soil's productive potential. In this sense farmers have never been, and are still not, urged to keep their business records. Their needs for automatic data processing are consequently very low and this is one fundamental reason to explain the scarce development of software houses and programs for the agricultural sector in Italy.

Conclusions

As stated above there is a lack of co-ordination of the various initiatives regarding development of agricultural software procedures. Only in recent years has a census been made of such initiatives which are often publicized at 'ad hoc' symposiums (some examples of the most relevant ones are: Informatica in Agricoltura, Verona, 1987; Informatica e Genio Rurale, Padova 1991; Agrimatica, Torino, 1991) or in specific agricultural bulletins and journals (Informatore Agrario, Verona; Genio Rurale, Bologna; etc.).

Programs of great interest are emerging, but require consolidation and testing in the field. Indeed there are few fully operative procedures and these are generally the result of collaboration between public and private bodies. Private software houses, on the other hand, offer few innovatory procedures in agro informatics and are prevalently involved with the production of accountancy and management programs mainly based on DBMS technology. Advanced economies rely heavily on computer science technologies, but when we consider the different sectors that make up these economies we find that agriculture is behind the times, as compared to the industrial and commercial sectors, in widespread adoption of information technologies. This is mainly because modern agriculture is still closely linked to human labour and to uncontrolled factors like climate conditions, soil, etc.. Nevertheless agriculture could take advantage both of management

information systems (accounting, decision support systems, data base management systems, technical management, expert systems, etc.) and of automation of production processes (irrigation, harvesting, milking, etc.) but, bearing in mind the above considerations, agro informatics development should consider the most effective applications, i.e. those best suited to agriculture and the agro-food sector.

References

- AGRISIEL (1988):
SIAN, punto centrale della politica dell'informazione in agricoltura. Agricoltura, No 181/182
- BALESTRIERI M. & BOATTO V. AND POVELLATO A. (1985):
La valutazione dell'efficienza aziendale col Personal Computer. E.S.A.V., Centro Scientifico Didattico, Settore Assistenza Tecnica, Venezia.
- BALESTRIERI M. & BOATTO V. AND DEFRANCESCO E. (1988a):
Ceres: an inferential knowledge based system to support the choice of class and optimal variety of seed maize. In ORCS '88, EAEE.
- BALESTRIERI M. & BOATTO V. (1988b):
Un modello di controllo e pianificazione della gestione delle aziende agricole. Informatore agrario, No 8.
- CENTRO SPERIMENTALE IDROLOGIA E METEOROLOGIA (1989):
Catalogo del Software prodotto. Dipartimento per l'agrometeorologia, Teolo (Padova), Italy.
- CRPA (1990):
Software per l'assistenza tecnica. CRPA, Reggio Emilia, Italy.
- ENEA-RENAGRI (1989):
Informatica ed automazione. Agricoltura ed innovazione, No 9.
- INEA (1991a):
Agrissoftware 90. L'informatore Agrario, Verona, Italy, Volume 1.
- INEA (1991b):
Agrissoftware 90. L'informatore Agrario, Verona, Italy, Volume 2.
- INEA AND CNR (1991).
AgriDataBank. L'informatore Agrario, Verona, Italy, Volume 2.
- PAGANO, A. (1988):
Sistemi Esperti in agricoltura: l'ENICHEM presenta Agres. Agricoltura ed innovazione, No 7.