Development Foundation
Systems Engineering Economics Lab
Portsea Isle, Hampshire
England

Final Evaluation of AFA-AGRONET System

Resumé

Pannonian-Invest Kft
Budapest

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Introduction

AGRONET was run as a pilot programme and it serviced the needs of the Hungarian counties of Nógrád, Heves, Borsod, Szabolcs, Hajdú and Szolnok. The project was operational between 2000 to 2009, including the prototyping phase of one year (2000-2001). This report is a summary of the substantive findings of an assessment of the operation of AGRONET, its contribution to know how, improved farming operations and lessons learned for any subsequent development of the system or other initiatives based on the same or similar approach.

Project objectives

AGRONET is an online farm planning and extension information system. It is an operational system and serves to demonstrate the benefits of the application of gross margin data based upon farm accountancy and productivity information collected under the FADN (European Farm Accountancy Data Network) in operation in EU member states. It provides information to assist farmers improve farm performance in terms of income and profitability. It includes an agricultural project evaluation system for the identification of profitable investments. The system allows the simulation of incremental investments on the basis of a linear programming model used in farm planning with the objective of maximizing farm profits through the appropriate allocation of enterprises (different farm crop production activities).

Sources of funding

The initial development work for this project was provided by the European Union Phare Programme and the Hungarian Government. The project was managed by AFA-Agrárfejlesztési Alapítvány (Hungarian Agricultural Development Foundation). Additional financial contributions to project management over the 9 years of operation came from EU Regional, Cohesion and SAPARD funds.

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Pannonian-Invest Kft
Bathory 17, 1/5
1054 Budapest
Hungary

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1. System Content

The home page of the AFA-AGRONET online system (http://www.afa-agronet.com) is in the Hungarian Language and a menu control enables users to gain access to an English Language home page. The whole system is bilingual with equivalent information and functionality at all levels in both Hungarian and English.

The home pages provide access to a Reference Section describing the site content, explaining the concept of appraisal, how optimization works, how performance is measured, how to compare financial options and undertake business planning.

Reference Section	Farm Planning Tools
Agronet Contents	How to use Agronet Crop Data Sheets & Calculators Farm plan records
Appraisal	Crop Data Sheets Manpower Inputs Machine Speeds
Optimization	Cultivable Area Equipment Capacity Cash Optimization
Performance	Land Equipment Cash
Financial Options	Land Rental Investment Valuation of Land Land Mortgage Equipment Lease/Purchase Cash Flow
Business Plan	Return on Equity

In addition to this online descriptive content another section of the home page contains access to all of the project assessment and farm planning tools described in the Reference Section.

The initial pages provide an explanation of the procedures to be followed in using the system, an explanation of the content and function of basic crop data sheets that provide the input and output technical rations for poor, average and good production practice, and how to use farm record sheets.

Under the appraisal section crop data sheets are detailed, explanations on manpower input calculations and machine working speed calculations are provided.

Under the optimization section, calculators for cultivable area, equipment capacity, cash availability and optimization procedures are included.

Under the performance section there are calculators for estimating performance against specific constraints such as land, equipment and cash. The objective here is to identify which constraints provide the highest returns to their incremental increases as a basis for deciding on investment options.

The financial section provides calculators to assess options for increasing performance including calculators to assess land rental options, calculators for estimating the investment value of land, the potential use of land mortgages and options for using equipment lease/purchase.

The business plan section has a calculator to provide an estimate of the overall return on equity of any particular plan.

The sections “Sources of Finance” and a “Discussion Board” were to be maintained directly by AFA.

2. General assessment of level of content clarity, ease of use and the utility of calculators.

Content clarity

The level of content clarity of all sections in both languages was considered to be good. In the context of the system's function it was considered to contain all of the essential information necessary to understand the procedures and methodologies to undertake farm plans and investment appraisal.

Ease of use and the utility of calculators

The calculator system, consisting of over 120 calculators in two languages is transparent providing, in each case, a "launch page" with an information profile of the purpose of the calculator, what the output is, a specification of the required information inputs and a detailed description of the formulae used. An example of one is provided on the next page.

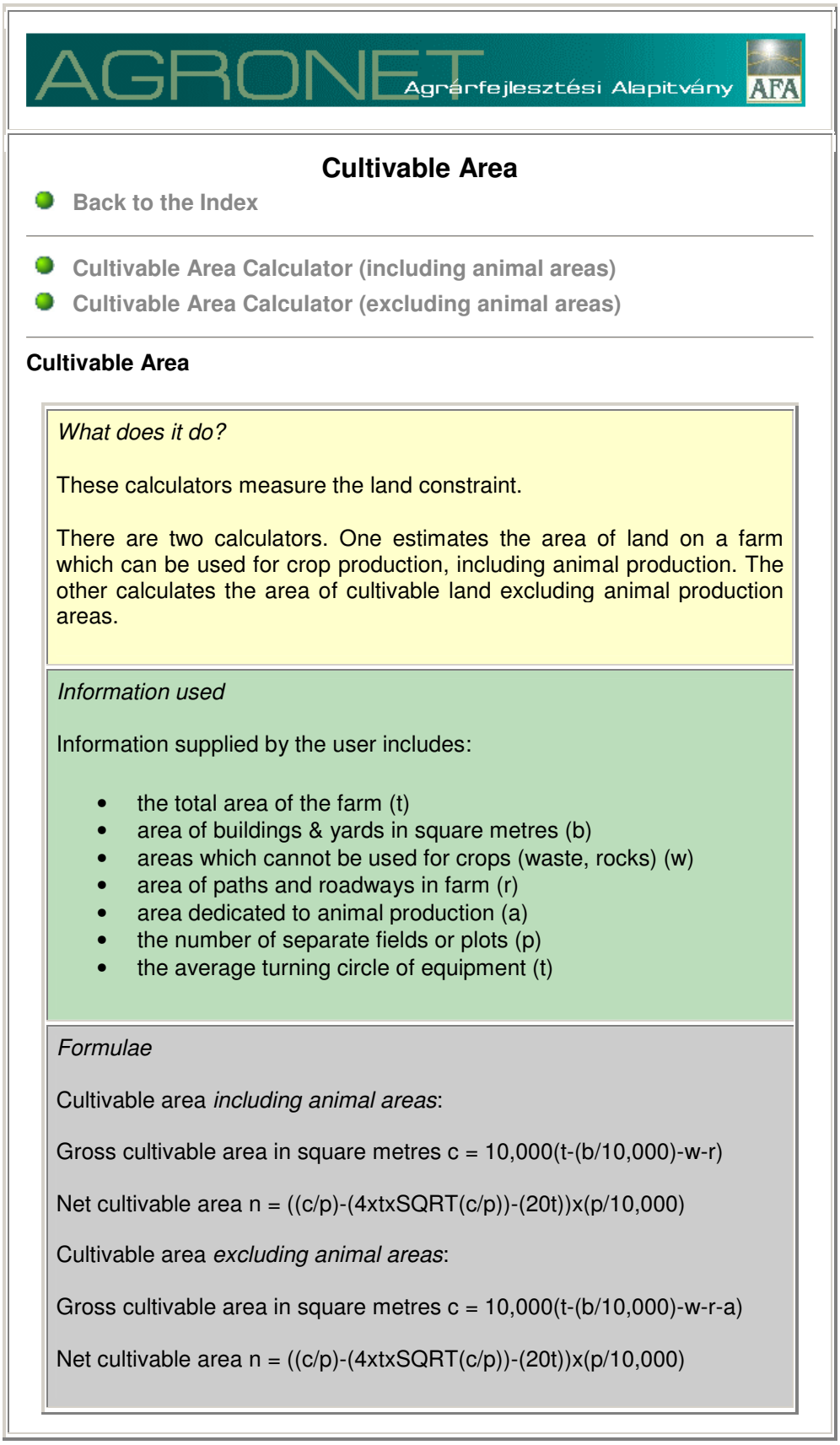
The calculator outputs are intelligible and in all cases proved to be accurate.

When used as instructed the system provides accurate data for farmers to prepare inputs for the optimization procedures and optimizations and simulations for the crops selected were presented in a transparent report format.

Conclusions

In terms of content clarity and the ease of use and utility of calculators the system scores high amongst those who administered the system AFA-Agrárfejlesztési Alapítvány (Hungarian Agricultural Development Foundation) as well as users, including agricultural university students and farmers. Therefore, the system is considered to have addressed the main operational requirements established in collaboration with AFA at the beginning of the project.

Figure 3 Example of a calculator information profile



3. Areas for improvement

As a general comment, the server system and all associated software and scripts operated well for over 9 years. Technical support staff do not recall the server software or the scripts being cause of any technical support calls other than minor issue that arose during the prototyping phase. The only significant potential technical issues involved a transfer of all of Navatec.com servers from a section of their server farm to a new section with state of the art servers. However, this transfer was accomplished with no break in the AFA-AGRONET systems services.

Areas for improvement related more to use of the system and data of which there were four (4) issues:

- As advised in the introduction to the calculations section, the sequence of calculations required is described. This is quite intelligible. In spite of this some users who did not follow these instructions would get lost or end up requesting reports for which they had not set up the required data inputs. This is not a fault of the system but rather of the issue of attentiveness of users. Some users suggested that a more robust "redirection" of users during the use of calculators might prevent users getting lost.

- Land area calculations in terms of tractors with ploughing rigs used an inline operation (ILO) calculation. This is adequate for those farms that use this technique. However, increasing numbers of farmers maximize the use of land area by completing field edge-parallel operations (EPO) to use "turning circle" land and then switching to inline mode. In this way the whole available area is put down to cultivation. In such cases, the land area calculation underestimates the actual utilizable area.

- As part of the operational agreement, crop data sheets were to be maintained by AFA on an annual basis so as to ensure that optimization information remained relevant. However, as from the 2nd year of operations these were not maintained. This meant that the direct applicability of the data sheet quantitative measures eroded over time.

- The use of printable recording sheets for farmers helps improve the data coherence and convenience of use of the system. However it was suggested that the introduction of user sections where they could record intermediate data rather than taking notes of calculator outputs external to the system, would enable users to pause, go offline and then return so as to continue from where they had stopped in the previous visit in the data management sequence.

All of these constraints were identified by the design team in early 2002 and a proposal to improve these correct these aspects was presented to AFA. However, at that time, the lack of available funding caused this work not to be undertaken.

According to the design team leader H. W. McNeill,

Sequencing

> "Sequencing of user inputs could have been enforced through simple user dialogue prompts. However, the thinking behind having users write down

calculator results was to help them understand the steps involved. Indeed, some users preferred the hand written recording of the data to be input to each optimization or simulation run. It needs to be remembered that this system contained a significant "learning content" for users with a very wide range of educational backgrounds and capabilities in handling figures. By facilitating the use of the system with "wizards" it is very easy to have users generate output that they do not fully understand. On the other hand, the optimization or simulation reports contain a complete record of the data inputs used."

"One reason the system remained "multiple entry" is that quite often a farmer is interested in probing some point of interest such as "...how much wheat can be produced with a given amount of cash" or "what is the trade-off between more leased equipment or more rented land?" Such questions are of vital importance to farmers to get a feel for the many decision options they have in manipulating the many production factors on a farm and they can all be answered without completing the full farm planning sequence. However, in order to complete a comprehensive and optimized farm plan the full sequence needs to be followed to ensure all of the necessary data has been collected."

"It would have been better to have a two level system, one for learners using the hand written data and probing different issues and an automated system for those who had understood the full data management procedures and/or were only interested in full optimization analysis. Unfortunately there was no funding available to undertake this upgrade to the system."

Land area calculations

"Effective land area calculations related to tractors & ploughs, and other trailed field equipment, could be underestimated in the case of farms not using EPO. The error would vary with the size of fields and size of rigs. However, on average we estimated that the discrepancy, where it existed, averaged out at around a 6% underestimation. In terms of enterprise allocation, that is, the farm plan, these details made very little significant difference because of the error applied across the whole farm and therefore the overall allocation was unaffected. On the other hand such an error could result in under-estimates of cash requirements for inputs and time requirements for machine operations."

"Once we became aware of this issue we proposed an upgrade to the calculator bank by introducing the EPO options but there was no funding available to undertake this upgrade to the system."

"This issue in fact is not critical simply because the common sense solution is to assume that all of the field area is used and not bother with effective land area calculations. This way the option already exists to determine EPO results."

Crop data sheet updates

"It isn't possible to maintain an effective farm planning system without crop data sheets being updated to reflect changes in the values (unit quantity x unit price)

> of variable inputs and use of equipment. This the purpose of the FADN system and private systems of data collection. The physical quantitative relationships over a period of a decade would not be expected to shift significantly but market prices can have a dramatic effect on what constitutes an attractive crop in any given planning period (season)."
>
> "The normal practice upon which we based our system's design was that of the crop data sheet approach used in the Farm Management Pocketbook (John Nix - England) and the Farm Management Handbook (SAC - Scotland). Both of these remain in active use because they are updated each year. We introduced a innovative aspect to these gross margin structures relating gms to technological levels of inputs."
>
> "It is regrettable that as a result of lack of financial resources that this updating activity was not maintained as it should have been."

Online data recording for users

> "I have covered this point under the sequencing issue and simply confirm that the use of a user sub-domain for recording own data and saving different plans is, of course, normal practice now. We proposed to introduce such improvements to address thus issue but there were insufficient funds available to pay for this upgrade."

4. Differences in the Hungarian and English versions

The different language versions were assessed to be equivalent to each other.

Both were intelligible both in the help sections and in the operations sections.

In evaluations the assessment of Hungarian mother tongue and English mother tongue users were roughly equivalent and the only criticisms arose in relation to the elements reviewed in Section 3.

5. Estimates of Usage

The expected rate of usage for this prototype was a user community of around 1,500 to 2,500. The site statistics show that the system ended up serving around 10,000 users over the operational period with a core group returning on a regular basis made up of some 5,000 enterprises as from 2002. However, the failure to update crop data sheets resulted in a gradual reduction in the numbers using the site with the final user population being around 2,500 by 2009.

According to the team leader H. W. McNeill,

> "If the required upgrades had been introduced in 2002 and sufficient promotion has been provided through the normal government channels it is likely that the system could have significantly increased its service area and in particular to the

rest of Hungary. Unfortunately budgetary constraints on the part of our client AFA did not allow this to happen".

6. Benefits

The user base was not all farmers. In fact a lot of users were not even located in Hungary. There was considerable interest in the "system" on the part of other European visitors and in particular educational establishments in the USA.

Of the 10,000 users recorded about 60% were from Hungary of which, from site usage some 40% were likely to be farmers using it to plan their farms, that is about 2,500 farms. This was also confirmed by the sequences of use of the system resources using data that reflected real farm conditions.

It is estimated from data input that the average size of farms making use of the system seemed to increase over the period from around 350 to 820 ha. Larger farms would have been expected to have easier access to the World Wide Web because of the general correlation between income and the ownership of personal computers and laptops and access to the World Wide Web via the Internet.

The average Gross Margin increase in aggregate gross margins irrespective of crops and divided by the utilizable areas of the farms was of the order of Euro 20/ha. These planning options were generated by the AGRONET linear programming system (Simplex).

The estimated theoretical benefits arising from the AGRONET system based on this gain in GM are shown in the table below:

Period	Average size	Per farm benefit	Number	Annual benefit	Life cycle benefit 9 years
2002-2004	350 ha.	€7,000	2,500	€15.5M	€31M
2005-2009	820 ha.	€19,400	2,500	€41.0M	€205M

Theory & practice

The variation in yields related to early and late seasons and the incidence of flooding in Eastern Hungary during the operational phase of this project meant that farm plans seldom achieved the gross margin objectives of the linear programming optimized plan. It is therefore necessary to reduce the life cycle benefit by weighting the annual benefits by low production and high production seasons resulting in higher than normal and lower than normal prices. However, assuming a reduction in yields and assume low production years to sustain normal prices then the life cycle benefit over 9 years can be converted to pessimistic estimates. The removal of benefits from 2 years in 5, that is a 40% reduction in the planned estimate Gross Margin, would result in a life cycle benefit of €12.4M in the first period and €82M in the second or a grand total of some €94.4M.

Reality

Because of the failure to update crop data sheets the system's designers (Navatec.com, a division of Hector W. McNeill & Associates) argued that the relevance of the system was declining and the estimates of benefit therefore likely to be exaggerated. Indeed they only made use of one

benefit estimate based on the first two years of operation, that is €12.4M considering the subsequent period estimate, of some €82M to be largely illusionary.

7. Lessons Learned

The AGRONET system was extremely innovative for its time and made use of the latest web technology in the form of server side ECMAScript[1]. The system server ran, without any interruption, between 2000-2009 including prototype models (2000-2001) on which the main system was based.

The continuous 9 years server operation of the AFA-AGRONET system was provided and managed by Navatec.com through their technical services unit in Seattle, Washington State, USA. This server management service was provided this service free of charge as part of the original design and implementation service agreement with AFA. Although the operation ran uninterrupted the timely introduction of appropriate upgrades was affected by a lack of continuity of fund provision. The majority of the design and implementation funding was provided in the first year, that is, during the establishment phase.

During the life of the project AFA in collaboration with the target county local authorities and the Hungarian government were able to provide small sums to cover administrative, as opposed to development, effort sourced from Phare, EU Regional Funds, the Cohesion Funds, SAPARD and government.

Although with current technology, such as server side ECMAScript in the form of the Vanguard System using DScript, a complex system like AGRONET can be conveniently designed, implemented and maintained but the lack of contractor funds for the service provider constrained the ability of Navatec.com to update the system up to current state of the art capabilities.

The advances in capabilities are a combination of advances in programming technique as well as a significant number of additions to the primitives available with DScript (Vanguard System) and library functions available through Seel-TelesisScript library functions (Systems Engineering Economics Lab).

8. Value of the system, demonstration effects and its potential

The system clearly has a significant potential in increasing the profitability of farms. The conservative estimates of the potential benefits in terms, of economic and financial contributions to farm incomes, provides a practical and convincing demonstration of its potential.

There is little doubt that with a better funding arrangement this type of approach to farm planning and investment project evaluation can produce significant benefits to farmers and rural communities.

[1] AGRONET was one of the world's first major applications for the online decision analysis system DecisionScript which makes use of an ECMAScript (JavaScript) extension known as DScript that operates server side and is optimised for complex online decisions analysis applications. DecisionScripot and DScript were developed by Vanguard Software Corporation, Cary, North Carolina, USA. Today this significantly enhanced system is known as Vanguard System.

According to the team leader H. W. McNeill,

> "The lack of funding during the last 7 years meant that direct investment in the system was low and we simply maintained its operation. However, in other systems operations our skills in server side ECMAScript have developed significantly along with the spread of ECMAScript within the World Wide Web as the main scripting language, albeit on the client side".
>
> "It would be beneficial to expand the scope of this system to include a formalized project preparation, evaluation, implementation and management system. This is being advanced with the development of a vertical application development of the Real Time Audit applied to agricultural project life cycle management including farm planning optimization and investment appraisal. This will extend the utility of the system to include optional technologies and techniques as a basis for comparison and identification of best solutions according to decision-maker preferences".
>
> "In order to avoid the risks associated with reliance on third parties to provide crop data sheets the new system provides an expert system to assist users generate data sheets from current market prices and state of the art technologies."
>
> "The system works and it delivers sound plans which, weather permitting, can increase farm incomes. The basis for extending this service to a more extensive one exists and is based on server end ECMAScript. This has come a long way since 2000".
>
> "The cost-benefit ratio for this project, even on the basis of our own lower and pessimistic calculations, is extremely high. In such a system, as user numbers increase then benefits increase at a far higher rate than the operational costs. This system certainly provides a demonstration of the value of online systems and shared resources".

9. Recommendations

Budgetary constraints would appear to have been the cause of the AFA-AGRONET system not achieving a far greater impact than its estimated €12m during its first 2 years of operation, or some €6M each year. This was achieved on the basis of an estimated participation of less than 3% of Hungarian farms.

Clearly an initiative like this is of benefit and against an estimated commercial maintenance cost[2] of around €175,000-250,000 each year the benefit is extremely high. Based on this type of charge the cost per farm is of the order of €35 to €50 each year and the benefit derived is of the order of €1,200 each year or an average benefit/cost ratio of 29.26. This represents a very high present value return on investment for the farmer even if they were required to fund this service on the basis of an annual fee.

[2] Estimates from Navatec.com assuming a core user base of 5,000 and a cost per farm of €35 to €50 each year

It would be well worth investigating the potential of an improved design, including those design improvements outlined in section 3, to provide the basis for a better funded proposal for implementation in target countries of the EU or even as part of aid services under Europe Aid or as a system offered as a service perhaps subsidized by aid and donor organizations to improve project performance.

ANNEX 1

Terms of Reference

This review is to provide an assessment of the online agricultural decision support system known as AFA-AGRONET (url: http://www.afa-agronet.com) which was developed with the financial support of the Government of Hungary, EU Phare, the Structural Funds, Cohesion funds and SAPARD and the Hungarian regional governments of the counties of Nógrád, Heves, Borsod, Szabolcs, Hajdú and Szolnok.

This review should assess the operation of the system both during the prototyping stages 2000-2001 and then operational stages 2002-2009.

The review should provide insights into the following aspects of the project/system.

- System content
- General assessment of ease of use and utility of calculators
- Areas for improvement
- Differences in the Hungarian and English versions
- Estimates of usage
- Benefits
- Lessons Learned
- Value of the system, demonstration effects and its potential
- Recommendations

The designer and implementer of AFA-AGRONET, Hector McNeill, agreed to respond to all technical questions concerning this project.

The technical services team at Navatec.com who provided ongoing systems operational management throughout at their Seattle technical centre have also agreed to answer any questions that might arise and will make the system user statistics available for the purposes of this review.

This review and assessment should be completed by the end of 2009 in order to make up part of an information pack to be reviewed by appropriate organizations with a view to identifying promising initiatives.

6th March, 2009
Development Foundation
SEEL
Portsmouth