KodA: from knowledge to practice for Dutch arable farming[1]

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Abstract

To maintain the strong position of Dutch arable farming, a transition should take place towards a sustainable, process-oriented farm management, based on actual information combined with state-of-the-art knowledge. Management support systems and ICT can play a key role in this transition. This paper presents the results of an exploratory study resulting in a program proposal to work on this transition. The proposal focuses on cooperation in practical networks in which management tools are developed in a demand-driven way. Integration of new and existing ICT systems must support and sustain the activities in the networks. This will result in an infrastructure consisting of a personalized web portal, containing management supporting applications, a set of generic tools and a facility for data storage. Attention will also be paid to the process of knowledge construction to accelerate adoption of management tools.

Key words: management support; knowledge management; ICT adoption

1 Introduction

Dutch arable farming and field production of vegetables was worldwide renowned and market leader for several agricultural products. Last years, this position is being undermined and could be rapidly lost to other countries in the EU. Chances to retain this position are good because the Netherlands has several strong, worldwide operating processing industries and mercantile houses that are important to the Dutch national economy. However, this requires a well-developed arable production sector with innovation power, high-grade technology and a good knowledge infrastructure. Therefore, a transition must take place to a sustainable, process-oriented farm management, based on actual information combined with *state-of-the-art* knowledge.

In current practice, development of knowledge and management support systems and the storage of data are too much isolated processes. A new impetus is needed to initiate a process in which knowledge is constructed and circulated in an efficient and effective way.

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This problem statement was recognized and picked up by a group of people from the primary arable production sector. They discussed this problem with the Minister of Agriculture and received a positive response on their request to do something about this situation. He asked them to prepare a proposal for a long-term program to work on these problems and develop solutions. An important additional condition was that it should result in a renewed cooperation between research and practice.

Hence, research institutes became involved and a programming study was carried out to investigate the problem statement and to explore directions for solutions, resulting in a proposal for a program. The results of the study and the program proposal are presented in this paper.

Codename for the project became 'KodA', which is a Dutch acronym for 'Knowledge in the Field of arable farming'.

2 Programming study

2.1 Approach and activities

The approach in the programming study was as follows. First, a workshop was held with all people involved in the project and the research domain was demarcated and actors in this domain were identified. Then, two parallel activities took place: (1) an inventory was made of wishes from several different actors and (2) potential possibilities of existing knowledge, contained by models or existing farm management systems, were explored. The results of these two activities were combined and a first synthesis was made, using the subjects of *knowledge*, *ICT tools* and *organization* as focal points. The question to be answered in connection with these points was: what are the requirements for the intended KodA program? Preliminary conclusions were tested in a workshop and bilateral conversations with the actual stakeholders. The outcomes of this workshop and conversations were used to accentuate the preliminary conclusions resulting in a final proposal for the KodA program.

2.2 Results and program requirements

The domain and actor analysis resulted in a list of stakeholders in the field of arable farming and field production of vegetables. A small number of firms and persons was interviewed in-depth resulting in reports that were analyzed systematically. Two main future orientations for arable farming emerged: (1) commodity-oriented: improvement of both quality and quantity for current crops and products and (2) specialty-oriented: search for new products in demand-driven niche markets. For both orientations a need was identified for practical management tools that synthesize state-of-the-art knowledge and actual farm and/or market information so that advises for management support are tailor-made. The development of these tools should be demand-driven by arable farming practice and all relevant stakeholders, practice and research, should be involved from the start.

The inventory of possibilities started with the examination of a framework for farm management, containing different perspectives, like planning, execution, evaluation, data storage, etc. The theory behind this framework is described by Verdouw *et al.* (2005). Along these perspectives, a long list of management tools was obtained, mainly by desk research. Each tool was described in a structured way indicating e.g. the status of implementation and usage in practice, critical success factors, used computer platform, used programming language, etc. An evaluation of these results concluded that there are many tools available, but that there are many problems with adoption of them in practice. One main problem is that current tools are difficult to use in an integrated way in everyday farm management, because there are many different suppliers and there is a lack of standardization. Another problem is that many tools are developed by researchers and do not always match with everyday practice of a farmer, although the knowledge within those models could be potentially useful. These findings confirm results that were found in similar previous research (Parker, 1999; Keating and McCown, 2001; Wolfert, 2002).

The interest for the workshop in which the preliminary conclusions and proposals were discussed was overwhelming, which indicates a broad support and a sense of urgency to work on this subject. In general, the findings of the study were confirmed. The workshop also indicated that it was necessary to give the ideas concrete form in order to get the support from arable farming practice. Subsequent conversations

with individual industrial firms resulted in a list of several concrete ideas and project proposals. To mention a few: a tool for benchmarking crop production, demand-driven production of high-quality wheat and potatoes or an advisory tool on crop rotation.

From these results a program proposal for KodA was made that is described in the next section.

3 Program proposal

3.1 Objective of the program

The objective of the KodA program is to give an innovation impetus to the Dutch arable farming sector that accelerates the transition to a sustainable, process-oriented farm management and strengthens the Netherlands' position in the world market. The program must lead to a renewed knowledge infrastructure with demand-driven knowledge construction as a major spearhead. Improvement of farmer's entrepeneurship and craftmanship, supported by management tools that connect up-to-date knowledge and farm-specific data, plays a central role.

The program should result in:

- *Practical networks* consisting of farmers, industrial partners, service providers and researchers interacting with each other to meet the KodA objective.
- *Management tools for evaluation and analysis* that help farmers to become aware of and gain insight into their practices and farm's situation and to generate ideas on how to improve this.
- *Management tools for planning and cultivation* that bring knowledge in the field in usable form. These can be decision support systems or learning material (courses, handbooks, etc.)
- *Integration platform*: an infrastructure that enhances integration of existing and new developed management tools, using information standards and reference models.
- *Implemented knowledge* in such a way that an organizational form is being established sustaining the aforementioned results and that knowledge development becomes anchored in practice.

The next sections describe how these results will be achieved.

3.2 Practical networks – the central method of working

Fig. 1 presents the basic principle of the method of working in KodA: the practical network. To establish demand-driven knowledge construction, users' groups are formed that primarily consist of farmers and their related industry partners. Researchers and (ICT) service providers complete the groups but have no steering role; they are involved in the process of formulating demands and requirements (i.e. wishes), in which they can point at existing possibilities.

The process is as follows. Wishes from farmers and industry are specified and translated into realistic goals and products. Then researchers and service providers start to search for existing possibilities or products, i.e. knowledge and models, and investigate if and how these can be transformed into a usable form. The reason to use *existing* possibilities as much as possible is to increase the chance that applications can be developed in a relatively short time period aiming at quick wins. If *new* knowledge is needed, other research programs must be searched for to develop this. The results of exploring existing possibilities are elaborated further in a pilot project and can be demonstrated to a larger group of people when progress is made. The aim is to implement the result in a management tool, preferably software. For a successful adoption, this software should be integrated with existing management software. The format of a management tool also increases the possibility to transfer the knowledge developed to a broader group than the original users' group.

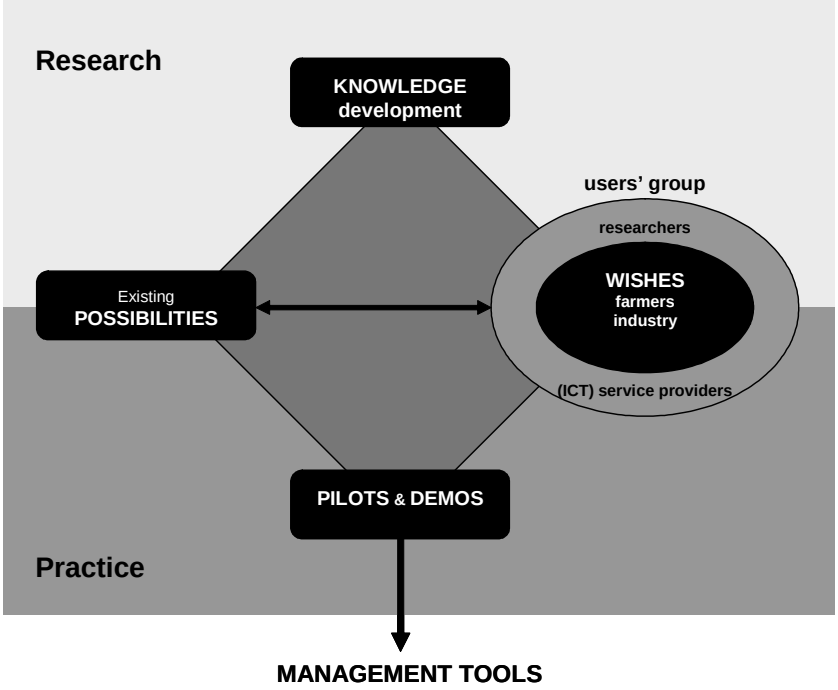

Fig. 1 The practical network in which user's groups play a key role in development of management tools in an interactive environment of research and practice.

Although this process is linearly described, it will be more iterative in reality, as indicated by the diamond in the center of Fig. 1. Knowledge is applied and experiences are shared amongst each other. This combination should lead to a systematic and stepwise improvement of management tools.

In 2005, practical networks are set up around the following projects:

- *Controlling quality in wheat and potatoes* – in this project users' groups of wheat and potato farmers will develop management tools for crop management that help to improve the quality of their products.
- *Improvement of returns in starch potato and sugar beet production* – in this project users' groups of farmers who grow starch potato and sugar beet crops will first develop management tools for evaluation and bottleneck analysis. After that, management tools for planning and crop management will be developed to improve crop return.
- *Practical pilot projects in the field and food chain* – in this project users' groups will develop management tools on chain business concepts, information gathering/collection and knowledge-intensive systems.

These projects were defined according to the wishes that were identified in the programming study. One covering project will focus on cooperation and exchange between the various users' groups. In this way it is stimulated that different processing industries (starch, sugar, grain, potatoes, etc.) work together to improve the innovation power of their farmers and knowledge infrastructure.

3.3 Program themes

The program is split up into the following themes:

1. *Network formation* – comprises all activities of setting up and guiding the practical networks. Interaction between various networks will also be stimulated. Activities will mainly consist of group sessions, discussions, workshops and demonstrations.
2. *Evaluation and bottleneck analysis* – in this theme the actual situation of the farm and results of the pilot projects are discussed and compared with each other. This will be supported by development of tools for benchmarking. The activities must result in descriptions of potential alternatives in crop and farm management that are tested in the pilot projects. Experiences with

these experiments should lead to general methods that can be used in other situations (different crops and problems).

3. *Planning and execution of crop and farm management* – comprises selection, implementation and/or development of management tools to support specific problems at different levels: crop, farm and chain. Especially in this theme existing knowledge from research is being applied in practical, usable forms.
4. *Systems integration and ICT infrastructure* – comprises all activities that integrate the results from activities in the other themes. This theme will focus on implementing an open and standardized architecture, an ICT-framework, using information standards and protocols that enable communication between various systems (different management tools, databases, machines, etc.). A conceptual framework of an architecture to realize this is described by Verdouw *et al.* (2005). Implementation should result in an infrastructure consisting of a personalized web portal, containing management supporting applications, a set of generic tools (a library or layer of functions/applications/services that is used within more specific applications), and a facility for (temporary) data storage, probably a data warehouse.
5. *Knowledge construction* – this theme will focus on the process of synthesizing and tailoring knowledge and data by farmers in the different users' groups. Thus, it monitors and evaluates the program activities in the other themes, but the results from this evaluation will be fed back to the users' groups so that they can learn from their own and other's experiences. Besides, existing scientific knowledge and experience of learning and adoption processes will be used to improve these processes. Tailoring knowledge dissemination regarding different learning attitudes and management styles is essential.
6. *Program coordination, process management and communication* – comprises the coordination of all activities in order to guarantee appropriate communication, synergy and coherence.

These themes and their mutual relationships are schematically represented in Fig. 2. Theme 1 to 3 can be identified as different phases of the practical networks as described in the previous section. The practical networks make up the heart of the program. They will have different objectives, resulting in different management tools. To ensure that a broader range of users than the users' groups within the KodA program can use these tools, and that they can be used in an integrated way in farm management, uniform working methods and standardization is strived for. This can be reached by development and application of standards and reference models that will be achieved by the integrating themes 4 and 5: systems integration and knowledge construction. Systems integration focuses on connections between different systems and data standardization and will be based on existing standards (like EDI) and on-going initiatives. Knowledge construction focuses on how knowledge from research and other sources can be applied in an effective and efficient way. For example, one can think of knowledge databases where knowledge is represented in a systematic way (instead of texts in reports) so that it can be easily searched. Theme 5 will also be based on and exchange experiences with existing, comparable initiatives. Thus, both theme 4 and 5 provide concepts and prototypes that are tested within the practical networks (theme 1 – 3) resulting in iterative stepwise development of standards and reference models that together with the concrete management tools will result in a renewed knowledge infrastructure. The word 'renewed' indicates that the program's intention is not to develop something completely new, but to build on existing structures and to link up with the current trend of personalized web portals where farmers will be able to build up their own set of applications and farm-specific information.

3.4 Current status of the program

The program proposal is approved by the Ministry of Agriculture on one hand and industry partners and farmer's organizations on the other hand. Both parties will equally finance the program for the first four years. In 2005, several projects will start.

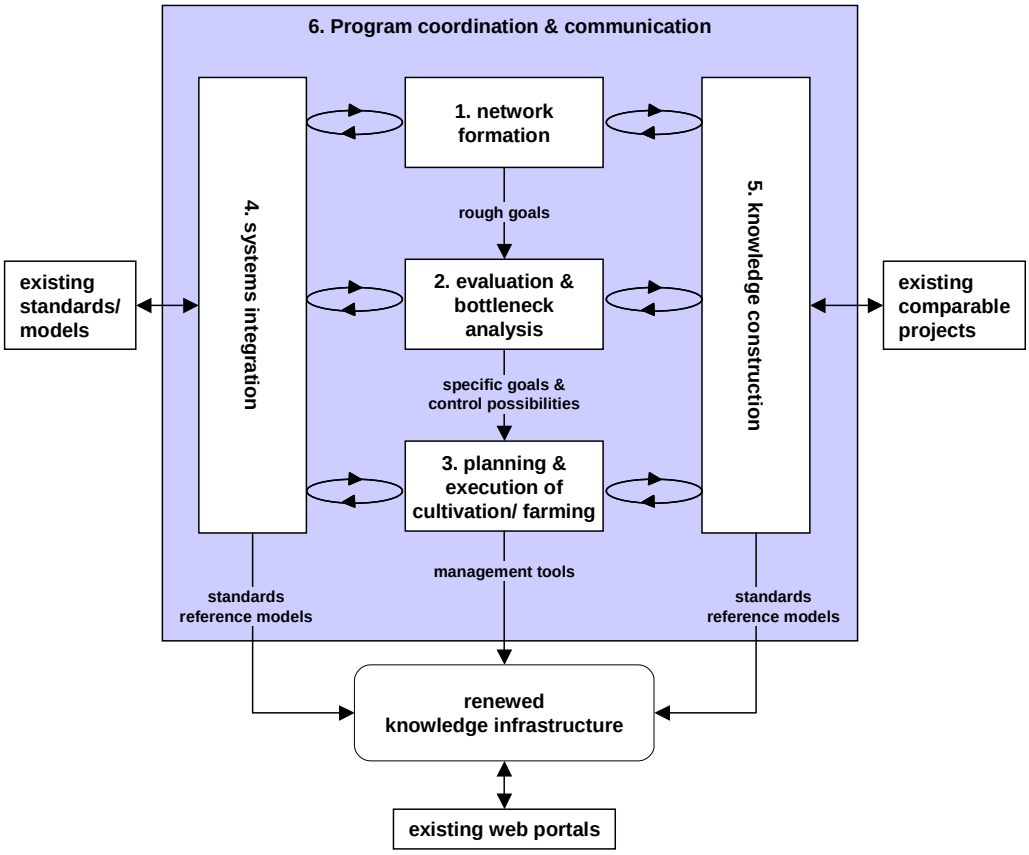

Fig. 2 Schematic overview of the program themes and their relationships

4 Discussion and conclusions

A programming study concluded that there is a strong need for management tools for arable farming that synthesize up-to-date knowledge and context-specific data. Main problems are the poor accessibility and applicability of research knowledge and the integration of data sources and existing management systems. The KodA program is going to work on these problems and tries to resolve them by guiding and facilitating three processes: knowledge construction, standardization and cooperation. Knowledge construction emphasizes the demand-driven process of management tool development and the direct interaction between all relevant stakeholders. Standardization is a must to do this in an integrative, and therefore effective and efficient, way. Cooperation between all relevant stakeholders is needed to develop the pre-competitive infrastructure that afterwards will be the right basis to stimulate competition between knowledge and service providers so that high-quality management tools for farmers are developed.

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