Multi layer networked development: how is stakeholder involvement successfully applied in ict development in agriculture?[1]

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Abstract

Adoption of ict for innovative purposes fails in many cases, because one tends to search for automated solutions too early in the process of change. For example a new means-ends relation needs time to be conceptualised, to be tried out and to be adopted into a (renewed) structure of a community of practice; respectively in the layers of a system. This paper describes the functions, methods and outcome in the phases of 1) conceiving will, 2) realising new routine, 3) building coherent social structures and 4) facilitating structures by automation. This methodology is being applied to several networks in the large RTD-program 'KodA' in the arable farming sector. Results from this case will be provided.

Key words: ict adoption, networked development

1 Introduction

The EFITA/WCCA conference in Portugal 2005 concluded that ict adoption in agriculture and rural development is still an issue (Gelb, 2005). For example, means have to be found and respected that end users are the key factor in defining needs, critical success factors, development and implementation (Parker, 2005). This article elaborates the latter conclusion, using the RTD-program 'KodA'.

In our time of information technology potentially a vast load of information is available or possibly to be generated. This information – is the assumption - could possibly contribute to the quality of decision-making. The question is which information to choose to support optimal decisions?

In this matter, the first question to answer is, what is an optimal decision? What information would be required for such a decision? The answer is that a context cannot be understood fully and a problem cannot be solved completely. Simon (1997) refers to this dilemma as *bounded rationality, which means that*:

a) knowledge in a certain situation is incomplete and always fragmented,
b) we cannot fully predict the consequences of certain choices, and
c) for practical reasons we can only choose and explore one or a few alternative(s).

These issues emerge in outsized when decision-making involves a sector, production chain or network. The information streams become unstable and optima are diverse for different stake holders and for the whole. This is due to changing contexts, changing minds, changing alliances, etc.

Information technology (ICT) is an excellent means to handle and stream large quantities of information. However, as discussed above, has to be put in perspective. Nevertheless many projects move into automation with high expectations, ignoring the common pitfalls:

[1] To be presented at the EFITA/WCCA2007 conference, 2 - 5 July, Glasgow, Schotland, www.efitaglasgow.org

a) the objective of decision-making is depicted as simple or too subjective. For example, assuming that maximisation of profit is always the main objective. Or
b) the process of decision-making is taken to be straight forward and stable. For example, assuming that stakeholders will take the right decisions promptly provided relevant information has been made available (internet, wifi, GPS etc.). Or
c) the complexity of the problem is neglected or masked. For example, a flashing ict-application shows in a polished way the possible alternatives.

How to avoid that in too early stages a step towards a (ict) solution is made?

Illustration from KodA

The research and technology development program 'Knowledge in the field of arable farming' – 'Kennis op de Akker', abbreviated as KodA, aims for a sustainable farm practice in the field of arable farming by putting knowledge into practice in an applicable way (Wolfert et al., 2005). In KodA, about 60 arable farmers and their suppliers and processors (about 12 large companies), work together to improve quality and efficiency of arable crop production. This co-operation takes place in so-called interactive learning networks in which the tasks for innovation are gradually implemented. It is a large program with a total budget of 8 MEuro, in a private-public partnership with the Ministry of Agriculture. In KodA, ict is seen as a key enabler to achieve the program's objective. By means of ict, the farmer is able to deploy knowledge, information and data in an efficient way. Development of integrated management support systems in which actual, state-of-the-art knowledge and farm-specific data are combined is regarded as a key prerequisite for further development.

Information is brought to the stakeholders in the sector for improved decisions, production, marketing and profitability to attain sustainable and competing arable farming. The call of the initiators of KodA was that the government would spend more money to achieve this. One of the high expectations was the contribution of ict. Public and private actors pushed to move into automation with priority. The ministry of agriculture for example reasoned as follows. Public financed research is our responsibility and thus making the output of it (mainly reports) available in an electronic way – including advanced search systems. This will do (mainly pitfall c). The private parties were not impressed and stressed that monitoring en sensing techniques in the fields require automation, so that large amounts of information become available in a convenient way (this is pitfall b). This supply surpasses the question about te required information for what objective.

2 The approach

Change is most times not a structured problem. Stakeholders may have different opinions about facts, interests and values. The objectives are not clear yet; leave alone the means to achieve the objectives. The approach is a 'heuristic problem solving cycle', it is incremental, step by step, trying and testing to shape gradually an improved and structured means-ends relation (Simon, 1977).

First of all the problem requires articulation and possible solutions are designed and weighed. Trying out, for example in a pilot, is a next step. The results are tested and the opinion may be that everything has to be done once again, or has to be cancelled, or in case the result is satisfactory that the pilot has to be adapted into the daily routines. When change applies to sector, production chain or network, the solution is more complex because means-end relations will diverge: when more stake holders are involved also more solutions will be required. Mutual and individual stakes may conflict and optimal solution for the whole may be hard to achieve.

Reflection on events in a number of learning networks did yield a number of insights. These are summarised in Fig. 1 and described below. The phases of maturity at innovation, are placed on an 2-dimensional co-ordinate system. The dimension of the x-axis ranges from a directive way of project organisation to an interactive approach. The dimension of the y-axis ranges from the situation in which the means-ends relation is vague to the situation in which this is clear. For each phase is indicated the objective, the main processes that take place and what kind of facilitators are usually involved. The central statement in this paper is that a sound route of a project, in which ict adoption plays a role, goes through all four phases. Our critique is that in reality, projects jump form phase 0 to phase 3 and quickly to phase 4 too often. The different phases are described in more detail in the text below

Phase 0: Mission impossible?

A ‘granted’ project often gives the false impression that a new perspective, a new routine and a renewed structure are available and that an ad hoc crew has to accomplish a defined task. Sometimes a ‘granted’ project indeed is a true project and can be organised as a true project. Most times however a project describes a camel’s nose – the procedure assumed in the project is a mission impossible. The project leader’s pitfall is to assume or negotiate a new perspective, a new routine and a renewed structure and do a neat job. The neat project result has no basis for support and the deliverable will end under dust on a shelf. The difficult and just way is to go back to the financer or client and propose a tactical procedure for the stages 1 and 2 in the diagram. In advance of the project steps may have been taken already or not at all, they may have been taken broad enough or fragmented. The challenge is to find a compatible continuation.

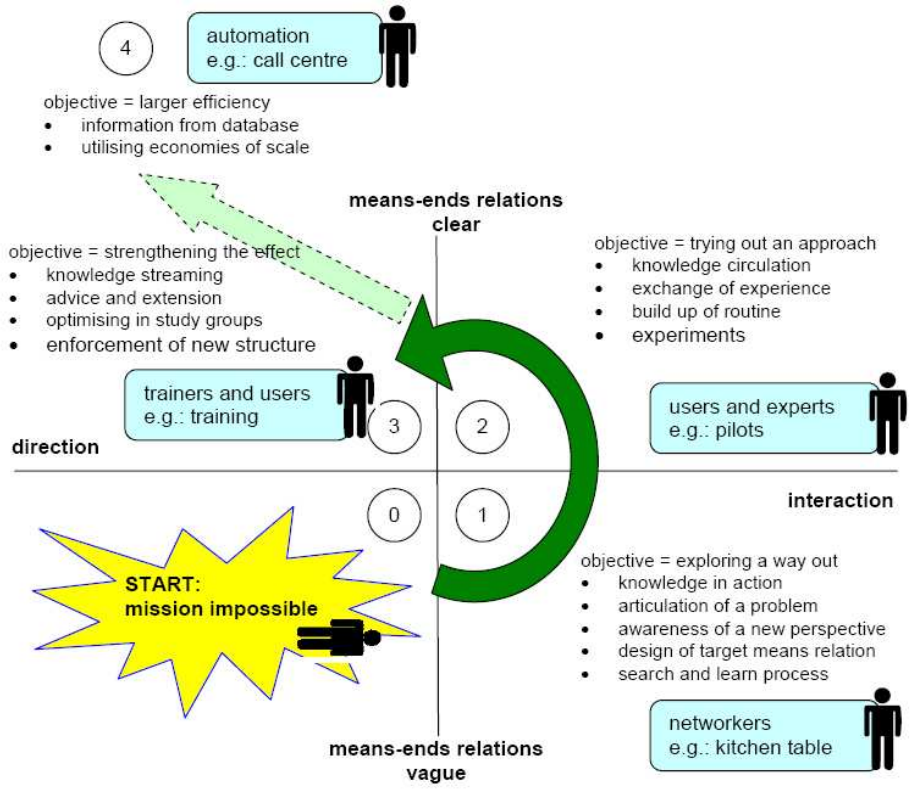

Figure 1: Phases of maturity at innovation

Phase 1: Conception of will

The origin of change is a feeling of unease or a promising thought of someone in a community of practice. Most time these signals are ignored, trivialised, phased out or banned from the community. This is the common battle field of emerging development. When signals are brought on the agenda of a community however the first step has been made in a process a change. This may result into a description of a problem or a challenge.

The articulated problem or challenge may be elaborated into a new perspective. Supporters of the perspective may be found. After this second step the learning and search process may continue and a means-ends relation may emerge. This is in course lines the development of content.

For several reasons broad qualities ought to be present in this phase. From the signal the community of practice may not have the capacity and knowledge to generate a valid problem definition, a challenging perspective and/or a promising means-ends relation. The requirements of production, organisation and government require a strategic, tactic and operational fit. The process itself should allow authentic learning – it is more or less a brain storm. That means that change of mind and attitude are allowed and encouraged. All questions and answers are valid, provisional, temporal and an aspect of quality.

Phase 2: Establishing a new routine

Once a means-ends relation has emerged, a community understanding the problem or challenge may be found to share the perspective and to support the target means relation. The objective of this group is to try in a pilot the means-ends relation. What is the result (can it be done?) and what is the effect (does it solve the problem or fulfil the promise?). The result is a routine to realise the means-ends relation. The routine utilises a new combination of insights and designs. The differentiation of work in the pilot shows the emerging required competence. Broad

qualities are represented in the pilot group. This is necessary for the performance and also for the quality of the ad hoc decisions in the course of the experiment. The process has the character of trial and error. The perspective from phase 1 is steering the pilot group. Reflection on temporarily result is possible by those that share experience. Interventions from outside should not interfere with this exchange of experience. Outsiders will ruin the knowledge creation.

Phase 3: Upgrading a structure
In this phase the 'old' organisation is at stake. A major go no-go decision is required once the new means-ends relation has been tried, the results and effects of the change are known and the required new routine and competences are clear. In case of a go, the structure of the 'old' organisation needs to adapt to the structure emerged from the pilot. At this phase it is important that governors and managers have been involved in the interactions of phase 1 en 2: in vertical networking. They need to be bearer of experience to construct effective and efficient provisions at their levels. A good architecture of innovation provides *the establishment of multilayer networks* in this stage; a prerequisite is the participation in phase 1 and 2. The new networks need to scale up the innovation in their layer of the organisation or system. This is the point where the also a common 'granted' project is plugged in.

Phase 4: Upgrading efficiency
The changed structure – once established, with articulated insights, designs, routines and competences – may be harbour opportunities for the utilisation of economies of scale. In the realisation of this opportunity the automation expert gets the lead and his full load.

Illustration from KodA:

KodA started off as a mission impossible. The objective – a sustainable, competitive agriculture and the means 'knowledge supported by a combination of ict-tools' was vague indeed. All participating parties fancied own images of this. By means of individual talks and sessions in groups attempts were made to headlight the general objectives in six themes:

1. efficiency improvement
2. quality improvement
3. sustainable management through optimal information supply
4. knowledge production
5. integration and standardisation of ict
6. collaboration

From January 2006, networks of representative groups of stakeholders have been established for each theme. The objective of change (innovative task) and the means (agenda with critical situations) have been drawn up in these networks. This will be described in detail in the next paragraph. From that point pilots and smaller working groups, sometimes supported by experts worked out ideas and tried out plans. This yielded concrete (combinations of) insight, design or competence. The results from pilots were broadened in study groups and when possible incorporated in existing or new ict-applications.

After one year, the results from phase 1 – the conceptual work on the means-ends relation – proved to be a stable touchstone for the evaluation of steering and quality. In spring 2007 most activities in KodA encompass a second cycle of knowledge production in phase 2 or 3. Is has been observed that a small number of people participate in a group through the stages 1, 2 and 3. These bear the experience knowledge from the scratch and they secure on basis of personal union the exchange of experience. This is the stabilising aspect of group dynamics; the innovative aspect is secured by the participation of new stakeholders.

3 The method

The application of the approach described above requires a mutual sense of quality. The basis for such a sense of quality is a means to measure the maturity of innovation. *To realise an innovative task, maturity is defined as the degree in which critical situations are solved.* Measurement of the maturity of innovation provides a concrete basis for tailor made follow up actions. The measurement is also the basis for multi-layered networking – the measurement informs the diverse levels of differentiation.

The first step in the communication of quality is the application of a differentiated knowledge concept. An important set of basics elements of knowledge differentiation are describes in Table 1.

Table 1: Four knowledge products (Geerligs et al, 2005)

Question	Knowledge product
Is it true?	Insight
Does it work?	Design
Is it useful for a community?	Routine
Are individuals competent to do the job?	Competence

An *innovative task* becomes operational in the form of appropriate routines of a working community. The routine generates the required use or value. When communities of practice cooperate in a production chain they follow conventions. The conventions describe required qualities and quantities and also a key for the division of the added value. At a meta level the cooperating communities of practice will share a perspective: "What do we realise together?"

To realise a perspective and the underlying conventions and routines, a number of thresholds need to be surpassed. The thresholds are *critical situations* that need to be solved for the benefit of an innovation may be may with approached with (new) combinations of (new) competence, designs and insights.

In a stable situation a system will have a consistent set of perspectives, with conventions and routines, on basis of a common combination of competences, designs and insights. The knowledge base is a common thing for those involved. At change discrepancies may occur at each aspect of the knowledge base.

Figure 2 describes a state of the art. What do we have right now and what is the picture of the future. The arrows enlighten relations and not process flow. Technology push for example takes a future design as point of departure. A policy plan very often is a description of a politically desired new combination of insights & designs. An entrepreneur in trouble may blame the market (conventions) or the culture in his enterprise (routine). KodA shows in 6 themes that an innovation may originate from any field.

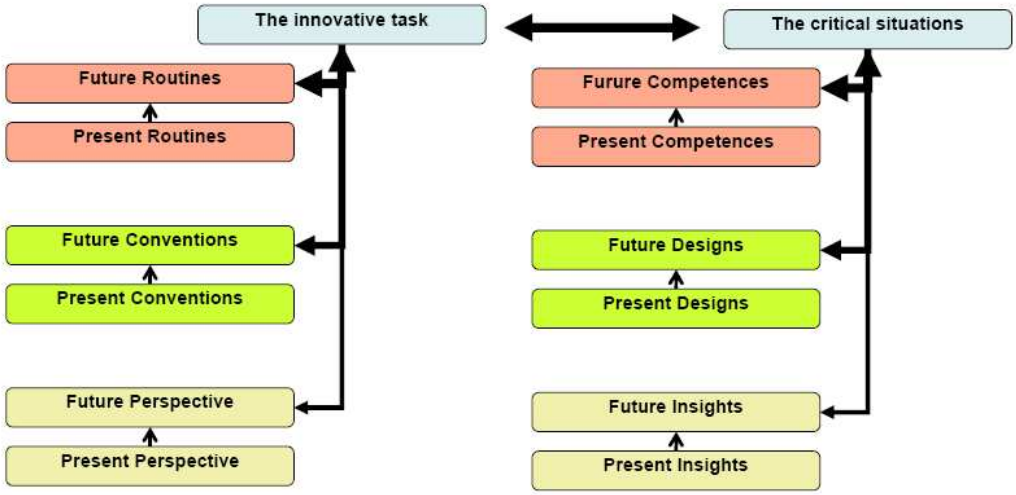

Figure 2: Indicator of maturity of innovation

Illustration from KodA:
The methodology was applied in several networks of the KodA program. The inventory required one or two workshop sessions per network and good communication. Available were clearly described new perspectives and innovative tasks and a description of the agenda of activities. This provided a basis for a number of pilot projects. Results of the inventory for KodA theme 3, sustainable management through optimal information supply, are presented in Table 2 and 3. They are based on a one days meeting of a network of arable farmers, researchers and connected stakeholders. By means of programmed communication and focussing exercises the innovative task for this theme has been established.

Table 2: The innovative tasks for sustainable management through optimal information supply

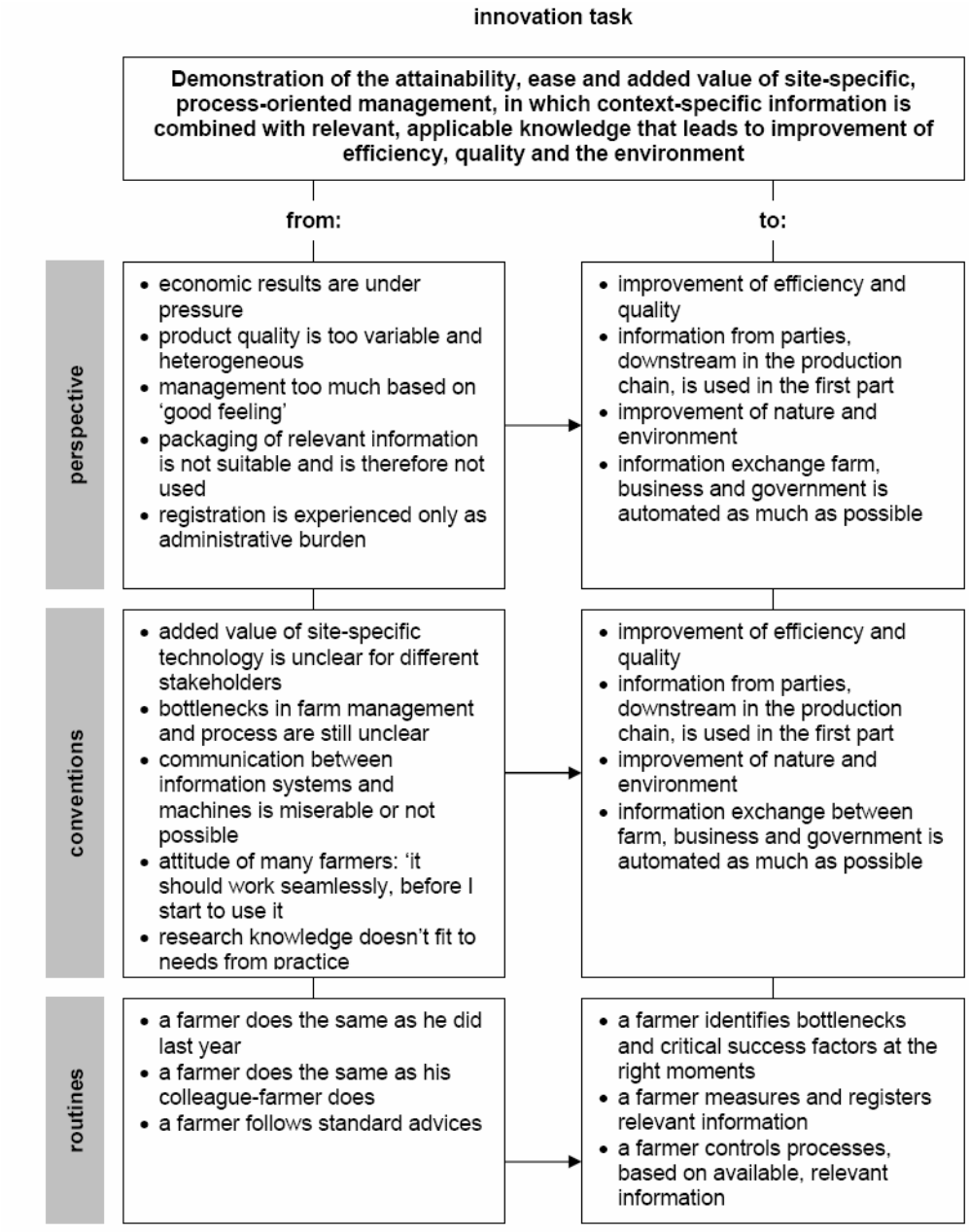

Table 3: The agenda with critical situations for sustainable management through optimal information supply

agenda (critical situations)

How is context-specific information combined in the management process with relevant, applicable knowledge leading to improvement of efficiency, quality and the environment?

competences	designs	insights
• be able to identify the right questions for a farm-specific context • be able to find the right information and valuate it • be able to translate information from the downstream production chain to the farm management • information development and supply that is tailored to the needs of the target group	• sensor-based precision agriculture: combining on-site detection and measurements using GIS • system for quality assurance based on tracking and tracing • integrated management environment ('cockpit') for measuring and control • customer-driven internet portals where information is combined in a smart way • discussion forum for exchange of knowledge and experience	• effects on efficiency, quality and environment of site-specific management • how is information absorbed • how is information translated into acting

4 Conclusion

Relevant points derived from the described approach are the following:

- common project management excludes vital points of innovation management;
- budgets for change need to be labelled as the innovation matures in the course of development towards emerging relevant critical situations;
- urgency and concern about critical situations trigger knowledge production and utilisation, while long lasting subsidiary trajectories are killing the initiatives;
- innovation is often a long path and throughout the process persevering carriers of perspective and experience are the most important success factor;

and as a result of these observations:

- for the success of innovations its more important to put effort in the selection and training of leaders with the right agenda, rather than putting effort in description of detailed project plans with testable criteria – these criteria are likely to be obsolete in short time and to hinder necessary flexibility.

Early stages of new development require articulation of a problem, followed by awareness of a new perspective and design of a new means-ends relation. A new means-ends relation requires a try out. In case of deep change this is a process in which the common structures and common information may loose meaning and significance.

This early stage of development requires melting pots combining all possibly required qualities; development is to be enhanced at the individual level, the level of working communities and the level of networking, and also the layer of operation, management and governance. This conception of new development enables innovators to employ anticipative and constructive initiatives to establish multi layer learning networks. From these networks standards of performance for continuous evaluation need to be derived to give proper feed back to the leaders of innovation.

In multi layer networked development, there is a sound basis for support which is crucial for adoption of ict. The automation expert is needed in all stages of emerging change. He may be the bearer of a feeling of unease or challenging idea on the battle field of innovation. He may have a role in an impossible mission. He may contribute in the phases 1, 2, 3 and 4. And only in phase 4 he can employ directly his back office expertise. In all the other phases he is a guardian of the perspective, of the target-ends relation, of the new routine of the new definition of structure. The leaders of change need to organise these roles and safeguard quality in each step.

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