
Learning Entrepreneurs: learning and innovation in small companies

PATRICIA M. GIELEN, AIMÉE HOEVE &
LOEK F.M. NIEUWENHUIS

Stoas Research, Wageningen, Netherlands

ABSTRACT This article concerns agricultural entrepreneurs involved in organising their learning so as to develop innovative and learning enterprises. In hi-tech sectors, such as Dutch agriculture, this learning and innovative capacity is particularly essential for economic survival. Reviewing the literature, we conclude that innovation can be seen as informal learning processes, in which social networks play an important role. Workers learn by sharing knowledge in the working team and employers learn by creating networks of colleagues and advisers. The results of two research projects suggest that interactive learning and innovation should be analysed from a perspective of uncertainty. Learning skills for interactive innovation, as part of the entrepreneurial craft, should comprise the capability of selecting impulses and combining newly selected impulses with existing skills and routines. Paradoxically, they need new impulses from weak, unknown networks to be continuously innovative. Innovative learning involves balancing the chaos of uncertainty with the old grooves of experience. Knowing how to escape this paradox forms the core competence of innovative entrepreneurship.

Introduction

This article concerns agricultural entrepreneurs involved in organising their learning so as to develop innovative and learning enterprises. Within small companies, the entrepreneur has a pivotal role in the innovative process: the entrepreneur is the professional learner. In hi-tech sectors, such as Dutch agriculture, this learning and innovative capacity is particularly essential for economic survival.

Innovation is a complex process, based on interactive network learning and processes of trial and error on the shopfloor. Small companies are dependent on external knowledge infrastructures for effective innovation. In the middle of the last century, the agricultural knowledge infrastructure in the

Netherlands was organised as a linear innovation model, in which research outcomes prescribed the way farmers had to produce. This resulted in one of the most successful agro-systems in the world; the only problem was its dependency on European and national protection policy. Now, under pressure from the World Trade Organisation (WTO), the European farm policy changes and consequently Dutch agriculture has to become market led. Farmers have to become innovators themselves instead of implementers of science-led government policies.

Learning and innovation as major parts of entrepreneurship are central to the argument of this article. How do farmers learn and innovate within a market-led agriculture and how should government policy support and facilitate innovation, avoiding the pitfall of protectionism? In the first section we sketch the development in the Dutch agriculture knowledge system, followed by a theoretical section on innovation and learning. In the third section we present the results of two research projects looking at the learning processes of Dutch farmers related to innovation strategies. The last section provides some conclusions and recommendations for further research.

Developments in the Knowledge Infrastructure of Dutch Agriculture

Within Dutch agriculture, links between the educational system and the economic system have existed since the emergence of agricultural education around the turn of the twentieth century. During the decades following the Second World War, these links developed into a system: the OVO triangle (Onderzoek – Voorlichting – Onderwijs, in English, Research – Extension – Education). The logic of the OVO triangle is based on the ‘scientification’ of agriculture, the ongoing reorganisation of agricultural practices, according to models designed by the agrarian sciences (Van der Ploeg, 1996). These models were delivered to farmers by an extensive government extension (information) service and a separate educational system. The system was legitimised by the linear modernisation paradigm that dominated Dutch agricultural policy. The central idea of this policy was that small and inefficient farmers should disappear and that large, promising farms had to be supported (by import protection, export subsidies and guaranteed prices). Entrepreneurs derived their parameters largely from an agricultural policy supporting generic new technologies to enhance productivity (Van Dijk & Van der Ploeg, 1995).

The OVO triangle proved its value, contributing considerably to the success of Dutch agriculture and making the Netherlands one of the largest ‘agro-powers’ in the world (Vijverberg, 1996; de Bruin, 1997). However, this model is no longer so successful as a result of recent developments. One important development is the recognition that, ‘the practice of farming is not to be understood as a more or less linear derivation of the “logic” of the market, or as a straightforward application of external technological designs. Markets and technology create specific room for manoeuvre that allows for differential positions’ (Van der Ploeg & Saccomandi, 1995, p. 15). Empirical

studies by Wageningen University show a variety of strategies, based on rational choice, which ensure a reasonable income. This recognition challenged one of the major principles of the OVO triangle – that there is one ‘best’ farming practice – and therefore the need to transform the agricultural knowledge system.

This need for transformation has been strengthened by economic and sociocultural change. In the 1990s, Dutch agriculture was faced with a severe crisis. Due to WTO pressure, the European Union was forced to reduce the economic protection of agricultural markets, which led to deteriorating incomes in the sector. The crisis was aggravated by growing public concern with health issues, increasing environmental awareness in European society, combined with serious food production scandals (see the recent disasters of bovine spongiform encephalopathy, swine fever and foot-and-mouth disease). Moreover, in the 1990s, the negative consequences of the modernisation policy became evident in overproduction, a continuous fall in the level of agricultural employment and increasing social demand to produce food without environmental, health or animal-welfare scandals.

Policy makers, sector representatives and scientists agree that structural changes in the current mode of production are needed, that is, farmers are expected to produce for a more competitive market and meet the growing public demand for quality-oriented and environmentally sound production. To be able to meet these demands, farmers need social and economic incentives. The latest policy document from the Dutch Ministry of Agriculture (2000) emphasises the need to stimulate ‘modern agro-entrepreneurship’. According to the Ministry, the two main conditions of modern entrepreneurship are economic autonomy and socially sound management. This new policy orientation thus no longer legitimises the need for an extensive government-supported OVO triangle. During the 1990s, a large part of the OVO triangle was privatised; knowledge was no longer considered to be a ‘public good’ that should be provided free of charge by government services.

Learning as the Basis of Innovation

Innovation is important for the competitiveness of enterprises and industrial sectors. In the 1920s, Schumpeter (Brouwer & Kleinknecht, 1994) formulated the process of creative destruction, in which enterprises with old-fashioned products were ousted by enterprises with new products. Innovation and technology development are the main tools for surviving this dynamic process. As the design of the OVO triangle shows, national and European policy makers believe in massive investment in technically oriented research programmes as a major impulse for innovation in industrial sectors. The production of new knowledge and technology is the prime target of these programmes, which are predicated upon the usefulness of the results of research for companies. A linear model (from research, through technology development and dissemination activities, to application on the shopfloor)

forms the main line of thought in these investment programmes. From this perspective, the learning needed on the shopfloor can be characterised as adaptation to new technology.

In practice, innovation is by no means a linear process (cf. Kline & Rosenberg, 1986). On the contrary, it is characterised by complicated feedback mechanisms and interactive relations involving science, technology, learning, production, policy and demand (Edquist, 1997). The innovation process can be regarded as a learning process at organisational level. This becomes clear from the vocabulary used by industrial scientists to describe innovation (for example, concepts such as 'organisational learning' and the 'learning organisation'). The learning organisation creates the conditions to enable its members to learn and an important characteristic of learning at an organisational level is alignment, a group of people functioning as a whole (the shared vision becomes an extension of the personal visions of its members [Senge, 1990, pp. 234-235]).

A central characteristic of innovation is creativity. Innovation involves the solution of ill-structured problems, requiring a creative solution (Dosi, 1988). But creativity alone leads to an invention and not innovation; an invention only becomes an innovation when it can be replicated reliably on a meaningful scale at practical costs (Senge, 1990, p. 6). Hurst (1995) emphasises that in order to survive organisations need to combine the learning and the performance loop. New practices in an organisation created in the learning loop have to be transferred to a performance context to be of use for the survival of the organisation. The learning loop is characterised by action outside the context, the performance loop by action within the context. Thus, innovation requires both first-order (in the implementation phase) and second-order learning (in the creative phase).

Any innovation process thus involves both a creative and a performance phase. Therefore, the central issue for an innovative firm or learning organisation is combining 'exploitation' and 'exploration' (Nooteboom, 2000). Exploitation means that people and organisations try to use their available competencies and resources efficiently, in order to survive in the short term. Exploration means that people and organisations aim to discover and develop new competencies, in order to adapt and survive in the long term. Nooteboom argues that these dynamics can only be explained by addressing the fact that in economic systems people construct mental or other models of nature and markets with which they develop speculative arguments, based on experience about possible futures and possible effects of innovative actions. They think, communicate and learn. Therefore, we should turn to theories of knowledge, learning and language (Nooteboom, 2000).

It is the people in the innovative firm who learn. In small companies, such as in the agricultural sector, the entrepreneur has a crucial role as s/he has a vital influence on the development of the company. In order to ensure the economic survival of the firm, the entrepreneur needs to interpret and

anticipate changes in the socio-economic environment. Through this learning process, an innovative strategy for the company is shaped.

As a result, the focus of knowledge management is now on people (and their learning processes) in the organisation (Brown & Duguid, 2000). The learning that takes place *in* the workplace, in the practice, is of significant importance. We see learning no longer as an individual activity that takes place outside the workplace but as an integral part of the workplace, embedded in the activities of practice. Most learning in the workplace is believed to take place informally, that is, learning which results from the natural opportunities which arise in a person's daily working life (Marsick & Watkins, 1990). Informal learning can be planned or unplanned and involves some degree of conscious awareness that learning takes place (Van Woerkom, 2003); it includes incidental learning, which is defined as a by-product of some other activity (Marsick & Watkins, 1990). The value of this term is that it draws our attention to the fact that work is an important source of learning.

Although it is the individual who learns, learning is not purely an individual process. Individual learning should be viewed not as learning utterly devoid of social contexts, influences and participation but as learning in which the factors of social mediation have relatively less, rather than more, presence (Salomon & Perkins, 1998). In innovation processes, knowledge and technology are exchanged within the networks of collaborative companies and institutes. Companies need to collaborate with other companies and knowledge institutes. This is especially the case for small- and medium-sized enterprises (SMEs) because they do not possess large internal knowledge sources. For effective innovation, SMEs have to use external knowledge sources.

The external knowledge context is complex for SMEs. The entrepreneur or employer, with his or her skilled employees, is involved in problem solving and innovative processes. In the first instance, the entrepreneur looks for internal solutions but, very soon, external sources will be used too. On the one hand, professional journals, financial advisers, suppliers and customers will bring in new knowledge, either deliberately or accidentally, whereas on the other hand, companies will be continuously looking for new knowledge sources. An interactive exchange of knowledge will thus develop around internal company processes. The enterprise is embedded within an expanding knowledge space. The knowledge space surrounding companies is multidimensional and at least three dimensions can be discerned: the product chain, the professional sector and the socio-economic region.

The product chain dimension points to the relevance of user-producer and producer-buyer relations. Enterprises exist within product chains. They need raw materials, tools and machinery to be able to produce their products and services which, in their turn, should be tuned to the specific needs and requirements of their customers. Chain management is an important new field of business management, focused on inter-company relations: product accountability, quality information exchange, logistics for transportation and

stock keeping are major subjects in this field. Knowledge development and collaborative innovation should be part of chain management; sources of innovative activities are not always located within the producing enterprise (Von Hippel, 1988).

The sectoral (or professional) dimension indicates the exchange of knowledge between competing companies. In many cases, common interests exist, pushing competitors into collaborative, innovative activities. Based on cooperation between companies, sectors should be able to build sector-bound infrastructures for technology transfer and training policies. Sectoral challenges to facilitate innovation and learning processes are: establishing preconditions for collaboration between competitive enterprises in the field of training and innovation, building future-oriented monitoring systems for technological development, building support systems for company-bound innovation and training, defining key competencies for skilled workers and entrepreneurs and creating sectoral ownership for innovation and training systems.

In the spatial dimension, knowledge exchange is seen as a process between companies in the same region. Direct contact through observation, discussion and shopfloor visits is an important feature of knowledge exchange. Morgan (1997) emphasises the importance of creating learning regions, analogous to the concept of learning organisations, such as building up collective learning capacities between geographically related enterprises and regional infrastructural provisions. Strong industrial districts seem to be characterised by learning interrelations between enterprises. Other emerging regions are characterised by chain relations: the exchange of innovation and information is related to purchasing and selling activities. These kinds of learning networks are strong because of their protective impact on economic activities. The challenge for local authorities is to establish labour market policies which will lead to high-level learning potentials and create networks of fledgling entrepreneurs as a part of their economic policy. Innovative training provisions could lead to an improvement in innovative capacity within regional economies (Cooke et al, 2000) and, by so doing, give an impulse to regional economic development.

The Innovative Entrepreneur is a Learning Entrepreneur

In summary, innovation can be seen as informal learning processes in which social networks play an important role. Workers learn by sharing knowledge in the working team, and employers learn by creating networks of colleagues and advisers. Within the traditional OVO triangle, farmers had to follow the prescriptions from the research agenda by adaptive, programmed learning. The 'neue Combinationen' from evolutionary economics (Schumpeter's basic concept) should have a counterpart within learning theory: creative learning (Ellström, 1998), expansive learning (Engeström, 1994) or Q-learning (Revas, in Marsick & Watkins, 1990; Q stands for learning through questioning, as

opposed to P, for programmed learning). These are forms of learning in which the learner is free to question the definitions of learning tasks as posed by the context: entrepreneurs who should be able to define or redefine the innovation task based on what they receive from their networks. Agricultural entrepreneurs have to develop flexible expertise (cf. Feltovich et al, 1997), based on a complex world view (Feltovich et al speak of World Two, which is continuous, simultaneous, organic, interactive, conditional irregular and multiple, in contrast to World One, which is static, sequential, mechanistic, universal and linear). Entrepreneurs should particularly be able to detect the irregularities in the world around them and to balance stability and flexibility.

Research on the Learning of Dutch Agricultural Entrepreneurs

Based on the theoretical framework presented above, we developed a research programme on the innovative learning of entrepreneurs. Innovative learning, consisting of both creative and adaptive learning, is embedded in strategic action for organising the knowledge context of the firm. The availability of external knowledge sources is vital for innovative learning. This leads to the question 'How do farmers organise their external networks and their own learning processes in order to deal with the dynamics of their socio-economic environment?'. To answer this question, we conducted two research projects.

Gielen & Jager (2001) studied the professional learning and searching processes of agricultural entrepreneurs. The general idea is that permanent antennae focused on external developments are a prerequisite for the survival of an enterprise. In this exploratory study, nine farmers were interviewed in depth on their activities in searching for company-relevant information. These nine farmers were not selected for a specific innovative stage; they were simply practising farmers. However, almost all the interviewees had been involved in important innovations during the previous year.

In a follow-up research project, Hoeve & Drost (2002) focused on the learning of farmers in relation to their innovative strategies. In this study, information was gathered through a survey of 752 agricultural entrepreneurs, followed by 15 in-depth interviews aiming further to clarify and illustrate the survey results.

The following sections present the results of these research projects.

Knowledge Sources and Learning Processes of Entrepreneurs

In general, farmers are actively looking for new information and knowledge. Three main reasons for this behaviour could be discerned in the interviews: general orientation, realisation of enterprise goals and solving of techno-organisational problems:

- With regard to general orientation, entrepreneurs try to keep their eye on developments in their markets, within their sector and in society in general.

They need to know what is happening in their economic environment. It helps to define a strategy for the enterprise and gives information on problems within the company which have not yet been detected. All interviewees were aware of the need for an open mind about external events.

- Specific information is gathered on technological and market aspects. For example, greenhouse farmers need daily information on price developments at the auction and specific technological information for the improvement of processes and products.
- Unlike the first two reasons for seeking information, problem-solving activities are narrowly targeted. Journals, networks and databases are used to look for specific solutions. For technical problems, the knowledge infrastructure offers rather good information; for marketing problems, the interviewees reported that they had to search much more independently.

Besides these three reasons, most of the interviewees also mentioned that they were just eager to know about new developments; they had a 'natural' tendency towards learning activities. There is also, however, a far more 'negative' reason to seek information and knowledge; a wide perspective on available information and knowledge is needed so as not to miss any crucial information. Missing information is seen as a real threat but at the same time the entrepreneurs know that it is not possible to keep up with the full range and variety of information.

The most important sources of new information are specific journals, fellow farmers, competitors, suppliers and customers. These sources were mentioned as very reliable. Training, extension and fairs were also mentioned but not considered very useful. Research and technological institutes were rarely mentioned; the 'mental' distance was too great. Information was looked for both locally and internationally, depending on the problem. Most of the interviewees were not afraid of looking internationally; they had a rather professional way of searching for new information.

Networks of colleagues, based on a sectoral perspective, were mentioned as one of the most powerful sources of innovative information. Participation in these networks was seen as a normal activity. Farmers use different networks for different types of knowledge fields: financial, social, technical and political. Long-lasting network contacts are mostly quite informally organised. The information exchange is based on a 'gentleman's agreement': you only can participate when you are seen both as a recipient and a provider of knowledge. Entrepreneurs are seen as a source of powerful information and knowledge and they are aware of the economic value of that knowledge. In former times, farmers' networks were quite publicly organised, because of governmental financing of these activities. Recently, in the last decade, some of these networks have turned into closed organisations; the competitive advantage of the knowledge exchanged is too great for open publicity.

Almost all the interviewees had been involved in important innovations during the previous year. Some of them were early innovators, others were adopting innovations from elsewhere. The product market was the most important impulse. Innovations were technical, market oriented and socio-organisational. (In this last category, for example, father-son successions are solved imaginatively.) Internal solutions were sought first, before looking externally. One interesting observation was that important learning experiences were not gained from theory (technology, new knowledge) but from learning processes (new ways of finding innovative information). There was also an interesting realisation afterwards that not all problems had been seen correctly; professional experience seems a relevant predictor of this.

Sources close at hand were used the most frequently: suppliers, colleagues and journals. Employees were not often seen as an important source of information; knowledge is concentrated in the entrepreneur.

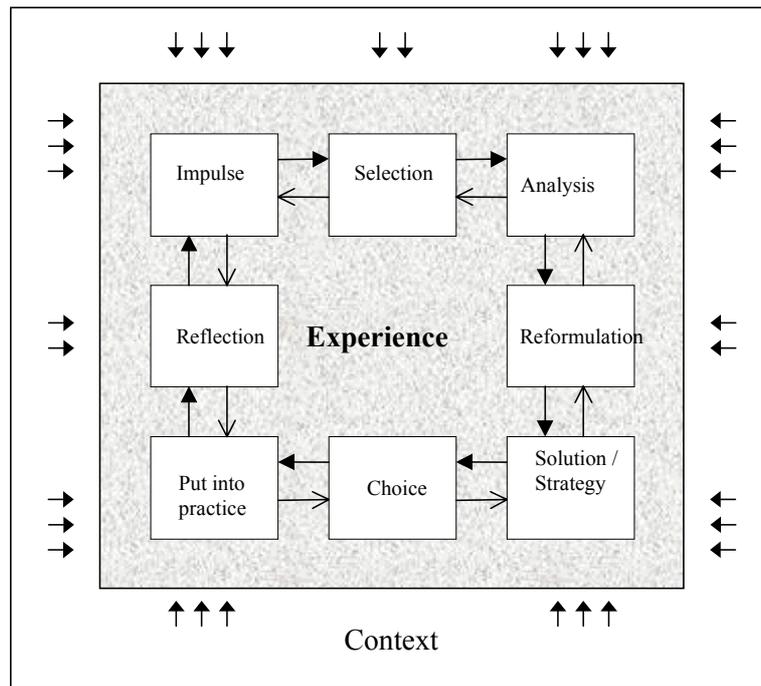


Figure 1. The entrepreneurial learning cycle. (Source: Gielen & Jager, 2001.)

The interviewees mentioned a kind of circular problem-solving strategy. In first instance, some stages were skipped (e.g. analysing the problem or formulating solutions). The first learning cycle can be characterised as trial and

error. Later on in the process, all stages were used more frequently. Time and money are crucial restrictive factors for the way learning cycles are finished properly.

Surveying Problem Contexts

In the follow-up research project, 752 farmers were questioned through a telephone survey to gather data on innovative activities and the use of knowledge sources of agricultural entrepreneurs.[1] A structured survey is not a good research instrument for gaining insight into learning processes; however, the data gathered provide information about the frequency with which farmers are involved in complex change processes (and thus need to learn) and the nature and frequency of contacts with others in the learning process.

Orientation on developments	% farmers
Marketing and sales	64
Consumer trends	63
Human Resource	39
Development	
Technology	75
General social developments	88
Agricultural policies	87

Table I. Fields of orientation.

The survey reveals that farmers find it important broadly to orientate in relation to socio-economic developments. Table I shows the percentage of the farmers who actively do this. The results of this survey confirm the observation of the explorative study that farmers in general are involved in innovative activities. Almost 56% of the entrepreneurs can name an actual innovation implemented on the farm. Most innovative activities undertaken serve to improve the production process through introduction of new technology, improvement of production circumstances (for example, greenhouse climate, housing of animals, working conditions) and introduction of new methods of production. Also, the changeover to another subsector in agriculture is mentioned frequently.

The nature of the innovative activities implies that entrepreneurs consider an activity as innovation if it is new to the farm, even though it is not new to the sector or market. So, in general, the activities undertaken are not innovations in the classical sense of the concept. Cobbenhagen (2000) points out that innovations that are only new at company level have a major impact on the organisation of production. As a consequence, the workers need to adapt to a new production situation and thus go through a learning process. This is confirmed by in-depth interviews undertaken afterwards to clarify some of the survey results. The entrepreneurs interviewed make clear that any

renewal activity, innovative or not, still calls for an intensive learning process. The survey also shows that only 18% of the innovating respondents replied that the innovation was externally developed and implemented without modifications. In general, innovative action thus involves creative thinking, ranging from creative new ideas to creative adaptations of existing technology. On basis of these results, it seems justified to conclude that the majority of the farmers are involved in complex learning processes.

In general, the results show that innovation is a social process in which knowledge is exchanged within the networks of collaborative companies and institutes. Almost 58% of the innovating farmers cooperate with others. The most important co-innovators are colleagues and suppliers (both parties are mentioned by 45% of the innovating respondents). Nature and frequency of contacts differ for the different stages of the learning cycle (see Figure 1). The results show that in the first stage of the learning cycle (observing the impulse), farmers try to take a broad view. The next step is the idea-generating phase in innovation. This entails the next four steps in the learning cycle: selection of the impulse, analysing, reformulation and strategy formulation. Forty-four per cent of the innovating entrepreneurs say that the idea for innovation is developed in cooperation with other parties.

Level of decision Parties involved	Operational decisions	Strategic decisions
Colleagues	74	58
Supplier companies	74	53
Buyers and customers	56	42
Bank		74
Centre for Innovation	9	10
Extension services	43	39
Institutes for applied research	31	20
Research institutes/universities	32	22
Agricultural VET colleges	19	10
Others	28	31
No answer	1	2

Table II. Percentage of farmers contacting the parties listed in decision making.

We asked the farmers whom they consult in decision making on operational and strategic decisions. The results are shown in Table II. In general, we conclude that farmers are eager to have a broad perspective and are open to spot technological, socio-economic and political changes and chances. However, they limit their information sources mostly to colleagues, direct partners in the production chain (especially suppliers) and, for strategic vision, the bank. In all stages of the learning cycle they seem to cling to strong contacts; they hardly make use of weak contacts, which in the innovation literature are seen as an important source of innovative ideas (cf. strong links and weak links for innovation in Elfring, 1999).

Back to the Process of Learning: in depth interviews

In the last stage of the follow-up research we interviewed 15 farmers to gain insight into the way in which they organised their learning process in an innovative activity. The results confirm our conclusion based on the survey that farmers wish broadly to orientate themselves in relation to a wide range of socio-economic developments but consult a limited number of sources. The farmers use specialist journals to stay up to date with the general developments in technology, policies, consumer trends and societal trends. Moreover, they use the specialist journals to filter the broad flow of information on what is relevant for the sector and/or their own business (first selection of impulses). Next, they go through the learning cycle to choose the impulse on which they will take further innovative action. This is a fairly unconscious process which, as one of our interviewees stated, takes place 'while you are working'. However, there appears to be a division between small and large companies. In the large companies, the entrepreneur is no longer bothered with practical executive tasks and therefore has the time to think explicitly about the consequences of ongoing developments for the company.

In this process, the ongoing developments in the medium term are interpreted in terms of the consequences for the position of the business in the market. The entrepreneurs interviewed are eager to maintain (or slightly improve) their current market position, and thus try keep up with technological possibilities, comply with requirements set by markets (in terms of quality of the products) and society (such as demands on animal welfare and environmental legislation). Four respondents can be characterised as front runners but most do not strive to be far ahead of the others; that strategy is considered to be too risky. In other words, innovative action is not so much inspired by strategic vision and aimed at novelty but determined by the need to balance risk and continuity. At this stage, the learning cycle is not followed perfectly; the farmers go back and forward and steps are skipped. One of the interviewees points out that this process can take years. At this stage, colleagues and advisers from supplier companies are important in the exchange of knowledge. Learning networks with colleagues are changing into more closed systems for knowledge transfer. When products were sold by public auction, there was not much competition between companies. Nowadays, more growers have contracts with supermarkets, which has led to the emergence of grower corporations with more closed knowledge systems. Several interviewees consider this a bad development. One expressed his concern as: 'Growers in a corporation in the end all perform according to standardised procedures. We all do and think the same and there is not much left to learn from each other.' To avoid being blinkered by the focus of one's network, the front runners participate in several networks.

Once decided upon what action to undertake, the entrepreneurs are very conscious of their learning and may go backwards and forwards through the learning cycle. However, at this stage, these are conscious moves. Colleagues

are often partners in innovation (especially in the grower corporations) and therefore partners in learning. Other important learning contacts are partners in the production chain (especially suppliers) and the bank (as financing partner).

A striking observation is that internal sources of knowledge are hardly used. Although, in horticulture, seven out of nine businesses employ 10 people or more, only family members and co-entrepreneurs are consulted in decision making and problem solving processes. One respondent was aware of the potential of using the knowledge of the workforce. We can conclude that agricultural entrepreneurs are very capable of organising their own learning process but lack the competence to organise a learning process at organisational level.

Based on the interviews, we conclude that really innovative entrepreneurs, the forerunners, distinguish themselves from the followers because they create the organisational preconditions (especially time) consciously to organise their learning and because they ensure participation in different networks.

Conclusions: learning as an entrepreneurial craft

Entrepreneurship seems to be synonymous with learning. The results of both research projects show that agricultural entrepreneurs are open to new knowledge and developments and they are eager to organise their knowledge networks. They mention a constant flow of learning activities and they have to select actively which external impulses to follow. In this selection process, and also later on in stages of the learning process, the farmers relied on the opinions of the entrepreneurs in their network. Naturally, solid links within old networks were more important than weak links in new, developing networks. This created a dilemma between routinising learning and the need for new, surprising impulses. There seemed to be individual differences among the farmers in positioning themselves within this equilibrium.

Investing in knowledge networks involved providing and obtaining information; participation in knowledge networks involved a gentleman's agreement. A higher degree of market orientation within agriculture involves more protection of innovative knowledge. Eventually, this will lead to the exhausting of the knowledge networks because they will function as closed shops. The public knowledge infrastructure should help to avoid this market failure.

The application of new technologies is not easy to achieve from outside the companies. Adopting new technology requires interaction between research and development and the enterprises. More linear communication channels, like journals, are used to select information. However, this linear information transfer does not seem to be sufficient to change the behaviour of the farmer. When the entrepreneur is deliberating the advantages and disadvantages, personal interaction is needed. We stressed the importance of

entrepreneurs experiencing a problem or, at least, having a need for knowledge before changing their behaviour. The question is whether these conditions can be achieved by knowledge transfer alone. Important incentives to change behaviour are economic return and the expectation of sanctions in the future.

The knowledge context around agricultural enterprises is changing dramatically from the stable OVO triangle, with its linear knowledge transfer principles, towards an unstable, interactive innovation arena, where competitive knowledge is developed in changing networks of collaborative enterprises. These networks are not only built on a sectoral dimension but chain relations and regional contacts are becoming increasingly important. Competitive enterprises regard innovative knowledge as a competitive asset. Sharing this asset is restricted to hedged networks where partners give and take, based upon a gentleman's agreement. Bearing in mind that, for agriculture, we are dealing with small- and medium-sized enterprises, most of these networks are established at local or regional level.

To be effective at the regional level, regional players should be aware of the chain dimension and the local dimension of the knowledge context; agricultural organisations should not focus only on agricultural knowledge institutes. As regional players, they should serve local firms and networks by opening ways to both sectoral and chain-related knowledge sources and by scanning opportunities to make 'neue Combinationen' with local firms from other economic clusters. Some farmers have scouted these lanes of opportunities, for example, by developing combinations of farming and psychological and medical care or farming and the leisure industry. Also, new initiatives to expand farming towards related activities in the food chain can be seen as new combinations of economic activities. These kinds of innovative initiatives need local support in the sense of networking, opening of knowledge channels and training for skills shifts, which should be easily offered by technical and agricultural colleges.

The notion of interactive innovation and learning points to a basic dilemma in analysing informal learning. Interactive learning and innovation should be analysed from a perspective of uncertainty. The impulses for learning cannot be predicted or planned, as is the case in the linear approach. Learning skills for interactive innovation, as part of the entrepreneurial craft, should comprise the capability of selecting impulses and combining newly selected impulses with existing skills and routines. Innovative farmers are quite capable of this kind of selective process but, on the other hand, they protect themselves against an excessively chaotic context by staying in strong, known networks. Paradoxically, they need new impulses from weak, unknown networks to be continuously innovative. Innovative learning involves balancing the chaos of uncertainty and the old grooves of experience. Knowing how to escape this paradox forms the core competence of innovative entrepreneurship.

Notes

- [1] One part of the research consisted of a telephone survey (a questionnaire) of 1504 farmers to document the real situation of agricultural entrepreneurship in the Netherlands. As the original survey contained too many questions for one individual, we divided into the survey in two questionnaires. Half the farmers (752) were asked to answer the questionnaire considering learning and innovation strategies.

The addresses for the telephone survey were the results of contact with 6000 farmers and growers chosen at random from the six sectors (1) dairy husbandry, (2) pig husbandry, poultry and veal, (3) arable farming, (4) vegetables in the open, fruit farming and tree cultivation, (5) vegetables under glass, and (6) flowers under glass. Per sector, 1000 addresses were chosen. The 6000 addresses had, in their turn, been chosen at random from the address file for the year 2000, used for the annual agricultural inventories of the Agricultural-Economics Institute. Lower limits were defined for the size of farms in the different sectors. It was agreed beforehand that the response would have to be approximately 1500 and divided evenly over the six sectors. The questions asked dealt with: (1) farm characteristics (size, etc.), (2) strategy on how to keep up with business demands, (3) personal qualities, (4) use of the knowledge infrastructure, (5) use of social networks, (6) innovativeness, (7) personal data (e.g. age), and (8) financial data.

Most questions could be answered by allocating a score of between -4 (totally disagree) and +4 (totally agree). In addition, some open questions were included for more detailed information.

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PATRICIA M. GIELEN is research fellow at Stoas Research in Wageningen, Netherlands. Previously, she worked at an institute for job analysis. At Stoas she has worked on the labour market research programme for agricultural education and on international education development projects. She has carried out research on work-based learning of workers and entrepreneurs and several themes on linking education and labour at the institutional level. *Correspondence:* (patriciagielen@wur.nl).

AIMÉE HOEVE works as a researcher at Stoas Research in Wageningen, Netherlands. In 1994, she was awarded a degree of Wageningen University in Sociology of Rural Development. She has carried out research on the development of agricultural entrepreneurship in the rapidly changing agricultural context. In addition, she has been involved in research on learning in the workplace. Recently, she started a Ph.D. study on learning in innovation processes (research carried out under the NWO programme 'The Learning Potential of the Workplace'). *Correspondence:* (aih@stoas.nl).

LOEK F.M. NIEUWENHUIS is senior researcher at Stoas Research in Wageningen, Netherlands. He is coordinator of the labour market research programme for agricultural education. Previously, he worked at Groningen University and Erasmus University Rotterdam on institutional and learning aspects in VET. At Groningen University in 1991 he finished his Ph.D. study on complex learning situations in school and enterprise. Together with colleagues at Twente University, he has recently been working on a new research programme 'The Learning Potential of the Workplace' funded by NWO (2001-2006). *Correspondence:* Dr Loek F.M. Nieuwenhuis, Education and Employment, Stoas Research, PO Box 78, 6700 AB Wageningen, Netherlands (lni@stoas.nl).