Adjustment and Differences in Farm Performance - a Farm Management Perspective from the Netherlands

Krijn J. Poppe & Hans van Meijl[1]

Abstract

There are differences in performance between farmers. In the Netherlands this has been a major topic of research for at least 30 years. Research has shown that the managerial capacities of farmers play a major role in differences in economic and environmental performance. Management can be measured and the optimal level is not the maximum level. Farmers differ in their objectives, competences and local external situation and therefore their strategies. These strategies can be identified. In recent years strategic management has become more important and this can be supported with consultancy. Farmers also differ in their adoption and innovation behaviour.

These micro economic results, that correlate with large differences in income and high prices of fixed assets with a limited supply, can be explained as being consistent with economic theory on perfect markets. Although these findings suggest that some farm households have attractive strategies that can cope with policy adjustments, the research supports the hypothesis but does not (yet) prove that a severe adjustment of agricultural policy e.g. towards a more market oriented policy, induces more innovation, and that due to this innovation the effects of adjusting the agricultural policy are less severe then ex-ante estimated with current dynamic policy models.

Keywords
Adjustment, Income differences, Innovation, Farm management, Performance

1. Introduction

Humans differ in their capabilities, also in their professional work. A few actors win an Oscar, others struggle to get staged for a B-movie. A few researchers become a Nobel laureate, many more face difficulties to get their papers in a B-journal. As there are good and bad actors, good and bad researchers, it is extremely likely that out in the fields there are good and mediocre farmers. For those who doubt, figure 1 gives the distribution of family farm income of dairy for different European regions.

This fact of differences in performance, raises a lot of policy-relevant questions: what are the determinants of these differences, can these determinants be influenced by policy, to whom should support be targeted: frontrunners or laggards, can farmers be better trained to move the average capabilities upward, how much incentives should be build in the policy to let good farmers win the competition from the mediocre ones, etc. Such questions become even more important in the light of policy adjustments.

[1] The authors work at the LEI, the Agricultural Economics Research Institute of Wageningen University and Research Centre, The Netherlands. Corresponding author: krijn.poppe@wur.nl

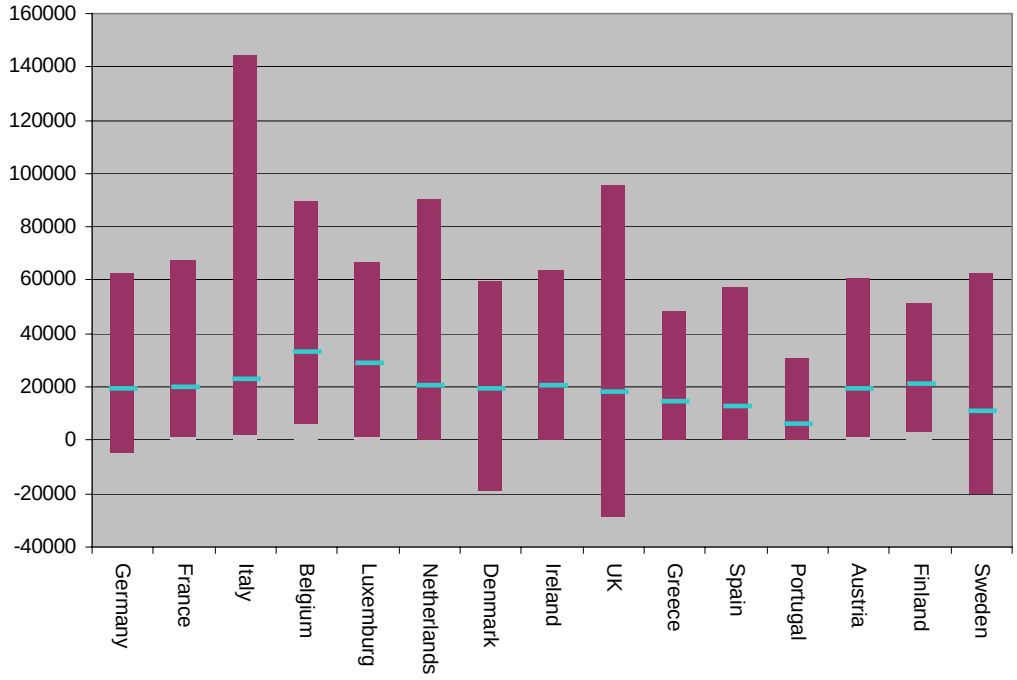

Figure 1 Distribution of family farm income (in euro) of specialised dairy farms, 1999
Source: FADN-CCE-DG Agri; adaptation LEI. (Vrolijk et al., 2004)

In the preparation of this workshop the organisers Hill and Blandford noticed that in recent years the agricultural economic journals have not published many papers on the topic of differences in farm performance. Our impression from the Netherlands is that this is indeed true and due to the fact that the topic went a bit out of fashion and shows not much innovation in methodology (the Data Envelop Analysis method perhaps being an exception). But some of this type of research was undertaken in applied research, be it sometimes with another goal (like environmental issues or the role of information technology).

With the organisers we agree that the theme is for the future with major policy reforms on its way and ahead, becoming more important again. From a scientific point of view as the changes in policy and organisational structure of the food system provide ample empirical data to test theories, in which nowadays e.g. also risk attitudes and management are integrated. And from a policy point of view to understand the role of farm management in the developing of the farm sector in West as well as Eastern Europe.

In this paper we try to review the developments on this topic in the last 30 years. We have been asked to do this from a European perspective, but in writing the paper we decided first to concentrate on the Dutch developments. We know these best and are able to add undocumented developments in research as the authors worked for most of this period on the theme[2]. In addition to this Dutch case we added some relevant European literature that we are aware of.

The paper is structured as follows: after a brief introduction to the strategic management literature the next four sections follow a historical path. We then turn to innovation theory and economic theory in general to interpret findings from the earlier decades. We then move to the

[2] The best documentation can be found in the jubilee publication of the LEI at its 50th anniversary, see Bauwens et al., 1990

policy relevance of this material and end up with conclusions and recommendation for further research.

2. Strategic management literature: A brief description

The strategic management literature studies the creation of a competitive advantage and it provides a background why farms differ in strategy and performance. In this brief description we focus on the influential theory of Porter and on the resource-based theory of competitive advantage.

Porters' theory

Sustainable competitive advantage is the fundamental basis of above-average performance in the long run in Porters' (1980,1985) theory. There are two basic types of competitive advantage a firm can posses: *low costs or differentiation*[3]. The ability of firms to earn above-normal profits is dependent on the attractiveness of an industry which is subject to the rules of competition. These are embodied in five competitive forces: the entry of new competitors, the threat of substitutes, the bargaining power of buyers, the bargaining power of suppliers and the rivalry of existing competitors.

To analyse the sources of competitive advantage Porter (1985, ch.2) introduces the *value chain*, which desegregates a firm into its strategically relevant activities to understand the behaviour of costs and the existing and potential sources of differentiation. Every value activity employs purchased inputs, human resources (labour and management) and some form of technology to perform its function. The value chain of a firm is embedded in a larger stream of activities that Porter calls the *value system*. Value is created by the value chain of suppliers, the value chain of channels and eventually a firm's product becomes part of the buyer's value chain. Porter stresses that these vertical linkages are frequently overlooked and that gaining and sustaining competitive advantage depends on understanding not only a firm's value chain but how the firm fits in the overall value system. The competitiveness of a firm or chain can be improved by coordination and cooperation between chain members. Both product (logistics) and information flows are crucial.

The Resource-based theory of Competitive Advantage

"A firm's competitive position is defined by a bundle of unique resources and relationships and that the task of general management is to adjust and renew these resources and relationships as time, competition, and change erode their value (Rumelt, 1984, pp. 557-558)". The central point of the resource based theory is that firms' ultimate objective is to obtain above-normal returns. These can be achieved for a long time if tangible and intangible *resources* of an organisation are combined in a strategic manner such that the firms product is distinctive in the eyes of buyers (e.g. the firm's product must offer to consumers a dissimilar and attractive attribute/price relationship, in comparison to substitutes), or that a firm selling an identical product in comparison to competitors must have a low cost position (Conner, 1991).

[3] These two basic types of competitive advantage combined with the scope of activities lead to three generic strategies for achieving above-normal performance in an industry: cost leadership, differentiation, and focus. The focus strategy has two variants, cost focus and differentiation focus. The cost leadership and differentiation strategies seek competitive advantage in a broad range of industry segments, while focus strategies aim at cost or differentiation advantage in a narrow segment.

Barney (1991) shows that there are four characteristics of resources that lead to sustainable above normal profits: the resources must be *valuable*; that is, it makes a positive contribution to exploiting a position in the market, the resources must be *rare*; it cannot be widely available to competitors, the resources must be *not perfectly imitable* by competitors[4], and there *cannot be substitutes* easily available for the resource.

The resources cover physical, financial and human capital on the one hand and organisational capital on the other (Tomer, 1987). The latter includes knowledge, information, intangible assets (such as brand names and market position), decision making processes and coordination systems. Especially the latter are difficult to imitate and can create a sustainable competitive advantage.

3. Differences in farm profit

For the Netherlands a review of the literature should start with the seminal PhD thesis of Vinus Zachariasse (1974), the current director of the Social Sciences Group of Wageningen UR (including the LEI).

Economists doing empirical work on differences in farm performance have seldom a good control on their data: in micro-economic data sets farms also differ in farm size, location etc. Zachariasse had the possibility to overcome this problem not by statistical methods but by making use of the data of farmers in the area were he grew up: the Noordoostpolder, an area reclaimed from the sea in 1942, were the 29 arable farms studied in his sample all started their farm in the same year, on the same type of soil, with the same farm size (about 33 ha) and farm buildings, the land all in the same rectangular size. The farmers had to pass a selection process when the farms where handed out to them (most came from regions with land-re-allotment schemes elsewhere) what perhaps resulted in having not the worst farmers in the area, and hence in the sample. That made the findings even more striking. The difference in income between the best and the worst were roughly the level of a minister's salary: roughly € 25.000.- in current currency but 1968 price level and double that amount in 1969.

Zachariasse gathered a lot of economic and technical data on the farms, and using factor analysis he showed that factors in day-to-day management, and hence the farmer himself was the determining factor in the differences in income. Most of the farmers had difficulty in balancing work organisation on the farm and especially also in long-term (strategic) decisions. A great part of the differences in physical yields per ha could be explained by differences in the farmer's technical competences. A survey on the farmer's learning process showed that his capacity to think about the growth process of plants is essential for his competence. The analysis indicated that the farmer's willingness to criticize his own decisions and actions and to continue learning are fundamental in keeping the enterprise profitable.

Even the farming community was surprised to learn that differences were that high. From an information perspective it suggests that farmers often compared (sometimes biased) technical results, but did not benchmark their more privacy-sensitive economic data. So they were not aware of their relative economic performance. One of the more practical results of the study was

[4] A resource cannot be easily replicated if it arises from the idiosyncratic history of the firm (path dependence), socially complex phenomena within or between organisations, or causal ambiguity in the strategy process (i.e. cause-effect relationships between resources and sustained performance are poorly understood and therefore difficult to imitate).

a boost in more detailed farm accounting (introduced with EU subsidies a few years earlier) and benchmarking study groups.

The work by Zachariasse was followed up by a large number of studies for several farm types and crops. They were often carried out by economists of the LEI (from Zachariasse's department) and more technical oriented researchers at experimental stations. They involved very detailed data gathering (also on soil quality, soil preparations etc.), that was then analysed by factor- and regression analysis. A typical study was one on ware potatoes in an area south of Rotterdam. Main conclusion was that there were big differences in yields and income per ha, and that the quality of management decisions in spring time were decisive: mistakes in soil preparation at planting have big effects in the growing season and are hard to repair with a bit more fertilizer.

The focus of these studies on operational management can be explained by hindsight: marketing and strategic management were not so important then, and the results of such studies were very usable by the state advisory system to provide general (i.e. not very farm-specific) advice.

After a decade this type of research went out of fashion. Researchers moved on to environmental issues (which we will review in the next section), the introduction of ICT and to the management of the farm at tactical level. That was based on a publication by Wim de Hoop and others (1988) who interviewed dairy farmers that indicated that dairy farmers spend much attention on tactical management: the way in which several aspects of the farm will be developed in the coming period. This includes what-if analysis, not carried out formally on paper, but by own reasoning. With the growing in size of farms, organisational issues became probably more important.

Before we move on, a number of additional marks have to be made on the results of the research on differences in economic performance, also in more recent years. First of all it is important to realise that due to weather influences and cobb-web cycles results in agriculture differ from year to year. Farmers know this and have a number of techniques (from saving and timing of investments to hedging) to cope with this. This is not always perfectly reflected in accounting and yearly indicators, and yearly fluctuations in income are a reality. That means that distribution data can better be calculated by averaging the incomes of holdings over a three year period, then using yearly data.

Secondly it has been noted that in the Netherlands the distribution of total family income (that is farm income and non-agricultural income) had become more skewed in the 1990s. This has even led to questions in parliament and led to a study by Alleblas et al (1998). Part of the explanation was sought in differences in farm styles and differences in objectives and strategies of the farm family (see also below). Increasing technological change can also contribute (and in various ways[5]) to increasing income differences.

In recent years a number of studies at the European level have been carried out to analyse differences in cost prices of production between regions. These studies investigate the competitive position of the regions. It has been shown that in a number of cases the differences between farms within European regions are bigger than those between regions.

[5] first way is that some innovators find a more rewarding business model then farmers that lag behind. In addition some of the innovators can show low results as their new business model is not as successful as they anticipated. And some of them invest heavily, accepting low margins, to increase their holding to reap the profits later. Conservative accounting can then understate future income.

4. Differences in environmental performance

It is not just in income or profitability that farmers show differences in performance. The same is true for their environmental performance. Since the mid-1980s a lot of research has been carried out on the environmental problems in Dutch agriculture, that relate to energy (glasshouse horticulture), mineral nutrients (including the manure issue), pesticides and even water.
For each indicator of environmental performance the value for the 20% best performing farmers is ways ahead of the lowest 20%. This can perhaps be expected as long as there is no (policy) incentive to manage this environmental performance, but in the Netherlands these differences still exist after many years of targeted policies.

The fact that there are such differences and the experiences with benchmarking and study groups even played a large role in designing the Dutch mineral policy by introducing mineral accounts. The idea was that a farm accounting system could easily also generate a mineral account that could be used in farm management, benchmarking and could be taxed like income (Breembroek et al, 1996). The system not only focuses on manure production (or number of animals) per ha, but also on fertilizer. Although methodological superior and rather successful (Hubeek et al, 2004), the system now has run into trouble as its results are not in line with the EU Nitrate Directive.

The AAEA Award-winning PhD thesis by Stijn Reinhard (1999a, see also 1999b) is probably the best starting point for English reading researchers who are interested in the differences in environmental efficiency. Reinhard used the stochastic frontier approach and Data Envelop Analysis to analyse the efficiency of Dutch dairy farms. His main innovation was to show how environmental aspects could be modelled into the neo classical production function by defining it as a bad output. The empirical part of the study shows that environmental efficiency differs between dairy farms and can be improved by encouraging a higher milk yield and by providing the farmer with more insight in the nutrient balance of his farm.

At Wageningen University a number of comparable studies have been carried out, using FADN data and advanced econometrics to create profit function and household production models (see for an overview in English: Peerlings and Oude Lansink, 2000).

5. Different management levels

The innovative Dutch horticultural sector, with fast growing holdings to reap the benefits of efficiencies of scale in a growing market, provided a fruitful environment for several studies on management.

During the period 1979 – 1987 the LEI researcher Joop Alleblas carried out a number of studies that contributed to his PhD Thesis (Alleblas, 1988). The objective was to measure the actual level of management in glasshouse horticulture, to analyse its relationship with the economic performance of the firm and to assess the appropriate level of management given the entrepreneur's objectives and the firm characteristics (and hence to comment on the discrepancy between actual and appropriate level).

Management was made measurable by making a model in which decision making activities and characteristics were identified in six fields: strategic decisions, cropping plan decisions, task-scheduling decisions, training and educational level, modernity and technical level (up to date or not?) of the business, and other, mainly social factors. Measuring the actual

level of management showed that this was rather low (40% of the theoretical maximum level) and could be improved considerably. The (factor) analysis carried out, showed that 50% of the differences in yield level and economic results could be attributed to differences in management. However, the appropriate (or 'fitting') level of management is not necessarily the maximum level. It depends on the entrepreneur's objectives and structural characteristics of the firm. It was shown that the appropriate level is in general higher for larger firms and for firms where employees (in addition to family labour) are involved. Expanding firms have a higher level of management than stable ones. The study made recommendations on how management consultancy could be based on measuring and closing the gap between the actual and appropriate management level components.

In recent years Nicole Taragola has expanded this type of research in Belgian glasshouse horticulture by including research on the relationship between managerial and firm characteristics with information use (Taragola, 2002) and on adoption of innovative practices (Taragola, 2001). These studies reveal that the general theoretical framework for explaining the adoption of pro-active' or 'innovative' strategies is also useful for the case of adoption of environmental sound and high quality production strategies in Belgian glasshouse horticulture. Personal characteristics of the firm manager, such as expressive objectives ('ambition', 'self development' etc.), have a positive impact on tactical environmental management decisions. Growth-oriented and larger firms are more likely to invest in such strategies.

6. Differences in farm strategies

In the 1990s differences in farm strategy became a research topic. The background were developments in the strategic management literature as described in section 2 and that some farm sectors faced big adjustment processes. With saturated markets and more competition (e.g. from Spain in tomatoes, from several regions in pigs and poultry, following the lowering of cereal prices and higher environmental costs), many Dutch farms faced strategic decisions. Also as new opportunities in so-called multi-functional agriculture had to be evaluated by farmers vis-a-vis scaling up the farm by e.g. buying quota.

This type of research was also carried out -under another research agenda- by economic sociologists like Jan-Douwe van der Ploeg at Wageningen University (see for instance Ploeg, 1996). In this type of research farmers were classified into different `farm styles`: different methods to run the same type of farm, that received descriptive labels like `machinery dairy farmers', `herdsmen`, 'cattle breeders'. Classification was partly based on farm structure and economic indicators, and partly reflected normative notions in peer groups on 'how to farm'. The policy relevance was that certain CAP policies fitted one type of farmers more than others with the risk of some types becoming extinct and a loss of diversity. But it also showed that new rural development policies could fit some types of farming very well.

Economists working in farm management at first rejected some of these studies. Besides the not-invented-here effect, this was due to the fact that differences in farm styles were interpreted in economic theory more as consumption than as investment behaviour. If income on some farms was high enough to spend lavishly on machinery, that was more seen as a result of an imperfect market or room for spending, than as a farm strategy.

Once farm management researchers started to do their own research into strategic management of farms and farm households, they began to stress that farmers have different objectives and competences, and that their strategy is and should be based on this. Two examples illustrate this type of research:

Van den Ham and Ypma (2000) investigated attitudes and behaviour of farmers that successfully developed their farm into multi-functional agriculture. Based on 18 in depth interviews they classified them into two groups: Inspired Multi-functionalists and Rational Multi-functionalists. The inspired ones have a clear mission that is different from the dominant one in the sector. Based on that mission they have clear objectives and a detailed strategy. Their 'corporate social responsibility' objectives are at least as important as their economic ones. With vision and creativity they try to overcome challenges and in this they use a broad array of social and communicative competences, building bridges to the non-farming and even non-rural community. Rational Multi-functionalist however decide on rational (economic) reasons for multi-functional activities (including organic farming). They are much more focussed on government policy, which they see as a reflection of societal trends. These farmers have more problems with inconsistent signals, as their choice for multi-functional activities is less intimate. However this group is probably as five times as large as the Inspired Multi-functionalists.

The second example on 'different concepts of farming for different competences' is also by Van den Ham (2003). To analyse differences in production costs of milk (and hence profitability of dairy farmers) in this study dairy farms where classified on their objective in business development and farm strategies. The objective in business development ranges from the Inspired Multi-functionalist to Growth-for-scale farmers, with the Rational multi-functionalists as one of the groups in between. These groups were split up with more detailed farm strategies. Figure 2 and box 1 provide some of the results. The study concluded that farm sector adjustment processes ask for strategic entrepreneurship of the farmer, in which own competences, external analysis and strong and weak points of the farm are central.

Researchers in farm management have developed tools to support farmers and their advisors in this strategic management. These tools are also used in policy research. Policymakers commission such studies to see the effects of their policy proposals when innovation is treated as endogenous, and to show such results to the farming community. These tools for strategic management have been developed at the LEI into a methodology labelled 'Integrated Strategic Planning (ISP)'. It is a method in which well known tools from strategic planning (like a SWOT matrix) are used to support farmers in their strategic decision making. ISP is based on the farm management cycle (figure 3). Information products that farmers could use in these stages are a strategic management report (figure 4) and a benchmark report (figure 5). ISP can be used by consultants (agricultural advisors and accountants) to provide specific individual farm support. However the farm manager himself is the problem holder and should stay central in the process of strategic decision making.

Full cost price farmers are not so much stressing certain aspects of the farm but are keen to reduce costs. *Growth minded farmers* try to increase the economies of scale of the farm and prefer own machinery over contractors. *Environmental farmers* are focusing on very low mineral surpluses. *Grassland managers* looks for high yields of grass and labour saving: cows are only part time outside to combine high nitrate use with good environmental practice. *Economical farmers* are economical and strongly risk-averse. *Practical farmers* focus on labour saving and choose to source out activities to contractors. *Machine managers* don't use contractors, probably due to less optimal location of land parcels. *Cow farmers* try to optimize the results per cow, seeing the animal as the main asset.

Box 1 Types of dairy farmers (see figure 2 for their results).

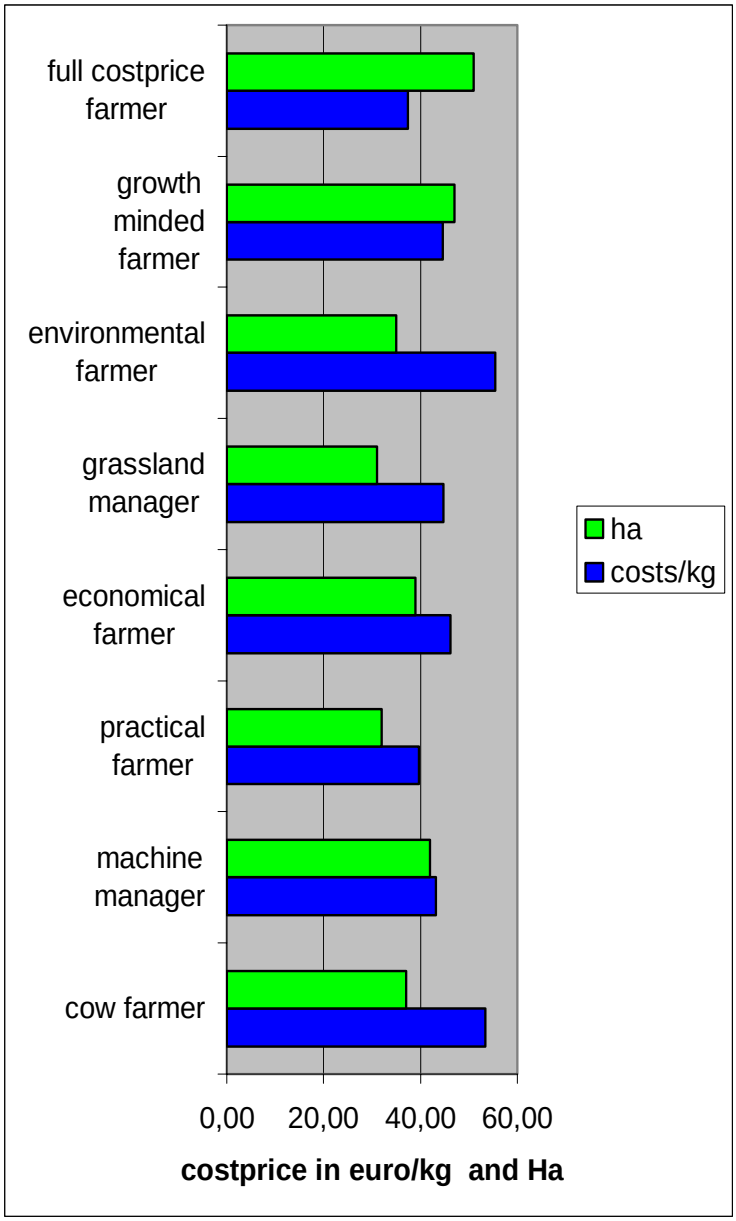

Figure 2 Cost prices per kg of milk and farm size in ha for different groups of dairy farms in the Netherlands, 1999/00

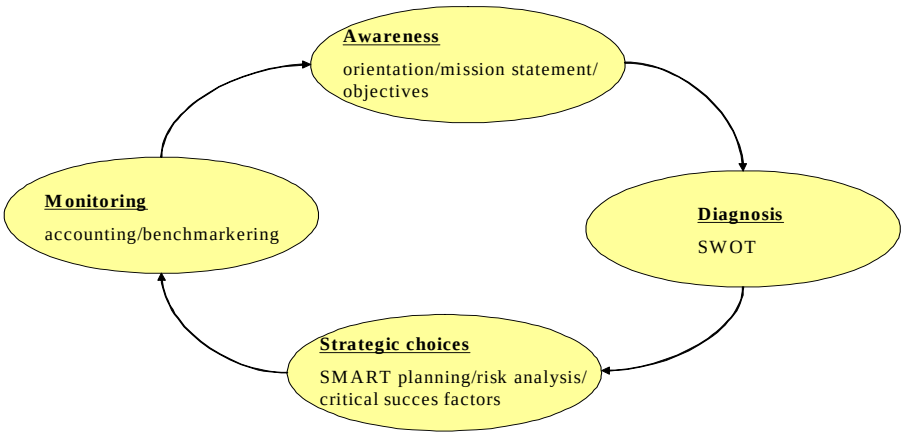

Figure 3 The Farm management cycle

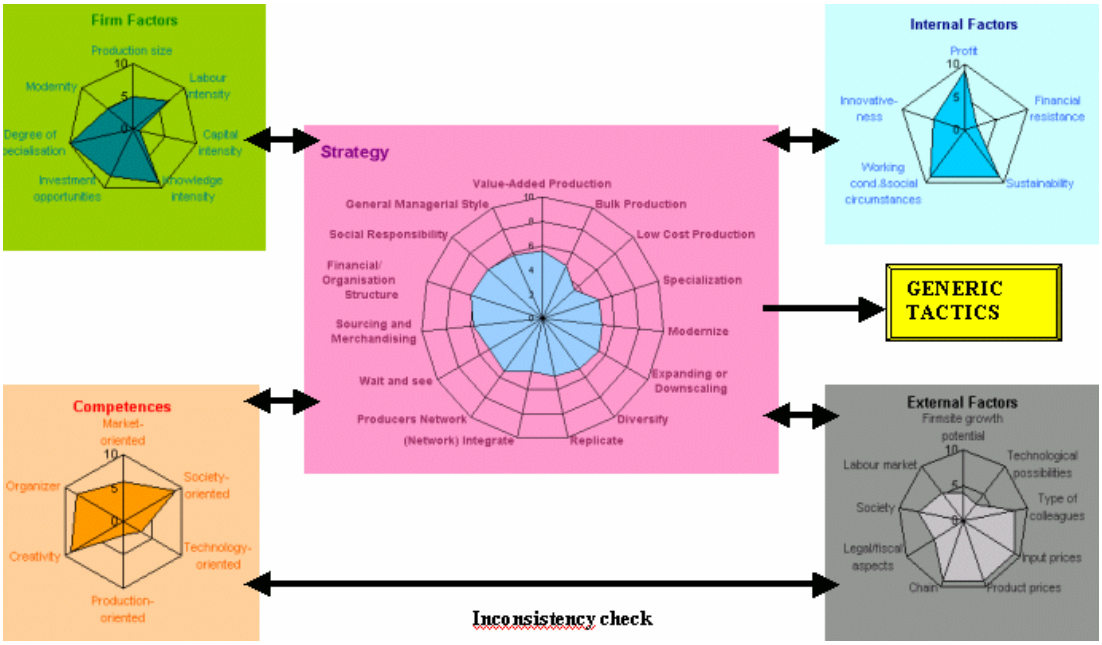

Figure 4 An example (summary) of a strategic management report

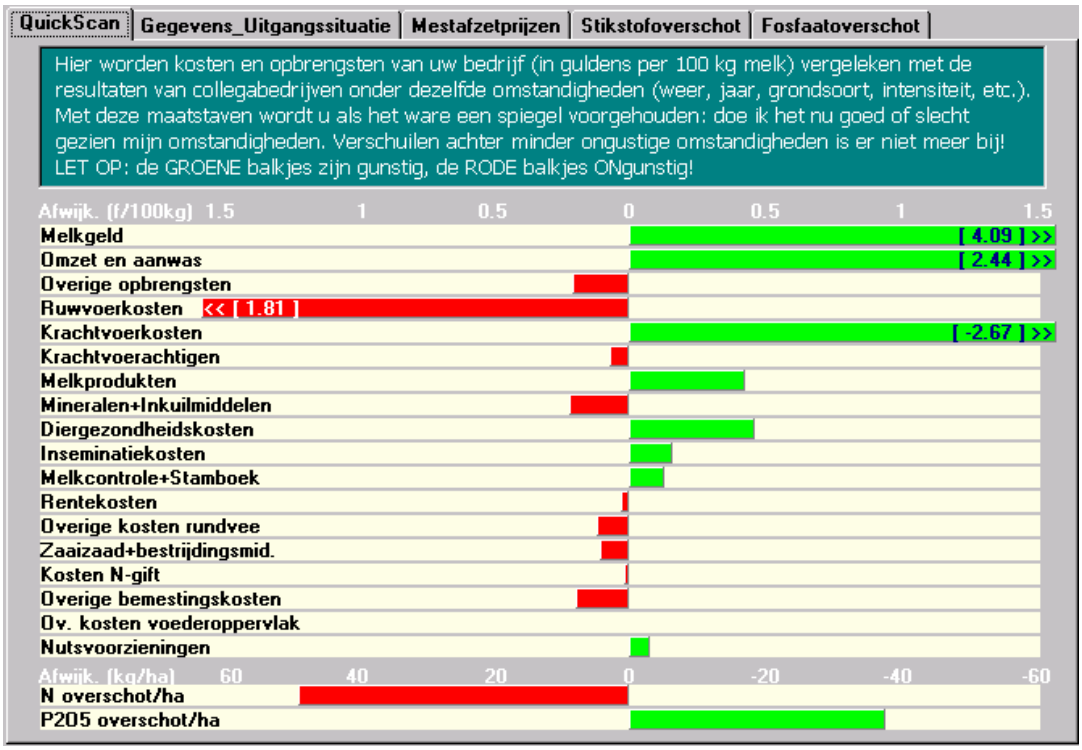

Figure 5 An example of a benchmark report (in Dutch, on top explanation, left hand side key indicators, bars with comparison)

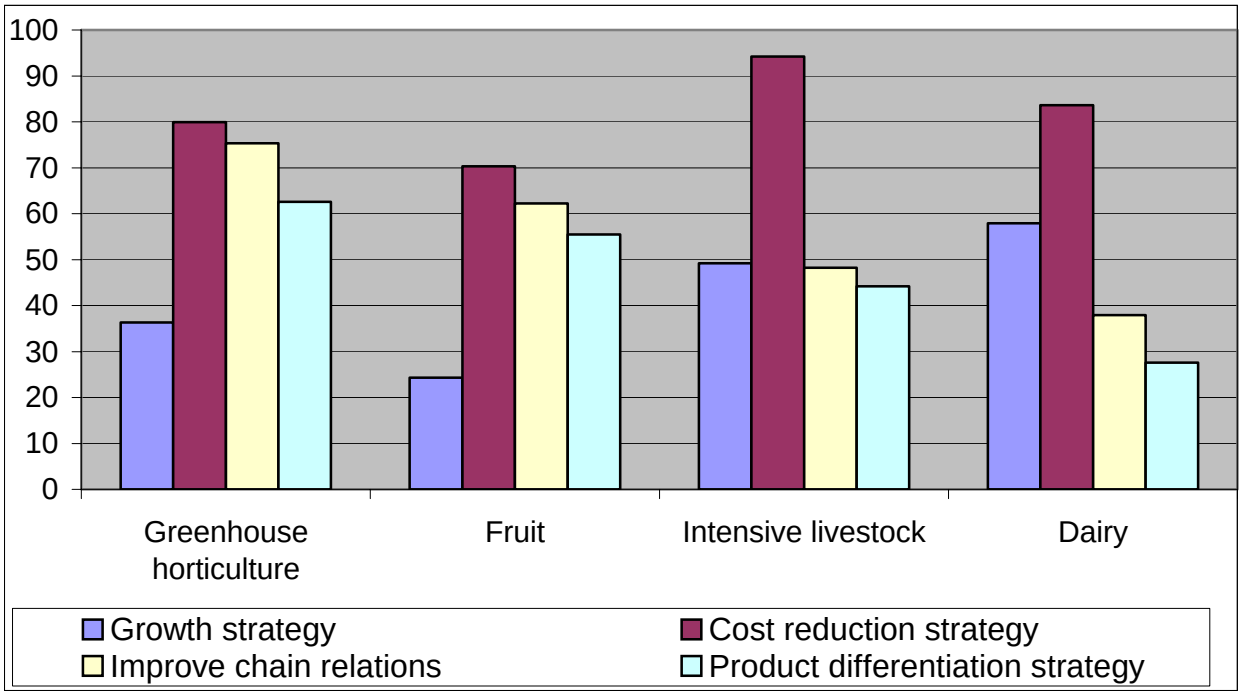

Figure 6: Percentage of respondents that consider a certain strategy important for their holding, by sector. Source: Galen en Bunte, 2003.

Figure 6 illustrates the importance of different strategies for various agricultural sectors. The cost reduction strategy is seen as most important in all sectors. This is in line with the common perception that agricultural sectors produce homogenous commodities and the only way to obtain a competitive advantage is reducing costs. In dairy and the intensive livestock sectors the cost reduction strategy is still the dominant strategy. Often it is combined with a growth strategy directed at obtaining economies of scale. However, if we focus on the greenhouse horticulture and fruit sectors a product differentiation strategy and improving chain relations are almost as important as cost reduction. Since the nineties the horticulture sectors in the Netherlands are changing rapidly from a cost reduction focus to a more and more market oriented focus. The consumer becomes central and the whole chain works together to full fill consumers' needs. More and more, different strategies can be observed together, some horticulture farms choose a cost reduction strategy, others a product differentiation strategy.

7. Different innovation strategies

A related topic to differences in farm performance, farm strategies and differences in management levels, is the research on innovation. Since the last part of the 1990s, the LEI tries to evaluate the innovation policy of the Dutch government (that is in line with the EU's so called Lisbon process to create a more dynamic and innovative economy based on knowledge). The evaluation is based on questionnaires and micro economic data from the Farm Accountancy Data Network.

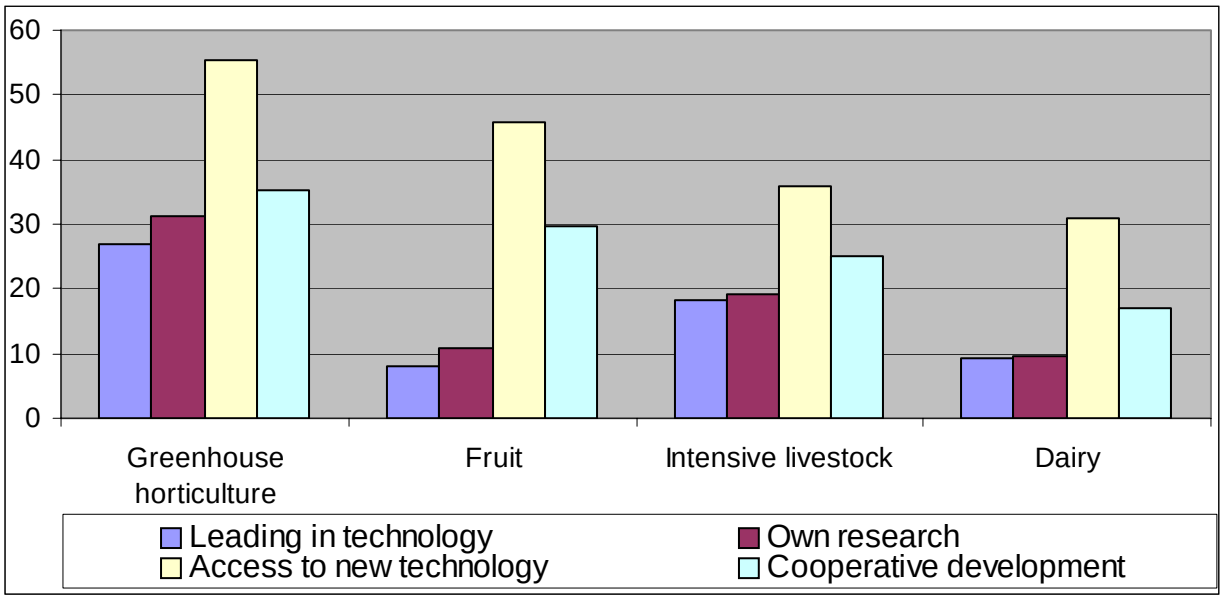

Figure 7 Percentage of respondents that consider a certain technology strategy important by sector. Source: Galen en Bunte, 2003.

Innovation is important to obtain a competitive advantage and earn above average profits. Figure 7 shows that own research activities and leading in technology are considered more important in the greenhouse horticulture sectors. Own research in these sectors is partly directed to creating new varieties (e.g. flowers). In the other sectors own research efforts are still limited.

This may be due to the small size of farms and the difficulty to appropriate benefits due to the large number of farms and the difficulty to differentiate its product. Because of their small scale of operations, they have limited opportunities to develop and implement innovations in a profitable way, they have limited financial resources and in-house specialised expertise, and limited management resources. Because farms are rather small adoption of technologies developed elsewhere and cooperative research is a relatively important strategy. A recent report (van Galen and Bunte, 2003) has a number of conclusions relevant to the differences in strategies and performance of farms:

- The innovative capacity of Dutch agriculture is limited: 3% of the holdings in the sample realised an innovation in 1999. This means that in the Netherlands 3100 agricultural holdings started to use a means of production (input or machine) or started to market a product that was new for the Dutch agricultural sector. However a third of the farms realised something new (by copying) on their own holding. Ten percent had R&D expenses. Glasshouse horticulture is much more innovative as arable and livestock farming.
- Investments in agriculture have an incremental character. Risks are limited and effects on profit and market share are also rather small. Innovators handle more radical innovations and see a larger effect on profits and market share.
- A quarter of the farms invested in new production techniques, where less then 5% started to market a new product. This can be explained by the fact that managers report fast changing technologies, severe competition but limited changes in demand. Changing the agricultural chains into demand driven supply chains have until now only limited impacts on farm level innovation. Societal demands also contribute to innovations, but is also seen as a bottleneck in innovations, especially in pig- and poultry farming.
- New production and organisation methods are adopted. Diffusion follows the well known S-shaped curve
- Most important bottlenecks for innovations are uncertainty on government policies, restrictive policies and high costs. The first one is the most important for innovators, they are able to find solutions for the other two.

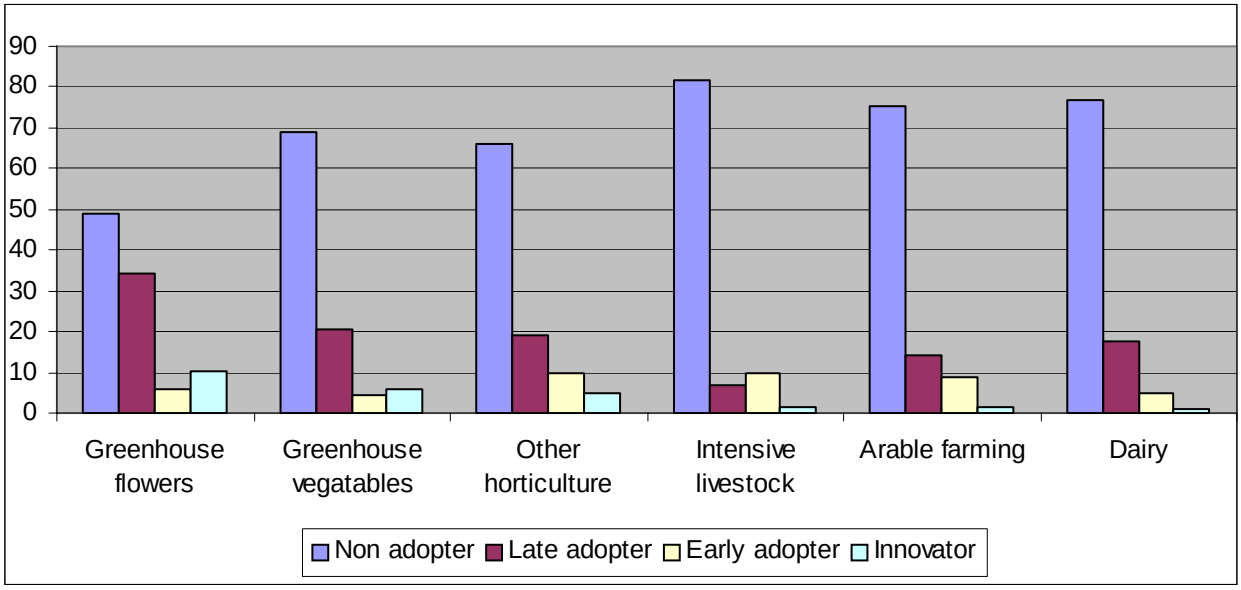

Figure 8: Percentage innovative farms per sector, 1999 (Source: Galen and Bunte 2003).

There is an extensive empirical literature on the relationship between firm size (absolute or relative to the market) and innovation (Cohen and Levin, 1989; Brouwer and Kleinknecht, 1996). A look at the raw data in Figure 9, showing the distribution of innovative and non-innovative firms across a number of size categories, already suggests that there is a relationship between size and innovativeness: non-innovative firms are smaller on average.

Diederen, Meijl and Wolters (2002) found that innovative agricultural farms on average are larger than non-innovative firms, have more market power, engage in all sort of entrepreneurial behaviour, are well informed, have younger management and supply unregulated markets. Furthermore, they are more profitable and grow faster. In a second paper, Diederen, Meijl and Wolters (2003a), analysed the choice of a farmer to be an innovator, an early adopter or a laggard (an adopter of mature technologies or a non-adopter) in the adoption of innovations that are available on the market. They estimated a nested logit model with data for a large sample of Dutch farmers and found that structural characteristics (farm size, market position, solvency, age of the farmer) explain the difference in adoption behaviour between innovators and early adopters on the one hand and laggards on the other. Early adopters and innovators do not differ from each other regarding these structural characteristics, however, they appear to differ in behavioural characteristics: innovators make more use of external sources of information and they are more involved in the actual development of innovations.

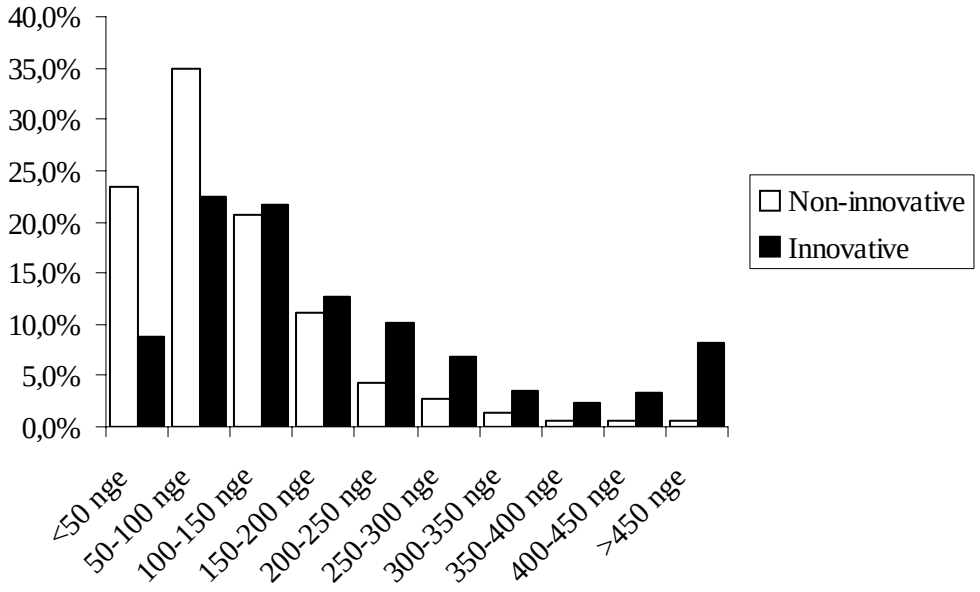

Figure 9 Size and innovativeness

Source: Diederen, Meijl and Wolters (2002); Note: Size is measured in nge (Nederlandse grootte-eenheid), which stands for "Dutch size unit, roughly comparable to the European Size Units"[6].

[6] The number of nge is measured by multiplying the area or number of animals in each production unit with its standard gross margin (SGM) per unit, and that amount is divided by a specific factor (equal to 1310 in 1994) that leads to handy numbers and compensates for inflation. So a company that has 2 ha of tomatoes (SGM = € 202,000 per hectare) has [(202,000*2)/1310] = 308.40 nge. This method allows to aggregate different products.

In a second paper, Diederen, Meijl and Wolters (2003a), analysed the choice of a farmer to be an innovator, an early adopter or a laggard (an adopter of mature technologies or a non-adopter) in the adoption of innovations that are available on the market. The estimated a nested logit model with data for a large sample of Dutch farmers and found that structural characteristics (farm size, market position, solvency, age of the farmer) explain the difference in adoption behaviour between innovators and early adopters on the one hand and laggards on the other. Early adopters and innovators do not differ from each other regarding these structural characteristics, however, they appear to differ in behavioural characteristics: innovators make more use of external sources of information and they are more involved in the actual development of innovations.

In a third paper, Diederen, Meijl and Wolters (2003b) used an ordered probit approach to relate adoption behaviour to variables that capture characteristics of the farm (labour and financial resources and market position), of the business environment of the farm (type of production and market, degree of regulation) and of the farmer (access to information, capabilities, preferences). They found that adoption behaviour shows some persistence in time: being an innovator (or a late adopter) in the past increases the probability of being an innovator (a late adopter) in the current period. Finally, they found that characteristics of the business environment matter. Especially, a high degree of market regulation seems to have a negative impact on adoption behaviour. The degree of market regulation was measured by including a dummy variable for farms producing in regulated sectors (e.g. dairy and arable farming). This appraoach does not prove the negative impact of regulation on innovation because other common sector characteristics that are common between regulated sectors may cause this result. For example, products in regulated sectors are more homogenous, which limits the possibility for innovation.

8. The findings from farm management studies in the light of economic theory

Those who have been trained in economics, and see the agricultural markets as a text book example of perfect competition, are often amazed by the micro economic statistics that show a large distribution of income, large differences in farm structures and high prices (relative to average incomes) for fixed factors like land and quota.

Findings from farm management and innovation studies, as reported above, however can easily be framed into normal economic theory. Agricultural markets, and especially those for bulk products like milk, wheat or pork, are very competitive with limited possibilities for product differentiation. That requires farmers as a price taker to focus on costs of production. However farmers differ in their competences. They also inherit farms from the previous generation with different characteristics and in a different local external environment. But even if (like in the studies of Zachariasse, 1974) this would be not the case, strategies and performance of farmers differ.

Different strategies can be an effective manner to adapt to the market, given own competences and local environmental conditions. But they can also lead to different performance. In theory farmers should then learn from others and adopt a better strategy, or go out of business in a perfect market. But such learning is probably difficult. It is not always clear that better strategies are available, given ones own competences and the local external environment. Concerning self criticism and learning, the small farmer, working more or less alone, is perhaps different from workers in larger organisations and networks where more feedback mechanisms exists.

In addition farmers can survive some time before the competitive market forces them out of business. They can adapt their consumption pattern, and their competences as self-employed are not always in demand for other jobs in the rural area. So opportunity costs of labour can be low, and especially for older farmers it can be economic rational to stay in business with a very low level of (replacement) investments to sustain their cash flow.

Farmers with the best skills and strategy are able to have a high profit margin and income. They are interested to increase production and to realise economies of scale of new production technologies. Then they often need extra assets that have a fixed supply like land and quota. For a marginal increase in the size of the farm (where other fixed assets like buildings or machinery can be made more profitable) this can lead to high bid prices for such assets. 'High' in relation to average profits in the sector, not necessarily to return on investment of the investing farmer.

The high prices for assets with a fixed supply reflect a rent and contribute to the capital gains and wealth of farmers. And especially farmers with a low performance and income, who cannot follow a strategy of increasing their farm size, are cashing in those capital gains at the moment that they retire. Their farm is then too small for one of the children to take over as a full time enterprise. It also explains why farmers live poor and die rich, which also implies that farm sectors with a lot of assets that have a fixed supply, have a very strong barrier to enter. Due to the high prices of the assets (when not bought as a marginal increase of an existing holding) the return of investment is too low.

In interpreting statistics on agricultural income this means that differences in income can be (partly) explained as differences in competences (or management levels) and strategies of farmers. They can also be interpreted as a photo of competing strategies in a kind of evolutionary process, where the fittest strategies have not yet survived and new strategies still emerge.

This is even more the case when external shocks, like technical change or policy adjustment takes place. In such situations strategic management is more important and asks for different skills, where some farmers have only been trained in the past in operational management. Strategy and marketing were less important in a central planned agricultural economy than in a market oriented, larger scale market economy with product differentiation. In times of external shocks more mistakes will be made in selecting and executing a good strategy by farmers. And some farmers develop strategies that take low incomes now for granted (by heavy borrowing, or converting their farm to another production process) to win market share and to cash in later. The accounting photo therefore does not necessarily provide a true and fair view of the film that reality is. With that in mind, larger differences in income (a more skewed income distribution) and relatively higher prices for assets with a fixed supply might be expected in times of adjustment.

9. Lacking research on reactions to farm policy adjustment

As far as these authors are aware of, there is not much micro economic research done to study the reaction of farmers to policy adjustments. The studies reported above deal with differences in farm performance, strategies and farm characteristics / farmer's competences. They do suggest that policy adjustments have different effects on farms with different strategies and farm styles. They do suggest that some public policies (like multi-functionality or organic farming) are easier taken up by some type of farms then by others (Eshuis and Buurma (1998) provides an example for organic farming). And they show that innovation is different between sectors like glass house horticulture and dairy farming, which can partly be explained by the characteristics of the market and the agricultural policy that are different (Diederen et al, 2003b).

However they do not prove that a severe adjustment of agricultural policy e.g. towards a more market oriented policy induces more innovation, and that due to this innovation the effects of adjusting the agricultural policy are less severe then ex-ante estimated with current dynamic policy models. In management the saying is that 'you need a man, a plan and a crisis for change'. Adjustment of farm policies is often perceived as a crisis, but it seems that good empirical studies are lacking to see if man reacts with a plan leading to profitable change.

From our point of view this is a key research issue to address. We therefore make a number of additional comments related to this question. First we quote on the developments in European agriculture in the 1990s, as reported in a study for the European Parliament (Vrolijk et al., 2004), when some sectors like cereals were reformed, and others (like dairy) were not:

> 'The analysis of income trends in the nineties reveals some interesting observations on the role of the CAP reform on income development, even if an ex-post evaluation of those reforms is not the purpose of this report. First of all it is concluded that economic processes like farm expansion (to reap the benefits of economies of scale), specialisation, reducing labour input, increasing capital, and restructuring the industry concerning the number of farms (leading to concentration) goes on in all sectors, 'reformed' by policy interventions in the early nineties, unreformed under the CAP or nearly untouched by the CAP (like horticulture). An exception is perhaps the (reversal of) the trend of specialisation in dairy production (due to quota), but the other processes (like concentration and capital investment) confront the dairy farmers with at least as many strategic decisions and changes in their farm management as their colleagues in other sectors. In general this implies that regime changes in the CAP, like the McSharry reforms, if well designed, do not seem to hurt the economic efficiency of the sector. It also implies that keeping the policy stable, like in dairy, does not mean that there are no changes in the sector. Also in that case there are losers and winners in the economic competition.
>
> Secondly, it seems that the introduction of direct payments have contributed to sustain the incomes in the cereal sector (including proteins and oilseeds). The same seems to be the case in the beef sector. Especially in cereals the number of specialist farms has grown. This is remarkable, as at the time of introduction of the reform, there was much fear for a shake out of the sector. However the average incomes remain at a modest level in these sectors, compared to more attractive levels at farms in dairy, wine or horticulture.'

A second observation relates to the object of research. Nearly all the micro economic research cited above deals with the farm business and the farmer, not with the agricultural household. In some regions, farm types and strategies farmers combine farming activities with non-agricultural activities (and the boundary between the two is not so clear either). As individuals from a family pool their income or share their expenses in a household, a decrease in income from farming can also lead to more non-agricultural income by one of the other household members. It is therefore probably not the farmer or the farm that has a strategy to survive, but the household.

An interesting example of the policy relevance of such research was provided recently by Hennesy (2004) who made an ex-ante policy evaluation on the current reform (mid term review proposals) of the CAP. Using micro data and econometric models she showed how a lower marginal income per hour from farming (after decoupling) will lead to substitution of labour into more non-agricultural activities.

Besides using econometrics to model past behaviour it can be attractive to use simulation tools (like the ISP tools described above) and experimental economics to test the reaction of farmers to policies. Hubeek et al (2004) used this in ex-ante policy analysis on the Dutch nitrate policy. This type of 'gaming' is especially attractive in cases of important policy adjustments, and it can help policy makers to fine tune their policies.

Last but not least it seems attractive to explore further the role of human (and social) capital. It seems that farmers have not only different competences, but that there is a group of farmers with superior human capital, who are good in interpreting signals from markets and society, who are able to adjust their farm strategy and farm system in advance of others and even agricultural policy adjustments. In projects with farmers we come across farmers that have an environmental (and economic) performance at a level that will be required only in a few years time. They are fit for the future. It is the type of farmers who buy extra roughage at the time that others are still wondering about the potential effects of a dry summer elsewhere in Europe. It includes farmers who earned a lot of money in the 1990s on organic farming (first mover advantage), where it is less profitable now. It would be interesting and useful to learn more on the characteristics and methods of such persons, and how policy makers can remove bottlenecks that exist for others to perform in the same way.

10. Policy relevance

Even if we can not prove that a severe adjustment of agricultural policy e.g. towards a more market oriented policy induces more innovation, and that due to this innovation the effects of adjusting the agricultural policy are less severe then ex-ante estimated with current dynamic policy models, what advise can we provide to policy makers?

First of all policy makers should be careful with interpreting static statistics on the distribution of income, especially if given for a certain year in stead of a three year average. Increasing differences in income can be a sign of innovation and adjustment, and are not bad for the wealth of the nation by definition.

Second innovation, farm development and restructuring of industries occur in all sectors, being heavily regulated by the CAP, reformed under the CAP or nearly untouched by the CAP. If the objective of the CAP would be to keep farmers farming, it is not very successful.

Third, to be successful policies on innovation into new production methods should take into account that some types of farmers (depending on their competences and strategies) are more willing to take part in a the policy program than others. Examples are policies to promote organic farming, to produce high quality food products or to produce public goods in multi-functionality programs. In such policies segmentation of policy clients makes sense.

Fourth, if innovation as such is the policy aim (like in the EU's Lisbon process) policy makers should first of all take away uncertainty that arises from policy risks. Government policies can be restrictive, but they should not be subject to unpredictable, frequent changes that make investments unprofitable. Financial support is less important. Ideally policies (e.g. on animal welfare) should be announced in such a way that they fit into the normal investment cycle of a farm. Unfortunately that asks for long term management that short term looking, election dependent, administrations can not always provide.

Fifth, as innovators make more use of R&D by third parties, extension and consultancy, stimulating the availability and supply of such services can make sense. Education to farmers, also at later stages in life, to improve competences is potentially beneficial. Such activities can be a useful part of policy package that tries to cushion the effects of a farm adjustment policy.

Recent ex-post analysis on such projects in the Dutch environmental policy (Geerling-Eiff et al, 2004) learns however that such projects are not automatically successful and that careful project design is needed to secure success.

In the end policy makers, also in planning agricultural adjustment programs, have to decide how they allocate their resources over promoting innovation (including fostering R&D), diffusion (with extension etc.) and providing a security net (income and social policy) for those who are not able to adjust. All three objectives seem to be important but current research results do not give a general clue how to do such allocations.

11. Discussion, conclusions and recommendations

The replacement of the typewriter by the computer with text processing software led to winners and losers in secretarial jobs. This simple change in technology implied that skills like typing error free, deciphering hand written texts and recognising spelling mistakes were (at least partly) replaced or compensated by the computer: spelling errors were detected by software, typing errors could be corrected easily, researchers and managers started to type. Desk top publishing skills like improving the lay-out, making graphs etc became more valuable skills. The change in technology implied winners and losers: some secretaries learned new skills, and some of them had a better performance in these new ones than in their old ones. However some were not able to adjust and lost, sometimes even their job.

Adjustments in agriculture, be it technology or policy driven, have similar effects. There are winners and losers. This is often calculated in the direct income effect of an ex-ante evaluation of a policy proposal in relation to farm income (and sometimes wealth). If economists do their job well, they also calculate the income effect after markets reach a new equilibrium in prices and they compare it with a baseline scenario.

What is however most difficult in these calculations, is the time and costs needed by farmers (and their family members) to adjust to the new incentives from the market and the policy instruments. There is currently no reason to assume that such effects are underestimated. However two topics stand out for further research to improve our understanding on how farmers adjust to policy change:

- Some ex-post analysis of policy changes should be done on a micro-economic basis over a longer period to fully understand the effects of big shocks. The cereal sector in e.g. France or the UK in the 1990s and the plant potato sector in the Netherlands[7] are potential candidates for this.
- Cross country analyses on the relation between innovation, farm strategies and sector characteristics. The Diederen et al (2003b) study indicated that regulation has a negative impact on innovative behaviour. However, the evidence was partial because sector characteristics\technological opportunities also differ between regulated and non-

[7] The Dutch plant potato industry installed a private intervention scheme in the 1950s with legal backing from the Dutch government and later the EU. The aim was to support product differentiation for risky foreign (non-EU) markets by buying up produce that could not be exported below a certain minimum price. The industry, that became less fragmented under a few large cooperatives / exporters, abandoned this in the 1990s when product differentiation had probably gone too far and a risk of free rider behavior due to high intervention prices in relation to increased yields, was suggested. The impression is that after liberalization the exporters had an incentive not to start a price war and destroy markets, that prices did not drop as much as ex-ante analysis suggested and that competition between farmers increased. It is however not clear if this is all due to the liberalization and neither has any ex-post analysis been done on the strategies of agricultural households and the shocks they experienced.

regulated sectors. To separate these effects a multi country survey would be beneficial: A sample should include sectors which are protected in some countries and not protected in others. For example, dairy sector in Netherlands versus dairy sector in New Zealand.

- Research should shift from the agricultural production side to adaptations in the agricultural household to fully understand decision making of farm families. This probably would imply that besides a pure agricultural economics approach, some cooperation with economic-sociologists would be beneficial.
- Adjustment should take chain issues into account. Adjustment is also dependent on the competitiveness of other industries in the chain. For example, an innovative dairy processing industry can reduce adjustments in the primary sector.

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