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IMPORTANCE OF RISK MANAGEMENT IN AGRICULTURE

*Ruud Huirne, Miranda Meuwissen and Marcel van Asseldonk**

Abstract

Risk management is an increasingly important topic. At the farm level, it received little attention in Europe. Research indicates that whole-farm risk management approaches, i.e. approaches in which multiple risks and farm activities are considered simultaneously, seem more efficient than 'single risk and commodity strategies'. This paper first gives an overview of risk management and then it discusses the results of a 2001 questionnaire survey among livestock and arable farmers in the Netherlands. Although the survey was carried out some time ago, the results seem to be quite actual given the current worries about credit and economic crises (see for instance Buehler et al, 2008), which cause considerable uncertainties for farmers. The survey deals with farmers' perceptions of risk and risk management strategies. Risk management strategies include both 'single risk' strategies as well as strategies for simultaneously covering multiple risks. The latter are restricted to the type of strategies currently available in the Netherlands. Next, opportunities for broadening the scope of risk management strategies covering multiple risks are discussed. The paper concludes by identifying areas for further research in the field of whole-farm risk management.

Keywords

Risk management, agriculture, whole-farm approach, multiple risks, questionnaire survey

1 Introduction

The agricultural firm is constantly developing. The farm is and remains an essential player in the agricultural supply chain and in the rural area. The differences between the agricultural sector and the rest of the industry are getting smaller and smaller. Increasing farm sizes result in a more industrialized way of operating such operations. Important 'new' characteristics of such bigger, industrialized farms include: importance of manufacturing processes (versus commodities), a systems approach to production and distribution, separation and realignment of the stages in the food chain for the purpose of efficiency and low cost-price, negotiated co-ordination among those stages and with the environment (rural area), concern about system power and control, and new kinds of risk combined with a more important role for information. This implies risk consideration get more important and should addressed in a more formal way.

Income from farming is usually considered rather volatile due to a whole series of stochastic factors, i.e. risk. Over the years, a range of risk management strategies has been used to reduce, or to assist farmers to absorb, some of these risks (see later). Risk management strategies, especially risk-sharing strategies, generally deal with only one type of risk at a time. For instance, futures market contracts deal with price risks, hail and storm insurance schemes cover weather related production risks, and livestock insurance schemes cover the death of animals. Even disaster relief programs in such events as droughts and floods only consider one type of risk (which, in itself, is relevant if the whole - or a notable part of the - crop or herd is destroyed).

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This paper first discusses risk management in general (definition, sources of risk, risk-management strategies) and then the results of a 2001 questionnaire survey among livestock and arable farmers in the Netherlands. Although the survey was carried out some time ago, the results are still actual given the current worries about credit and economic crises in our society (see BUEHLER et al., 2008). Furthermore, because Dutch farms are not really representative compared to farms in many other countries, the results of the survey should be seen as an example. The survey deals with farmers' perceptions of risk and risk management strategies. Risk management strategies include both 'single risk' strategies as well as strategies for simultaneously covering multiple risks. The latter are restricted to the type of strategies currently available in the Netherlands. Next, opportunities for broadening the scope of risk management strategies covering multiple risks are discussed. The paper concludes by identifying areas for further research in the field of whole-farm risk management.

2 Risk management

The concepts of 'risk' and 'uncertainty' have already been referred to several times. It is time to elaborate upon them. The meanings of 'risk' and 'uncertainty' come close (HARDAKER et al., 2004). Uncertainty is the result of incomplete knowledge. Risk can be defined as uncertain consequences or results at the moment of making decisions. Risk particularly concerns exposure to unwanted, negative consequences. Risk management concerns the way in which managers deal with risk and uncertainty (MEUWISSEN et al., 1999, 2001, 2008; HUIRNE et al., 2000; VAN ASSELDONK et al., 2001; BUEHLER et al., 2008).

2.1 Types of risk

The current government policy has increasingly been aimed at creating an open market system. This results in, amongst other things, the fact that agriculture in the Netherlands is increasingly confronted with price-making in international markets, such as the world market, which generally means lower and definitely more fluctuating prices (MEUWISSEN et al., 1999, 2008). By further modernization of the sector there are also increasing economic consequences. Dealing with such risks, i.e., risk management, is getting more and more important, not only for individual farmers, but for all firms in the agricultural supply chain.

Many activities of an agricultural firm take place outdoors and are weather dependent. The agricultural sector also deals with live material. Because of this the sector is an outstanding example of being exposed to risks (ANDERSON et al., 1977; Barry et al., 2000; VAN ASSELDONK et al., 2001; HARDAKER et al., 2004). Production risks are caused by the unpredictable character of the weather and hence uncertainty as to the physical yield of animals and crops. Diseases and infestations can have a great influence on farm results, as the classical swine fever outbreaks in 1997/1998 and the foot-and-mouth disease outbreaks in 2001 clearly showed.

Moreover, the prices of production means most often purchased (such as concentrates, fertilizer, pesticides and machines) and of products sold (such as milk, tomatoes and cut flowers) are not known, at least not at the moment decisions on these have to be taken. As already mentioned, farmers are increasingly exposed to price-making forces in unpredictable markets. Thus, market and price risks are important factors.

Governments form another source of risk to farmers. Changes in laws and regulations with respect to running the farm can have far-reaching consequences for farm results. Examples are the continuing changes in the regulations as to environment, pesticides, animal diseases and animal welfare. On the other hand, governments have also set off particular risks (up to now).

Farmers working on their farms are a risk themselves to the profitability and continuity of the farm. The farm's survival may be threatened by death of the owner, or by divorce of a couple together running the farm. Long-term illness of the owner or employees can also cause considerable losses or can increase the costs considerably. Such risks are called human or personal risks.

There are also financial risks involved (BELLI et al., 2001). These are related to the financing of the farm. Using borrowed capital (such as mortgages and the like) means that first the interest needs to be paid before increasing one's equity capital. For farms with relatively much debt capital (for example, as a result of large investments), little will be left as a reward to one's equity capital at times of high interest rates. Only farms that are entirely equity-financed are not subject to such financial risks, but yet can sustain capital loss. Other risks connected to use of credit and loans are uncertain interest rates and not being able to obtain a loan or mortgage.

2.2 Reducing and sharing risk

Risks are thus unavoidable and influence almost any decision the farmer takes. That is to say risks are there, but can be counteracted. The farmer should anticipate such risks by his management. But how? In what way can risks be reduced? There are two categories of measures to reduce risks: taking measures within the farm and sharing risks with others (BELLI et al., 2001; HARDAKER et al., 2004; MEUWISSEN et al., 2008).

On many uncertain events (extra) information can be obtained easily. For example, asking for the weather forecast, analyzing feed or soil samples and consulting experts. Also particular risks can possibly be avoided or prevented. It is known that certain activities carry more risks than other. Reducing farm contacts can, for example, reduce the risk of disease introduction considerably. Another good strategy to minimize risks is not to put all one's money on a single farm activity. By selecting a mixture of activities, risks can be considerably reduced. The same holds for having various suppliers and buyers. Flexibility can be mentioned as a last measure at farm level. Flexibility refers to how well a farm can anticipate changing conditions. For example, by investing in multi-purpose machines and buildings.

The second set of measures refers to sharing risks with others (HARDAKER et al., 2004). One possibility here is buying insurance. At the moment there are several types of insurance available, with which, by payment of a premium, risks can be reduced or even eliminated. The farmer can also conclude contracts for example with suppliers and buyers in which price agreements are laid down. Agreements can be made on the duty to deliver and to buy as well as on the quality of the products or raw materials. Lastly, by using the futures market, price risks can largely be eliminated. The futures market is not yet very well known in the Netherlands, but in the US it is popular for a number of agricultural products.

Most farmers try to reduce risks when they face decisions that may have a considerable influence on their income or wealth (ANDERSON et al., 1977; BELLI et al., 2001; HARDAKER et al., 2004). Examples of such decisions are sizeable investments in milk quotas or in a second farm enterprise. The attitude of reducing exposure to risks is called risk aversion. A risk-averse person is willing to sacrifice part of his income to reduce risks. This consideration serves as a means to make a choice among the above measures. However, reducing risks will generally involve a cost.

2.3 Risk perception

Managers, policy makers and researchers alike often have a binary way of dealing with risk and uncertainty. One either assumes certainty and an exactly predictable future, or uncertainty and an entirely unpredictable future. In the latter case further analyses are often omitted and decisions are made either intuitively or not made at all. Under- as well as overestimating the

risks is potentially dangerous. Further analysis learns that there are at least four levels of risk and uncertainty (COURTNEY et al., 1997):

1. A clear-enough future; a single forecast precise enough for the purpose of decision making
2. Alternate futures; a few discrete outcomes that define the future
3. A range of futures; a whole range of possible outcomes
4. True ambiguity; no basis to forecast the future

Level 1 and level 4 do not occur very often in practice; they are extreme situations. So it is all the more distressing that many managers and advisors regularly operate at these levels of risk. Particularly working at level 1 where calculations are carried out and advice is given under the assumption of complete information and certainty, is alarming.

3 Farmers' perceptions of risk management

3.1 Materials

The questionnaire survey included questions on: (1) the farm, (2) farmers' risk attitude, (3) farmers' perception of risk management strategies, (4) their perceptions of risks and the extent to which risks are managed on the own farm, (5) farmers' ability to define 'risk management', and (6) farmers' interest into assistance in setting up a whole-farm risk management plan for their own farm. Most questions were closed questions, mainly in the form of Likert-type scales ranging from 1 to 5. In total, the questionnaire included 177 variables. The (pre-tested) questionnaire was sent in July 2001 to 390 clients of the Rabobank (major agricultural bank in the Netherlands). These included cattle, pig, poultry and arable farmers. After screening on completeness, the questionnaires of 101 farmers were available for statistical analyses, i.e. the effective response rate was 26 per cent.

3.2 Results

The majority of respondents has more than one type of farming: 44 farmers have dairy cattle on their farm, 58 have pigs, 9 respondents have poultry and 84 of the respondents are (also) crop farmers. In order to get insight into farmers' risk attitudes, 5 statements were rated. Table 1 shows the results.

Table 1: Farmers' attitude towards risks, n=101 (1: don't agree; 5: fully agree).

	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Average	Std
I am willing to take more risks than other farmers	7	16	44	22	11	3.14	1.04
I need to take risks to be successful	9	15	26	40	10	3.27	1.12
I am reluctant to introducing new ideas	14	27	29	25	5	2.79	1.12
New technologies first need to be proved at other farms	16	23	27	26	8	2.88	1.20
I am more concerned about losses than to forgo some profits	20	17	40	18	5	2.71	1.14

From the scores in table 1 it can be concluded that based on these questions respondents have a risk seeking attitude. It is noteworthy that this holds for all statements.

Table 2 shows farmers' perceptions of risk management strategies. We subdivided the strategies into strategies that cover single risks and strategies that simultaneously cover multiple risks. In making this subdivision we assumed that new technologies are primarily implemented to deal with production risks, that leasing machinery has mainly to do with financial risks and that leasing milk quota mostly deals with production risks. In the category 'multiple risk strategies', we assumed that vertical and horizontal cooperation deal with both price and production risks. In relation to spatial diversification we supposed that this has not only to do with diversifying production risks but most likely also with diversifying institutional risks (e.g. in case of environmental requirements) and/or price risks.

Table 2 shows that, in general, farmers perceive the single risk management strategies as more relevant than the strategies covering multiple risks: from the ten strategies ranked highest (see last column 'overall rank') only four strategies are within the multiple risk category. These strategies include increasing the solvency rate, comprising financial reservations, on-farm diversification and vertical cooperation. Popular risk management strategies in the 'single risk strategies' are strict hygienic rules, business insurance, personal insurance and the application of new technologies.

Table 2: Perception of risk management strategies, n=101 (1: not relevant at all; 5: very relevant).

	Average	Std	Overall rank
Single risk strategies			(1)
Strict hygienic rules	4.08	0.96	1
Business insurance	3.80	0.98	4
Personal insurance	3.71	1.09	5
Application of new technologies	3.64	0.93	6
Manure delivery contracts	3.54	1.35	7
Leasing / renting machinery	3.44	1.24	8/9
Price contracts for farm input	2.90	1.10	12
Price contracts for farm output	2.88	1.10	13
Leasing / renting milk quota	2.43	1.09	15
Futures and options market	2.35	0.92	16
Multiple risk strategies			(2)
Increase solvency rate	4.02	0.96	2
Comprise financial reservations	3.81	0.99	3
On-farm diversification	3.44	1.21	8/9
Vertical cooperation	3.40	1.20	10
Horizontal cooperation	3.27	1.20	11
Off-farm investments	2.75	1.21	14
Off-farm employment	2.27	1.31	17
Spatial diversification	2.15	1.00	18

Asking respondents for their 'top 3' risk management strategies resulted in the following answers (percentage of respondents indicating particular strategy between brackets):

1. Increase solvency rate (16%), on-farm diversification (16%), comprise financial reservations (14%);
2. Increase solvency rate (11%), comprise financial reservations (10%), strict hygienic rules (10%); and
3. Vertical cooperation (14%), on-farm diversification (12%), application of new technologies (12%).

From these answers it can be seen that from the 'top 4 strategies' from Table 2 (i.e. 1: strict hygienic rules; 2: increase solvency rate; 3: comprise financial reservations; 4: business insurance) the multiple risk strategies (option 2 and 3) are favourite in the top 3.

Table 3 illustrates farmers' perceptions of risks and the extent to which they believe that the risks are dealt with on their own farm. There are 7 risk categories. Besides the ones distinguished by Hardaker et al. (2004) we added the categories 'liability risks' and 'risks related to immovable objects'.

Table 3 shows that farmers perceive production and price risks as very important. Liability risks and financial risks are ranked 6th and 7th respectively. With respect to the management of the risks, farmers are convinced that they (largely) handled the production risks, institutional risks (as far as it concerns governmental regulations), personal risks, risks related to immovable objects, liability risks and financial risks. Note that for some type of risks the numbers in the column 'yes I managed the risk *partly*' are higher than for other risks. This is for instance the case for liability risks. Not (yet) adequately dealt with are price risks, risks related to the elimination of government support (e.g. in case of droughts and livestock epidemics) and the decrease of farms' collateral value.

The two remaining parts of the questionnaire, i.e. farmers' ability to define risk management and farmers' interest into assistance in setting up a whole-farm risk management plan for their own farm led to the following results:

- About 70% of the respondents was able to adequately define risk management.
- About 62% of the respondents showed an interest in assistance in developing a risk management plan for their own farm.

There was a significant positive relationship between farmers being able to define risk management and those interested in a risk management plan ($P \leq 0.05$).

These results are in line with a more recent study of MEUWISSEN et al. (2008).

Table 3: Perception of risk and the extent to which risks are managed on own farm, n = 101.

	Relevance of risk (1: not relevant; 5: very relevant)			Risk is managed on my farm				
	Average	Std	Overall rank	No (%)	Not yet (%)	Yes partly (%)	Yes (%)	n.a. ¹ (%)
<i>Production risk</i>			(1)					
Variability in technical results	4.22	1.07	2	6	2	37	55	-
Epidemics (livestock and crop)	3.98	1.22	5	2	4	39	55	-
Bad product quality	3.95	1.05	6	2	1	34	63	-
Diseases (non-epidemic)	3.76	1.21	8	15	2	34	47	2
Suffocation and decay	3.41	1.41	12	11	4	16	68	1
<i>Price or market risks</i>			(2)					
Price variability	4.00	1.20	4	47	13	29	10	1
Dependency on Dutch suppliers or buyers	3.50	1.21	11	42	13	33	12	-
Dependency on foreign suppliers or buyers	2.99	1.33	15	35	5	39	18	3
<i>Institutional</i>			(3)					
Regulations and sanctions	4.32	0.91	1	2	4	45	49	-
Elimination of government support	2.61	1.26	20	51	30	12	7	-
<i>Personal risks</i>			(4)					
Death	4.19	1.18	3	12	3	17	67	-
Illness and disability	3.88	1.14	7	5	4	26	64	1
Personnel	2.32	1.42	23	24	8	24	40	4
<i>Risks related to 'immovable objects'</i>			(5)					
Fire and ignition	3.73	1.13	9	9	10	45	36	-
Burglary	3.07	1.13	4	7	7	41	45	-
<i>Liability risks</i>			(6)					
Products and services sold	3.59	1.24	10	11	7	40	42	-
Buildings	2.96	1.28	16	5	1	33	61	-
Contracts (supply and delivery)	2.95	1.37	17	23	13	36	28	-
Environment	2.79	1.11	18	6	4	44	46	-
Traffic	2.55	1.27	22	23	5	30	41	1
Personnel	2.11	1.43	24	23	10	38	24	5
<i>Financial risks</i>			(7)					
Changes in interest rates	3.16	1.23	13	14	8	51	27	-
Decrease of farm's collateral value	2.64	1.29	19	35	23	19	23	-
Decrease of retirement provisions because of declining farm values	2.61	1.13	21	28	14	16	42	-

¹Not applicable

4 Multiple risk strategies

The ‘multiple risk strategies’ included in the paper so far are the classical examples of on-farm diversification, off-farm employment, increasing the solvency rate, etceteras. Vertical and horizontal cooperation are more recent examples (BOEHLJE & LINS, 1998). This section discusses three further opportunities for simultaneously covering multiple risks: certification, revenue insurance and stabilization accounts. Certification can be categorized as an ‘on-farm strategy’, revenue insurance and stabilization accounts are ‘risk-sharing strategies’.

Certification is already widely available in the Netherlands. Examples include KKM (Chain Quality Milk) for dairy farms, PVE/IKB (Integrated Chain Control) for pig farms, Safe Quality Food for primary producers (SQF-1000) and Good Agricultural Practices as defined in Eurep-GAP. Certification reduces production risks (through, among others, improved internal efficiency and less failure costs), liability risks (since certification effectuates due diligence) and price risks—if markets for certified products are more stable than other markets (UNNEVEHR et al., 1999; MEUWISSEN et al., 2003b; VELTHUIS et al., 2003).

Revenue insurance is not (yet) available in the Netherlands. It simultaneously covers price and yield risks of a particular commodity. If the correlation between both parameters is negative (i.e. lower yields result in higher prices, and vice versa) revenue insurance should be less expensive than insurance for yields only. The concept already exists in the US for many years (see for instance GOODWIN & KER, 1998). Schemes are highly subsidized by the US government (SKEES, 1999). However, since these type of insurance schemes seem legitimate in the WTO-framework (i.e. they fit into the “green box” representing allowed forms of support), the European Commission is now considering similar tools (MEUWISSEN et al., 2008).

Stabilization accounts not only cover multiple risks but (if relevant for a particular farm) also multiple commodities. The principle of stabilization accounts is that farmers can put money into the account in high-income years (when marginal taxes are high) while withdrawing it in low income-years (when marginal taxes are low). Examples of stabilization accounts (currently not available in the Netherlands) include the Canadian Net Income Stabilization Accounts (NISA) and the Australian Farm Management Deposits. NISA is a whole-farm program in which farmers put money into a bank account, government matches the farmer’s deposits (“dollar for dollar”), and each farmer can withdraw from the account in adverse times. Also NISA is legitimate under WTO-regulations. The Canadian government is currently reconsidering their program in order to also include on-farm food safety issues and environmental programs. The Australian scheme equals the Canadian one but without the matching contributions from the government (MEUWISSEN et al., 2008).

5 Future outlook

This paper was set up around ‘whole-farm risk management’. Results from the 2001 questionnaire indicate that farmers perceive to have managed their farm risks quit well (with some exceptions, mainly in the field of price risks and risks related to the elimination of government support). Farmers generally prefer ‘single risk and commodity strategies’. These results are in line with a more recent, EU-wide study published in MEUWISSEN et al. (2008).

Following a whole-farm risk management approach, i.e. an approach in which multiple risks and farm activities are considered simultaneously, may be more efficient, but probably also more complicated (OGURTSOV, 2008). 62% of the respondents indicated to be interested in assistance in setting up a whole-farm risk management plan. This percentage may even have been higher if respondents would not have known that the survey was initiated by the Rabobank (which has some direct interest in such risk management plans).

The multiple risk strategies discussed (i.e. certification, revenue insurance and stabilization accounts) have some features of a whole-farm risk management approach. For instance, when designing revenue insurance schemes it is relevant to have insight into the correlation between prices and yields. When setting up (subsidized) stabilization accounts, insight is needed into the correlation of revenues among various farm activities. Certification programs require the identification of critical control points of a farm, for example with respect to food safety.

From the above, we define the following areas for further research in the field of whole-farm risk management:

- An analysis of (the dynamics in) correlations between prices and yield of various agricultural activities.
- An analysis of the critical control points of a farm from the perspective of the overall farm viability.

After these steps have been taken, whole-farm risk management plans can be designed—and the ideal partners for advising about them can be identified (see also BUEHLER et al., 2008).

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