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Risk Management in Agriculture in The Netherlands

Olga Melyukhina

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Abstract

RISK MANAGEMENT IN AGRICULTURE IN THE NETHERLANDS

by

Olga MELYUKHINA*

This report analyzes the agricultural risk management system in the Netherlands, applying a holistic approach that considers the interactions between all sources of risk, farmers' strategies and policies. The policy analysis is structured around three layers of risk that require a differentiated policy response: normal (frequent) risks that should be retained by the farmer, marketable intermediate risks that can be transferred through market tools, and catastrophic risk that requires government assistance. The main risk-related policies in the Netherlands are implemented as part of the EU policy framework. Specifically, national policies focus on the management of catastrophic risks by promoting public-private partnerships, such as Livestock Veterinary Fund, to manage the costs of livestock epidemics. The mutual insurance companies specialised in the coverage of specific types of risks are also promoted, with some of them receiving start-up capital and re-insurance support. The recently launched subsidised multi-peril yield insurance exploits the new opportunities created by the EU framework.

JEL: Q18

Keywords: Agricultural policy, risk perceptions, risk management, pest and disease risk, Livestock Veterinary Fund, muti-peril insurance.

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FOREWORD

The OECD project on risk management policy in agriculture (www.oecd.org/agriculture/policies/risk) developed the framework and methods originally published in *Risk Management in Agriculture: a Holistic Approach* (OECD, 2009). These were then applied to the analysis of the risk management policies of five countries: Australia, Canada, Netherlands, New Zealand and Spain.

All five country studies which resulted from this project followed the same process of preparation. The key inputs to these reports were: responses by governments to a detailed questionnaire prepared by the OECD Secretariat; a background report drafted by a national expert; an OECD Secretariat visit to the country with the participation of national and international experts; and a report on the country visit by an international expert.

The OECD Secretariat would like to highly acknowledge financial, information and organisational support to this project by the Dutch Ministry of Economic Affairs, Agriculture and Innovation.

The background report for this study was co-authored by Marcel van Asseldonk, Miranda Meuwissen and Johan Bremmer from the LEI-WUR (the Netherlands). The OECD study benefited from the report by Kyösti Pietola from MTT Economic Research Institute (Finland) on the OECD country visit.

This project was led by Jesús Antón. The author of this report is Olga Melyukhina. Statistical assistance was provided by Christine Le Thi. Editorial work was done by Michèle Patterson. The authors would also like to acknowledge the useful comments and discussions with several OECD colleagues.

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Abbreviations

AI	Avian Influenza
ASF	African Swine Fever
BSE	Bovine Spongiform Encephalopathy
CAHP	Community Animal Health Policy
CAP	Common Agricultural Policy
CME	Chicago Mercantile Exchange
CPHR	Community Plant Health Regime
CSF	Classical Swine Fever
EC	European Commission
FADN	Farm Accountancy Data Network
FMD	Food and Mouth Disease
FMD	Foot and Mouth Disease
FMG	Farmers Mutual Group
GHG	Greenhouse Gas
IBR	Infectious Bovine Rhinotracheitis
KNMI	Royal Netherlands Meteorological Institute
LNV	Ministry of Agriculture, Nature and Food Quality of the Netherlands (currently, the Ministry of Economic Affairs, Agriculture and Innovation)
NCD	New Castle Disease
OIE	World Organisation for Animal Health
PSTV	Potato Spindle Tuber Viroid
SPS	Single Payment Scheme
SPS	Single Payment Scheme
VD	Vesicular Disease
VWA	Food and Consumer Product Safety Authority

Part I.

Risks, strategies and policies

1. Assessment of agricultural risks

Natural conditions and sector organisation

The Netherlands is located near the sea, its landscape dominated by flat and low lands. About three-quarters of country' surface is either less than one meter above the sea level or below it, with large areas reclaimed from the sea through dikes. Because of proximity to the sea and flat terrain, the country has a mild, maritime climate. Summers are generally warm and colder, rainy periods, or excessive heat are relatively infrequent. Winters can be cold, windy, with rain and some snow, but extreme cold is rare. Severe weather events occasionally occur when high and low pressure areas meet around the country's territory, which is prone to flooding. A rise in the sea level and more powerful North Sea storms are important concerns in the context of climate change.

The Netherlands natural conditions favour diverse agricultural activities. Dairy and grazing livestock farms are the most numerous, accounting for 50% of total farm number; greenhouses and open field horticulture are other principal activities (18% of farms), together with arable farming (15% of farms). There also exist intensive livestock units and farms with mixed activities, both accounting for 9% of total farm (LNV, 2008). Over the past decades, Dutch agriculture has experienced a remarkable growth in efficiency, with the sector becoming dominated by highly specialised and intensive production systems that exploit advanced technologies; many farms operating as high-technology biological plants, rather than along the traditional farming systems.

The transformation of farming into a knowledge-based and capital intensive activity was part of a broader drive for value-enhancement across the food chain. The majority of Dutch farms function as part of highly integrated vertical systems, with effective co-ordination mechanisms that span from input supplies to consumer level.

Another feature of Dutch agro-food chains is that they extend far beyond the country borders and rely on external markets as sources of supplies for local primary agriculture and processing. Imported feeds are supplied to livestock farms, which convert them into meat or dairy products, which are in turn directed to export markets. Some downstream segments operate entirely to add value to imported raw products. For example, the Netherlands is the world's leading producer of cacao powder and cacao butter accounting for 30% of the world's production. Overall, agro-food system contributes slightly less than 10% to the national GDP (2008), of which about 4% is the value added to imported

raw agricultural materials. As for the outlets, the Dutch agro-food system is strongly oriented towards external markets with about 70% of activities in the agro-food complex related to foreign sales. The country is the second largest world agro-food exporter after the United States and is home to largest agro-food transnationals, such as Unilever, Heineken, Sovion, Friesland Foods and Campina (LEI, 2009; LEI, 2010; LNV, 2008).

Policy context: EU policy framework

The Netherlands is an EU member and Dutch agricultural producers operate in a policy environment largely formed by the European regulations, in particular those constituting the Common Agricultural Policy (CAP).

From a risk perspective, a key implication of the CAP is that it establishes market price support mechanisms reducing farmer risks. This includes a whole set of policy measures, such as common import tariffs, export subsidies and domestic market interventions that apply to cereal, sugar, dairy, meat and horticultural markets.[1] Successive CAP reforms led to a reduction in border protection and down-scaling of domestic market interventions. All these changes mean that the policy buffer protecting EU farmers from price fluctuations in the commodity markets is being reduced, allowing for greater exposure of producers to price variability. With a phased introduction of direct payments, and in particular a Single Payment Scheme (SPS), stronger emphasis has been made in the CAP on mitigation of farmer income risks, as opposed to price (and revenue) risks.

Outside the CAP, EU regulations also establish principles and systems in the plant and animal disease areas. A Community Plant Health Regime (CPHR) and Community Animal Health Policy (CAHP) are the two principal EU frameworks defining, respectively, plant and animal health activity in Member States. These frameworks set the phytosanitary and veterinary conditions for imports of agro-food items products into the European Union, as well as requirements for their movements within the Community. They also incorporate EU programmes for the control, eradication and monitoring of diseases and establish common rules that must be followed by all member states in the case of disease outbreaks. CPHR and CAHP set the principles of financing veterinary and phytosanitary activity by the European Union, i.e. the types of losses/costs considered as a financial responsibility of the Community and the principles of co-financing of these activities by the European Union and member states. In the veterinary area, Community co-financing covers a broader range of activities than in the phytosanitary area, and may include co-financing of certain costs related to disease outbreaks incurred by individual farmers. In the phyosanitary area, only specified costs incurred by the national authorities can be co-financed.

Finally, the EU framework imposes disciplines on national support implemented by member states. These disciplines have direct implications for risk-related measures such as *ad hoc* disaster assistance and national subsidised insurance schemes, which are typically designed, implemented and financed at the national level.

1. Some important subsectors of Dutch agriculture, such as glasshouse horticulture, floriculture and intensive livestock production, effectively operate with no domestic price support mechanisms.

Key risks in agriculture and farmers' risk preferences

Sectoral diversity of agriculture in the Netherlands implies that the types of risks and their relative importance differ across sectors and farm types. Expert information about risks in Dutch farming is sparse and often incomplete. However, there have been a number of recent studies on risk perceptions in livestock and crop farming, with results summarised in Tables 1 and 2. Risks are grouped into categories of production, price, institutional and financial risks. Studies on livestock farms also distinguish liability and personal risks.

Baltussen *et al*. (2006), estimate the relative importance of various risks in dairy, pig and poultry farming based on risk probabilities and effects (potential scale of damage). Disease risks are evaluated as highly important concerns, although the ranking of specific diseases varies depending on whether the probability of risk or the effect is considered. For example, Bovine Tuberculosis or Avian Influenza are estimated as a low risk based on probability, but as a high risk based on the overall damage. Feed contamination is another high risk in all three livestock sectors. In pig and poultry farming, price risks also have high importance. This evaluation is generally consistent with the results of the larger surveys of livestock farmers by Meuwissen *et al.* (2001) and Huirne *et al*. (2007), which attribute high scores to disease and price risks, but also identify personal risks among the top risks. It is notable that in the most recent survey by Huirne *et al*. (2007) regulatory risks emerge as the highest scoring in perception of livestock farmers.

The evaluation by Baltussen *et al*. (2006) for the crop sector is instructive in that it identifies weather risks, which did not feature in the livestock sector. In contrast to the livestock sector, pest and disease risks in both the arable and greenhouse sectors have moderate importance overall. However, epidemic diseases are a high concern due to the large potential damage even if their probability is estimated to be very low. In the greenhouse sector, output and energy prices are identified as risks with a high probability and potential effect. Chain liability is another high risk specific to the greenhouse sector, whose probability is estimated as low but which may be associated with high loss. The risks in crop production were also studied by Palinskas and Székely (2008) who show that contagious diseases represent the highest-scoring risk in crop farming, followed by output price and production risks. Policy risks are also among the top concerns for crop producers.

Table 1. Risk perceptions of Dutch livestock farmers

	Dairy		Swine		Poultry		Livestock	Livestock
	---------- Baltusen *et al.,* 2006 ----------						Meuwissen *et al*., 2001	Huirne *et al*., 2007
	Probability	Effect	Probability	Effect	Probability	Effect		
Production risks								
Technical results							4.13/3.28[3]	4.22
Epidemics[1]							4.41	3.98
- FMD	M	L	M	L				
- Tuberculosis	S	L						
- ASF and VD			S	L				
- CSF			M	L				
- AI					S	L		
- NCD					V	V		
- Campylobacter					L	S		
Diseases (non-epidemic)							3.07	3.76
- BSE	S	L						
- BVD, IBR, Para, N	L	S						
- Salmonellosis	L	S	L	S				
- Aujeszky			V	V				
- PRRS			L	M				
- IB, Gu, Marek, AE					V[2]	V[2]		
Low product quality							-	3.95
Animal feed contamination	S	L	S	L	S	L		
Surface water contamination	S	M						
Failure of techn. installations			S	L	S	L		
Price or market risks							-	
Price								4.00
- Milk	S	M					4.36	
- Lease milk	S	S						
- Piglet			M	L				
- Meat			S	L	S	L	4.41	
- Eggs					M	L		
- Animal feed	S	S	S	M	S	M		
- Production rights			M	S	M	S		
Dependence on buyers/suppliers							3.47	3.50/2.99[4]
Institutional risks								
Regulations							3.86/3.57[5]	4.32
Removal of government support							3.14	2.61
Financial risks								
Interest rates							2.44	3.16
Decrease in farm value							3.47	2.64
Liability risks								
Products, serv. sold							-	3.59
Contracts							-	2.95
Environment							-	2.79
Personal risks								
Death							4.15	4.19
Illness, disability							3.69	3.88

Notes to Table 1

Results from Baltussen *et al.* (2006) are based on expert assessment (n=14), with measurements of probability and effect on a 3-point scale: small (S), moderate (M), large (L). Results from Meuwissen *et al*. (2001) and Huirne et al. (2007) are based on farmers' assessment (n=612 and n=101 respectively), with measurements on a scale from 1 (not relevant) to 5 (very relevant).
1. For acronyms, see the list of abbreviations for the report. In addition: Para=Paratuberculosis; N=Neosporosis; PRRS=Porcine Reproductive and Respiratory syndrome; IB=Infectious Bronchitis; GU=Gumboro; AE=Avian Encephalomyelitis.
2. "V" indicates existence of preventive vaccination schemes.
3. Technical results of fattening animals and milk yield respectively.
4. Dutch and foreign buyers and suppliers respectively.
5. Environmental and animal welfare policy respectively.

Source: Based on Van Asseldonk *et al*., 2010.

Table 2. Risk perceptions of Dutch crop farmers

	Field crops		Greenhouses		Crops
	---------- Baltusen *et al.,* 2006 ----------				Palinkas and Székely, 2008
	Probability	Effect	Probability	Effect	
Production risks					
Weather			M	M	5.06
- Frost	M	L			
- Hail	M	L			
- Other	M	M			
- Hail and storm			SS	L	
Flood	SS	M	SS	L	
Diseases and pests	L	M	L	M	
Epidemic			SS	L	5.98
- Brownrot	SS	L			
- Ringrot	SS	L			
- Corn borer	SS	L			
Price and market risks					
Output prices			L	L	5.24
- Arable	L	M			
- Vegetables	L	M			
- Fruit	L	L			
- Bulbs	L	L			
- Tree nurseries	L	L			
Chain liability			SS	L	
Energy			L	L	
Marketing difficulties					4.69
Input markets					3.27
Technological progress					4.31
Institutional risks					
Policy measures					4.89
Financial risks					
Debt					4.52

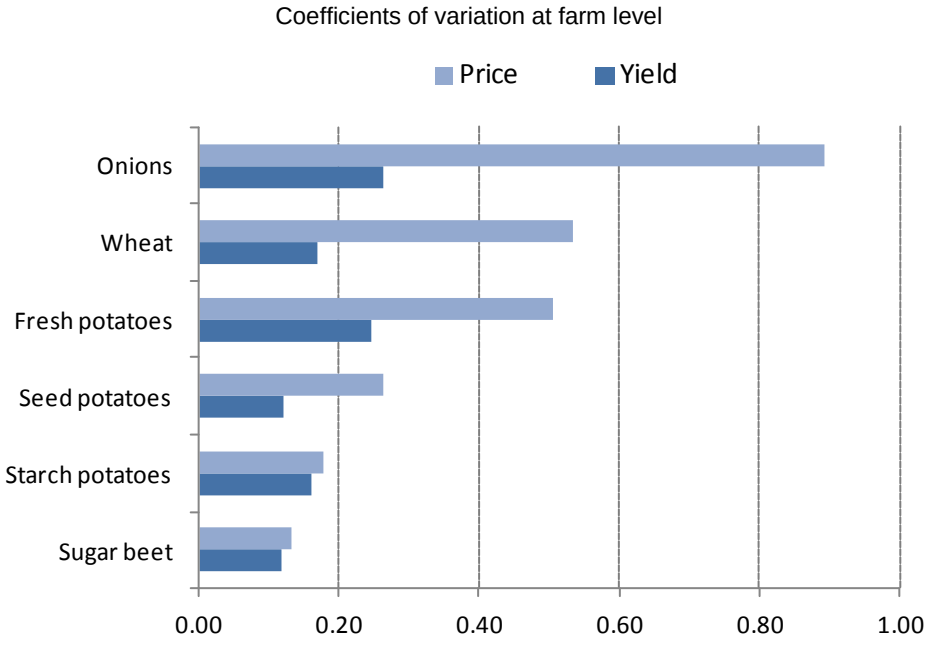
Results from Baltussen *et al*. (2006) are based on expert assessment (n=14), with the estimates of probability and effect made on a 3-point scale: small (S), moderate (M) and large (L). Results from Palinkas and Székely (2008) are based on farmers' assessment (n=226), with measurements on a scale from 1-3 (no effect) to 5-7 (large effect). Farms surveyed had crop and livestock commodities.
Source: Based on Van Asseldonk *et al*., 2010.

Quantitative assesment of agricultural risks based on farm-level data with special focus of Dutch arable farms

The analysis presented in this section is based on the method developed by OECD in a cross-country study of farm level risk (OECD, 2010a). Variations and correlations of prices, costs and returns are estimated based on the farm-level data. These indicators are used to evaluate farmers' risk exposure and the relative importance of the various sources of risks. All farm data used originate from the Dutch Farm Accountancy Data Network (FADN) and includes a panel of 97 arable farms of all size classes, with observations covering six years (2002-07).[2]

Figure 1 compares price and yield variability at the farm level for the key arable crops in the Netherlands. Prices for all crops demonstrate higher variability than yields, suggesting that price risks are more prominent than yield risks in Dutch arable farming. With some exceptions (e.g. onions and fresh potatoes), yields of principal arable crops vary moderately, between 12% and 16% compared to average yields in the analysed period. This, to some extent, is due to the mild climatic conditions in the Netherlands, but also to the advanced technological level of agriculture which enables to control yield risks better. In contrast, there are marked differences in the variability of prices across the crops, which can be largely associated with different price regimes applied in particular sectors. Sugar and starch potatoes, products with rigid price regulation systems show significantly lower price variations compared to wheat and onions, which are subjected mainly to border measures, or fresh potatoes, which is a non-regulated commodity.

Figure 1. Price and yield variability for principal arable crops in the Netherlands, 2007-09



Source: FADN.

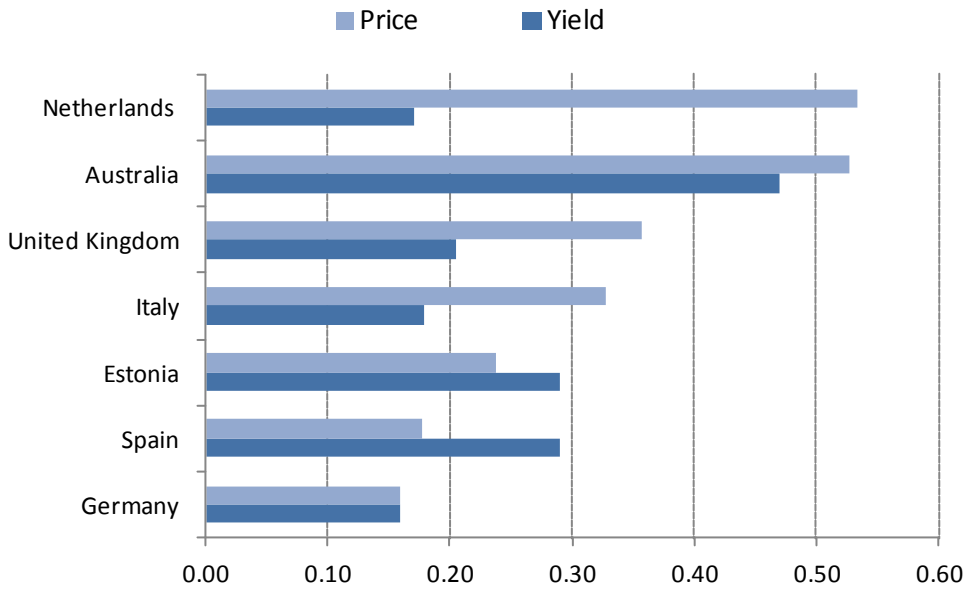
Figure 2 compares price and yield coefficients of variation for wheat across a range of countries, which provides an international perspective on Dutch farming risks. The

2. The initially processed micro-data data were kindly provided by Hans Vrolijk from the Dutch Agricultural Economics Research Institute (LEI).

Netherlands is among the countries with high price and low yield risk profiles. It is also notable that wheat producers in the Netherlands face the highest price variability among the six EU countries covered and which is roughly at the same level of price variability as found in Australia.[3]

Figure 2. Price and yield variability of wheat in selected countries

Coefficients of variation at farm level



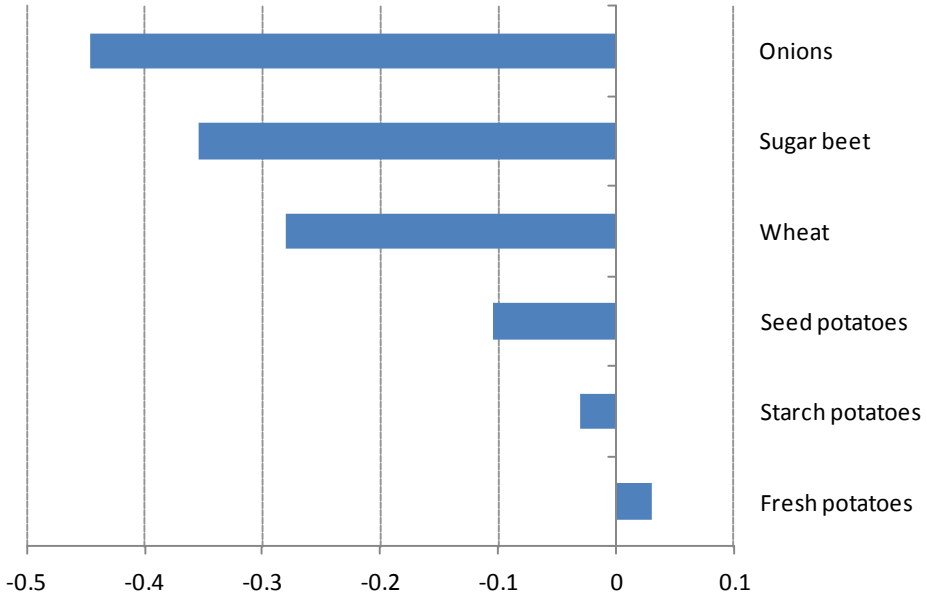
Source: OECD, 2010; FADN.

Price and yield variations are not independent, as prices typically react to yield (and output) changes. If correlations between prices and yields are negative, this stabilises revenue and operates as a "natural" market mechanism reducing farm income risks. Figure 3 shows that for the majority of arable crops in the Netherlands prices and yields are in fact negatively correlated, with relatively high coefficients measured for crops, such as onions, sugar beet and wheat. However, price-yield correlations are weak for all types of potatoes. For seed and fresh potatoes this is most probably due to the large shares of production destined for external markets. Their prices are thus strongly linked to developments in external markets, with limited impact of domestic supply on producer prices. Low price-yield correlations for starch potatoes reflect a generally non-elastic nature of demand for this commodity, and the fact that its prices are policy-administered.

3. The results indicating a relatively high variability of wheat prices in the Netherlands should be taken with care, as they may be sensitive to the period of observation.

Figure 3. Price and yield correlations for principal arable crops in the Netherlands, 2007-09

Coefficients of correlation at farm level



Source: FADN.

In analysing market risks, it is important to consider cross-product correlations. Imperfect correlations between yields for different crops and between prices for different crops reduce fluctuations in aggregate farm revenue. Table 3 demonstrates that correlations of yields across various crops in the Netherlands are typically positively weak, but in some cases they are also negative. This is combined with low and sometimes negative price correlations between crops (with the exception of seed potatoes). Such a pattern of correlations across product yields and product prices suggests that output diversification has a strong potential to reduce the revenue risks of Dutch arable farms.

Figure 4 provides some evidence on the extent to which output diversification in arable farming contributes to stabilisation of agricultural revenue. Per hectare variations in revenues generated from individual crops are compared with the variation of the aggregate (observed) farm revenue. One can see that variability of the aggregate farm revenue, which incorporates the effects of crop diversification, is significantly reduced compared to the hypothetical monoculture options (the only exception being sugar beet). This provides only partial evidence, as in order to assess the output diversification as risk management strategy, it is also important to account for the cost side of diversification and how it affects farm incomes. However, this remains outside the scope of this study.

A study by Vrolijk and Poppe (2008) provides additional insights into farming risks in the Netherlands. It examines variability of farm income and covers not only arable, but also other farm types in the Netherlands.

Table 3. Cross-commodity correlation matrices: prices and yields of principal arable crops

Yield correlations

	Wheat	Sugarbeet	Fresh potatoes	Seed potatoes	Starch potatoes	Onions
Wheat	1.00	0.24	0.19	0.13	0.21	0.09
Sugarbeet		1.00	-0.06	0.03	0.26	0.06
Fresh potatoes			1.00	-0.19	0.42	-0.04
Seed potatoes				1.00	0.07	-0.11
Starch potatoes					1.00	0.00
Onions						1.00

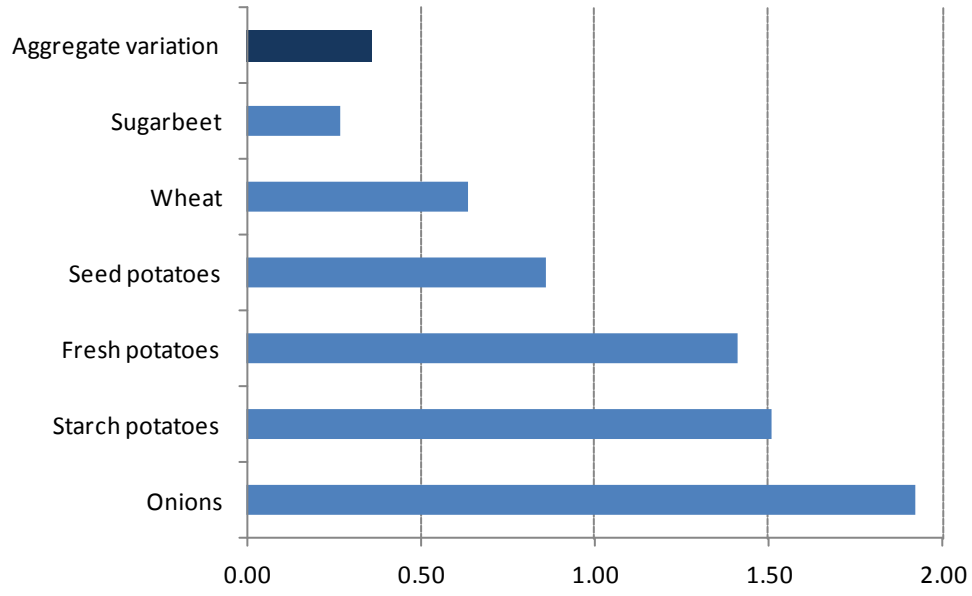
Price correlations

	Wheat	Sugarbeet	Fresh potatoes	Seed potatoes	Starch potatoes	Onions
Wheat	1.00	-0.32	0.12	0.55	0.50	0.25
Sugarbeet		1.00	-0.11	0.65	-0.48	-0.11
Fresh potatoes			1.00	0.65	-0.18	0.41
Seed potatoes				1.00	0.01	0.53
Starch potatoes					1.00	0.00
Onions						1.00

Source: FADN.

Figure 4. Variability of per hectare revenue in the Netherlands: monoculture and observed variation

Coefficients of variation at farm level

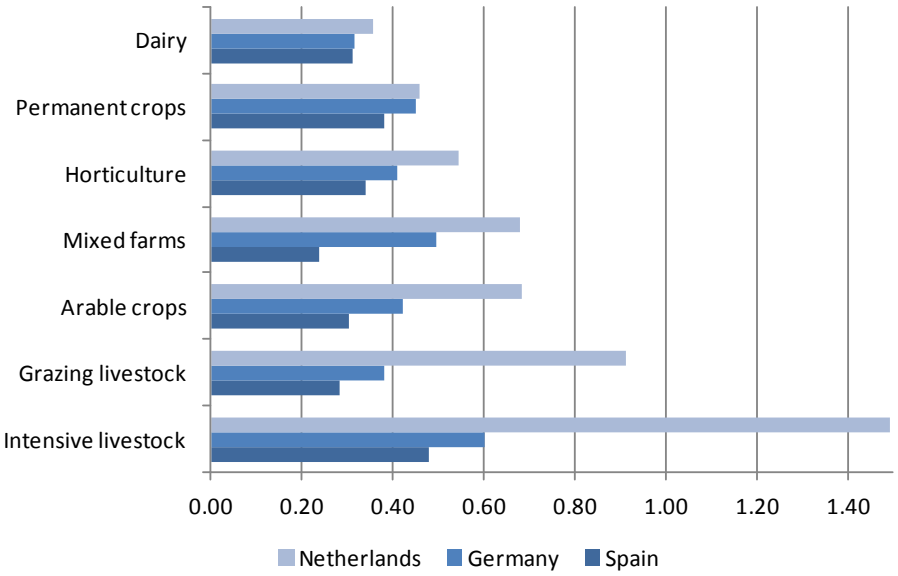


Source: FADN.

Figure 5 shows that there are significant differences in the levels of income instability across commodity sectors. Intensive livestock farms face the strongest income volatility (with incomes fluctuating at 150% around the mean levels during the analysed period). This is a highly specialised sector in the Netherlands, *de facto* operating with no market interventions, and therefore the associated volatility of prices is transmitted to volatility of incomes. It is also possible that the high income instability, both in intensive and grazing livestock sectors, also reflects shocks produced by serious livestock disease outbreaks that occurred during the period covered. Dairy is the sector with the lowest income variations, in part reflecting the operation of a market regulation system. In all types of crop farms income variability is visibly smaller than in non-dairy livestock farming, which can be related to the fact that these sectors have greater diversification possibilities, either across crops or across sectors (e.g. mixed farms in the Netherlands commonly combine crop and pig production). Degrees of output diversification, policy profiles of the sectors, and possible disease shocks are only a few explanatory factors that determine differences in income variability across the sectors.

Figure 5. Variability of farm income in the Netherlands and selected EU Members, 1996-2004

Coefficients of variation at farm level



Source: Calculation based on estimates by Vrolijk and Poppe, 2008; EU-FADN 1996-2004.

The authors made similar income volatility estimates for Spain and Germany and therefore a comparison can be made with the results for the Netherlands. Of the three countries, farmers in the Netherlands face the highest farm income instability. The authors point to the differences in financial structure of farms in the three countries as a factor explaining differences in the levels of income variability. Another possible factor may be the generally higher degree of specialisation of Dutch farms, leading to stronger volatility of farm incomes as compared to Spain and Germany.

The analysis by Vrolijk and Poppe based on FADN data also provides instructive insight into the resilience of farmers to price and revenue shocks. It shows that only 18% of arable farms and 2% of pig farms in the Netherlands would continue to have positive income after a 30% revenue shock; however, the postponement of credit repayment

would help another 22% and 4% of farms in these sectors respectively, to offset losses. The authors argue that financial risks are substantial in the Netherlands due to small margins. Therefore, although climatic conditions have an impact on the volatility of production, the volatility of farm incomes is strongly affected by the (financial) structure of the farm (Box 1).

Box 1. Financial robustness of Dutch farms: a simulation of a revenue shock

As the analysis of the farm-level data shows, the ability of individual farms to cope with revenue shocks varies strongly. Shortfall risks are specified as the percentage of farms that will have a farm income of less than zero due to a price or revenue decrease as a consequence of an external event reducing the output value by 30%.

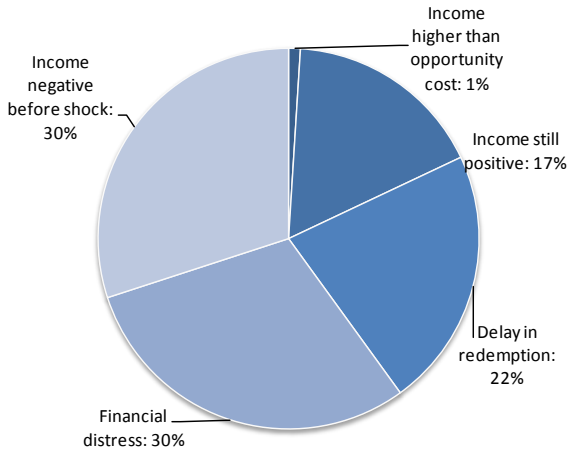
A distinction is made between the simulations by taking the opportunity costs into account or not. Cost of own labour is calculated as an average of paid labour in specific region, cost of own assets is calculated as 4% of own equity. The analysis is focused on specialised pig and arable farms. For every farm, the normal uncertainty in revenue was calculated. Based on the financial structure of the farm, it was analysed how robust a farm would be to withstand a 30% reduction in the output value. In order to show the robustness of farm itself, an assumption was made that no indemnity payments are provided and that the shock does not change the cost structure of farm. Five degrees of financial robustness are distinguished:

- Family farm income is positive and higher than the opportunity costs.
- Family farm income is below the opportunity cost but still positive
- Family farm income is negative, but credit repayment can be postponed.
- Family farm income is negative but cannot be compensated by postponement of loan repayment. Unless the farmer has liquidity to compensate for the negative income, the result will be financial distress.
- Family farm income has been negative before the shock, which deteriorates the situation.

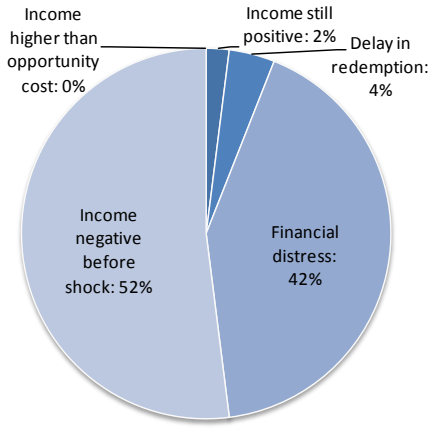
The results for arable farmers show that only 18% would have a positive income after a 30% reduction in the value of output. The situation is worse in the pig sector where only 2% of farmers would have a positive income. These numbers are somewhat biased due to the low income in 2002 and 2003 in the sector, which affects the initial farm situation (56% of the farms had a negative average income during the period of 2002-04).

Whether financial distress leads to bankruptcy depends on many other factors, such as farm wealth, off farm wealth, and off farm income. Further analysis has shown that no strong link exists between the size of the farm and the extent to which a farm can cope with an external crisis.

Arable farms



Pig farms



Source: Vrolijk and Poppe, 2008; FADN.

Several broad observations can be drawn from the analysis of the Dutch farm-level data presented above. One is that prices generally represent by far more important source of risk in the Dutch crop sector compared to yield risks. However, the level of price volatility across specific crops differ markedly, with price policies likely being an important factor explaining these differences. Importantly, crops with high price volatility are also those that demonstrate strong negative correlations between yields and prices. This suggests that high price volatility to a certain extent arises from active adjustments between prices and yield (output), a mechanism that naturally stabilises crop revenue. This mechanism does not have much importance for commodities whose prices are strongly linked to export markets.

Information and communication on risk and risk management

A number of government and private sources in the Netherlands provide information related to farming risks.

Royal Netherlands Meteorological Institute (KNMI) is the national centre for weather, climate research and seismology and it disseminates weather and seismological information to the public, government, and businesses. Detailed short-term weather forecast is freely accessible on-line (*http://www.knmi.nl/datacentrum/*), together with analysis of current climate developments. The Institute also conducts research on climate change which focuses on observing, understanding and predicting changes in climate systems. In addition, KNMI carries out seismological research and observations, and disseminates information on earthquakes and related phenomena.

A broad range of macro-economic, international trade, price and specific sectoral information is provided by the Central Bureau for Statistics (CBS), which can be accessed at its interactive internet site Statline (*http://statline.cbs.nl/statweb/?LA=nl*). Farmer journals and internet sites are other important sources of information on yields and prices (and their evolution over time).

The government finances a broad range of research projects dealing with risks; for example, risks of innovation, price risks in the context of the CAP, and social security. There is, however, no earmarked research budget for the risk theme.

Accountancy agencies, banks and insurers are the providers of financial information. Although fiscal reports are presented annually by an accounting agency, they typically do not assess the level of farm risk exposure. When large investments are made that require an additional loan, a rudimentary stress test of the farm plan is conducted.

More recently, several insurance companies and banks have facilitated farmers' use of internet tools in order to increase their risk awareness. In general, support of risk awareness is not centrally organised, and the use of internet tools and other means of dissemination is not fully exploited. An important step in this direction has been a project developed in LEI-WUR, co-financed by the government and the private sector. This project relates to the so-called risk barometers for the arable, poultry and dairy sectors. The impact of current farm plans and the benefits of risk reducing instruments are determined on the basis of a farm-specific whole-farm analysis. With a limited amount of farm specific input information, the farm specific risk level is estimated (Box 2). The barometer can be freely accessed on internet and users can make their own risk estimations.

Box 2. Risk barometer to assess whole-farm risk position

A risk barometer enables the assessment of the farm specific whole-farm risk position and a sensitivity analysis of alternative farm plans.

Analysing the trade-offs in risk and returns of alternative farm plans and evaluating the merits of risk-reducing instruments requires a method of farm-specific whole-farm analysis. To support decision making, an Internet tool has been developed for farmers who assess the (relative) riskiness of (alternative) farm plans.

Portfolio modelling approach

The portfolio modelling approach is often used to show how different combinations of assets may reduce an investor's risk more than when having just a single activity. When applied to agricultural businesses, the notion of portfolio modelling is extended to include alternative cropping activities, price contract arrangements and financing alternatives. The classical portfolio approach is based on mean-variance (E, V) programming. This method restrictively uses the first two moments (i.e. mean and variance) of each risky activity and the first co-moment (i.e. covariance) between the risky activities.

Assessing risk position

Means, variances and co-variances of de-trended yields and deflated prices are estimated using FADN data. Based on the farmers stated production plan, farm characteristics and preferred risk management strategies, the joint distribution of the household income is analytically computed. Risk on the barometer scale is approximated with the coefficient of variation (CV), whereby CV = (Standard deviation of household income / Expected household income) * 100.

The risk barometer is available on-line free of charge for arable, dairy and poultry farmers: *http://www.lei.wur.nl/NL/publicaties+en+producten/Toolssoftware/Risicobarometer+voor+akkerbouwers/*.

Source: Van Asseldonk *et al,* 2005.

2. Risk management strategies and government policies

This section examines risk management strategies in the farming sector of the Netherlands and government policies that support them. The strategies are classified according to criteria following the analytical framework introduced in OECD (2009); that is, whether the strategy reduces the probability of risk occurrence (risk reduction); whether it reduces the magnitude of the damage (risk mitigation), and whether it reduces the impact on consumption (risk coping). Additional distinction is the institutional level at which the main action takes place: some risks are managed by the means available within a farm household/community; others are dealt with through markets; and some risks require public action. Table 4 adopts this two-dimensional classification of various strategies, highlighting those which have special relevance in the Netherlands. This table is not exhaustive, but seeks to facilitate an effective comparison of risk management in the countries covered by the thematic reviews. The discussion that follows considers risk strategies in the Netherlands in a more comprehensive way.

Table 4. Risk management strategies having specific importance in the Netherlands

	Farm household and community	Market Collective action	Government
Risk reduction	• Farm financial management • Preventive plant protection • Strict hygienic rules • Quality assurance schemes		• Water management, dykes • ***Prevention of diseases**** • ***CAP price support****
Risk mitigation	• **Co-operation, forward contracting** • **Vertical integration**	• Private insurance • **Government-supported mutual insurance schemes**	• Credit guarantees • **Coping with livestock epidemics: Livestock Veterinary Fund**
Risk coping	• Savings		• *Ad hoc* disaster relief • Income tax: financial reservation option • ***CAP Single Payment Scheme****

* Policy measures with an asterisk are implemented within the EU framework.

The mapping of the risks and strategies to deal with them is specific to the risk and institutional environment of each country. However, there is a connection between the types of risks and the types of institutions by which different risks are managed. There are risks that because of their *catastrophic* character (low probability and high damage) are typically not manageable at the farm level or through risk markets and require *government action* with the underlying policies. There are risks that can be regarded as *normal* (with high probability and low damage) which are typically managed at the level of the farm (as a business entity and/or household) and without significant involvement of markets or government. Finally, there are risks with medium probability and medium damage that can be managed by transacting risks through *market* instruments or collective action by producers.

This section first examines the strategies used at the farm/household level and government policies related to normal risk layer; market instruments and the policies

supporting risk markets. Finally, government measures that deal with catastrophic risk are discussed.

The section concludes with an overall assessment of government risk-related measures and a discussion of how different policy measures fit into the different risk layers – normal, marketable and catastrophic – and how the boundaries between these risk layers are developed in specific risk and policy environments in the Netherlands.

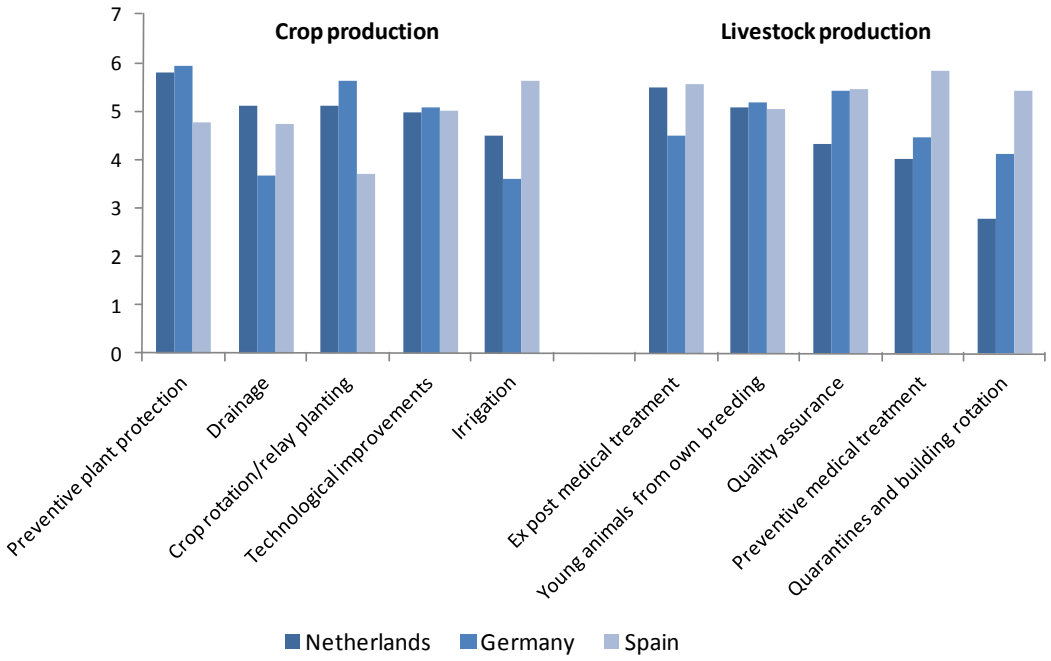
Strategies at farm household/community level

Production practices to reduce output risks

Production risks are primarily managed at the farm level. The survey by Palinskas and Székely (2008) identifies a number of practices in crop and livestock farming to manage output risks (Figure 6). The importance of various techniques is evaluated based on scores of their effectiveness given by producers. Although this does not measure the actual use by farmers of these risk techniques, it serves as an approximation, assuming that the perception of the effectiveness of various production practices is a principal factor in determining farmer's choice of risk management.

Figure 6. Effectiveness scores of various production techniques in reducing yield risk

Mean scores in a 7-point scale from very effective (5-7 points) to ineffective (1-3 points)



Source: Palinkas and Székely, 2008.

Dutch crop producers consider preventive plant protection methods to be the most effective in controlling output (yield) risks. Techniques, such as drainage and crop rotation, and technological improvements are also rated high, but slightly less than crop protection. The study also highlights the differences in perceptions of effectiveness of various methods across EU countries. For example, such differences are clearly seen when comparing drainage and irrigation techniques of the Netherlands, Spain and

Germany. As expected, drainage is rated highest in the Netherlands, while in Spain it is seen as a moderately effective technique and even less so in Germany. In contrast, irrigation has a relatively low profile in the Netherlands and Germany, but is perceived in Spain as the most effective technique to control yield risks. It is notable that farmers in all three countries attach equal importance to technological improvement, rating it as an effective means of managing production risk.

The key techniques to reduce output risks in livestock production in the Netherlands are given slightly lower effectiveness scores than the key techniques in crop production. Among the principal techniques identified, *ex post* medical treatment of animals is perceived as the most effective in the Netherlands, followed by the practice of breeding own young animals. Dutch livestock breeders evaluate the effectiveness of other methods, such as quality assurance and preventive medical treatment as moderately efficient, and much less efficient than do breeders in Germany and Spain. Nevertheless, what concerns quality assurance, 82% of Dutch respondents participated in such schemes (90% in Germany and 75% in Spain). It is notable that quarantines and building rotation are seen as ineffective techniques by Dutch producers, which contrasts with the evaluations by German and, particularly, Spanish breeders.

In addition to practices identified by this study, results obtained by Meuwissen *et al*. (2001) and Huirne *et al*. (2007) also point to the high importance of strict hygienic rules for output risk reduction (Table 5). This is congruent with the opinions expressed by many Dutch interlocutors when interviewed by OECD, which noted the necessity to apply advanced monitoring technologies and protection measures to prevent endemic disease and pest risks. These protection measures impose significant cost to farmers and may also have important external effects (e.g. on the environment or food residues). The emergence of more resistant disease and pest varieties was mentioned as a significant challenge that could jeopardize the future efficacy of protection measures.

Farm financial management and the role of the banking and financial system

The study by Meuwissen *et al*. (2001) highlighted that Dutch farmers attribute particular importance to farm financial management and, in particular, to ensure that they produce at the lowest possible cost (Table 5).

Table 5. Perception of risk management strategies by Dutch farmers

Scores on a 5-point scale from very relevant (5) to not relevant (1)

	Livestock farms Meuwissen *et al*., 2001	Livestock and mixed farms Huirne *et al*., 2007
Producing at lowest possible costs	4.67	..
Strict hygienic rules	3.96	4.08
Increase solvency ratio	3.45	4.02
Financial reserves (savings)	..	3.81
Application of new technologies	..	3.64
Enterprise diversification	2.05	3.44
Spatial diversification	2.17	2.15

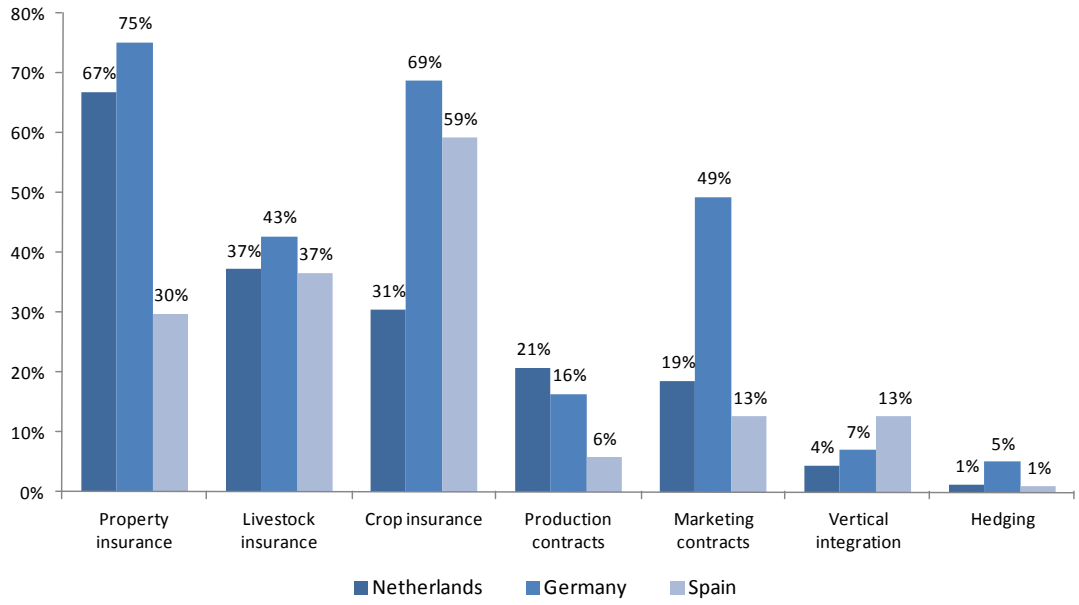
Results by Meuwissen et al. (2001) and Huirne et al. (2007) are based on farmer evaluations (n=612 and n=101 respectively). Respondents include livestock farmers and livestock /mixed farmers respectively.

Source: Van Asseldonk et al., 2010.

Risks associated with borrowing are often perceived as a principal source of financial risk. In the survey by Palinskas and Székely (2008), 38% of farmers responded that they avoided taking out loans, while around one-fifth created financial reserves to mitigate any financial risk (Figure 7).

Figure 7. Use of farm-level risk management strategies in the Netherlands and selected EU countries

Per cent of respondent applying the strategies



Source: Palinkas and Székely, 2008.

Despite the relatively high share of producers who are averse to borrowing, credit plays a very important role in financing agriculture in the Netherlands, particularly in the most intensive sectors, such as horticulture and intensive livestock enterprises. Borrowing also represents one of the typical farmer risk-coping strategies. Palinskas and Székely found that 54% of Dutch respondents carried debt to the banks at the moment of the enquiry, compared to 30% in Germany and 18% in Spain. Rabobank is the largest agricultural lender. Between 2005 and 2008, the overall amount of credit provided to the primary sector increased by almost one third, with the most important increase in borrowings occurring in the greenhouse (by 54%) and pigmeat sectors (by 30%). According to Rabobank, the debt levels in Dutch agriculture are among the highest internationally.

Different instruments are available to farmers to manage financial and currency risks; for example, taking credit at fixed interest rates, although this results in higher interest cost than loans at variable interest rates (Baltussen *et al*., 2006). Furthermore, borrowing as such helps to develop a longer-term view of the business amongst the borrowers, who are obliged to anticipate future returns and potential cash flows. As lenders, banks perform such functions as loan assessment and monitoring which addresses the financial risks incurred not only by lenders, but also by borrowers. After the outbreak of the 2008 financial crisis, the profitability of borrowers declined significantly as did their capacity to repay loans. This occurred against the background of a general tendency of falling

solvency rates in almost all farming sectors over the current decade.[4] Banks had no incentives to allow farms to go bankrupt because of the businesses lost their values compared to the pre-crisis situation. Rabobank, for example, postponed the loan repayments to provide some financial buffer to the borrowers during the peak of the crisis. Since 2008, the banking sector has become more conservative in its lending decisions; however, according to Rabobank, agriculture in general continues to be perceived as a low-risk activity.

Diversification and crop rotation

Dutch agriculture is mostly specialised and only partly diversified. Only 12% of Dutch respondents indicated they used enterprise diversification as a risk strategy (Figure 7). Most animal units, such as dairy, pig and broiler farms are highly specialised. Specialisation relates both to the type of product and the stage of the product (e.g. breeding *versus* finishing feeding of animals). In plant production, some branches are highly specialized, e.g. floriculture, production of vegetables and mushrooms in greenhouses. Other branches, such as tree nurseries, bulb and arable farming, are more diversified. In bulb and arable production, the main reason for diversification is technological, i.e. rotation has to be applied in order to prevent soil pest and diseases to cause harm.

Most farmers specialise in order to take advantage of economies of scale. Specialisation allows the farmer to orient his knowledge and skills, as well as focus machinery and firm equipment to a principle crop. Greenhouse production, in addition, requires climatic conditions that are specific to a particular crop. Strongly integrated vertical chains create additional pressures for specialisation of primary production in the Netherlands. Downstream industries, for example, demand products in large quantities and of high and uniform quality, conditions which can be generally attained in highly specialised production systems.

The main advantage of diversification is that it reduces revenue risks because it smoothes fluctuations in output and average price. As the analysis of the farm data shows, fluctuations in the aggregate revenues generated from the observed crop mixes in arable farms were significantly lower than fluctuations in individual crop revenues (Figure 4). However, diversification typically implies that either smaller lot sizes can be offered, or that the quality of products within the lot varies significantly, which results in lower price. The average unit cost may be increased and the average price may be lower compared to commodities produced within specialised operations, and so the gross margin for diversified firms may be lower than in specialised firms. This reduction in gross margin can be considered as a risk premium. Some analysts consider that the vast majority of Dutch farmers choose to not pay that risk premium.

In OECD interviews, farmers generally expressed similar views. Land allocations and product portfolios may still be important for some firms but not for the sector as a whole. Product diversification likely increases costs too much for farms being profitable in extremely competitive low margin and export oriented business. Land allocations are

4. An increase in firm sizes creates higher demand for loans. The banks have developed a "sale and leaseback" arrangement to facilitate firms to grow quickly. Under such arrangement, the bank becomes an owner of a new greenhouse or shed, which can be leased by the grower or farmer. The banks benefit from fiscal subsidy programs to support sustainable production methods.

mostly driven by the need for crop rotations to enhance the quality of high value crops and reduce risks of plant diseases, rather than a strategy of building diversified output portfolios as such. Within the Dutch agro-food system, forms of diversification other than related to farm output take precedence; that is diversification across marketing channels, time and locations and across the vertical activities in the food chain.

Off-farm income

Off-farm income includes remuneration for off-farm work of farmer and his partner, social benefits and income from capital invested outside farming business. The study by Palinskas and Székely (2008) shows that around 18% of respondents in the Netherlands had off-farm income and 6% made off-farm investments (Figure 7). These shares are substantially lower than in Germany, but somewhat higher than in Spain.

It is difficult to observe a distinct trend in the relative importance of off-farm earnings across time. Farm revenue has been highly variable and in 2008/09, it fell strongly following the economic crisis. However, considerable variations in the degree to which different types of farms rely on off-farm are clear. The data for 2001-09 shows that off-farm earnings constituted a considerable part of total receipts of pig and broiler producers, and at times either fully or partly offset farming losses of these producers**.** Off-farm earnings are also relatively important for dairy and arable farmers. In the arable sector, the daily work flow of smaller firms in particular allows external jobs to be taken. In contrast, off-farm activity is low in greenhouse horticulture (Table 6).

Generally, off farm income is more stable than farm income and therefore provides a cushion against income fluctuations. However, it is unlikely that off-farm earnings for Dutch farmers represent an intended strategy to reduce farm income risks.

Table 6. Off-farm income in Dutch farms in 2001-09

Average per farm[1]

Farm type	2001	2002	2003	2004	2005	2006	2007	2008	2009e
					Euro 1 000				
Dairy	8	9	13	13	15	19	14	12	16
Pig	10	12	19	14	14	15	20	20	22
Broiler	7	10	10	16	12	14	14	19	19
Arable	5	11	12	15	21	20	18	12	11
Greenhouse horticulture	4	6	8	6	9	8	7	-6	7
					Off farm income as % of total family income[2]				
Dairy	14	19	27	22	23	26	15	17	219
Pig	42	..	152	17	15	16	..	60	74
Broiler	10	323	99	248	11	147	18	112	28
Arable	10	47	22	62	39	23	25	21	17
Greenhouse horticulture	6	8	10	11	17	10	9	..	..

1. The average number of households per farm varies from 1.04 (dairy farms) to 1.2 (greenhouse horticulture).
2. Numbers exceeding 100% indicate that total income was smaller than off-farm income; ".." indicates that total family income was negative.

Source: FADN.

Government measures related to farm household/community strategies

Tax and social security provisions

Dutch farming businesses are eligible for tax on agricultural income with no concessional rates existing for agricultural producers; CAP support payments are treated in the Netherlands as normal income and are also subject to income tax.[5] The income tax regulation offers certain flexibility to taxpayers (which is not agriculture-specific) to manage their cash flows, giving all companies the possibility to spread profits over three years. A company may also use the option of "fiscal reservation," i.e. to set off losses incurred in a given year retroactively against its taxable income for three preceding years (carry back) and for the coming nine years (carry forward). As Table 7 shows, approximately 45% of farming businesses had recourse to this facility.

The Dutch social security system provides assistance to self-employed workers in financial difficulty (Bbz). The assistance may be provided to cover subsistence needs or working capital necessary to support business. Both types of aid are in the form of a loan. In the case of subsistence needs, the loan is given for one year (with the possibility of an extension) and is free of interest. The working capital loan is provided for ten years and bears interest.

The use of the income support for the self-employed is limited. Between 200 and 300 farmers receive this assistance annually. There is a greater tendency among entrepreneurs working in intensive livestock farming and greenhouse horticulture to have recourse to this scheme.

Access to social security benefits is difficult for Dutch self-employed farmers because they hold important assets. If self-employed farmers face economic hardships, or if they are unable to work, they generally have to rely on own assets as an economic buffer. However, only slightly more than half of self-employed farmers are insured against incapacity for work, partly because the cost of insurance is considered to be too high.

Table 7. Tax and social provisions related to farm business risk management and farmer participation rate

Area	Policy measure	Participation rate, %
Income tax	Fiscal reservation	45%
Disability	Private insurance market	52%
	Farm Maintenance Service	
Pension	General Pension System	100%
	Individual retirement accounts offered by insurance companies	35%
	Setting off part of profits for retirement (individual strategy)	-
Unemployment	No provisions	-
Low income	Assistance to self-employed persons (Bbz)	<1%
	Income support to aged and disabled persons	-

Source: Van der Meulen, 2009.

5. In several EU member states, income tax is not levied on agricultural income (e.g. Poland), is small for small producers (e.g. Hungary), or preferential rates are applied for certain farm groups. Several member states also apply various preferential provisions on taxation of EU support payments (e.g. France, Germany, and Belgium). (Memo, 2010).

Government credit guarantees

The Dutch government provides guarantees on loans for investments by small and medium scale agricultural enterprises. Among others, young farmers and producers who intend to make investments in "sustainable production" livestock units and Green Label Glasshouses can benefit from such guarantees. Up to 80% of the eligible loan can be guaranteed but up to fixed absolute maximum. To become eligible, borrowers are required to pay a one-off fee (a premium). The premium rate varies depending on the type of borrower, e.g. young farmers pay a premium of 1% of the guaranteed amount compared to a general rate of 3%.

In October 2008, the Dutch government began to provide temporary guarantees on bank loans to farms experiencing temporary financial difficulties. This was introduced in the context of the economic crisis which severely hit the Dutch agricultural sector. The average agricultural income per holding (including horticulture) dropped from EUR 50 400 in 2007 to EUR 5 500 in 2008 (LEI, 2010). The value of agricultural holdings has fallen substantially and their solvency levels have deteriorated. The exposure of the sector to financial risks increases considerably, particularly in the sectors with high recourse to debt financing.

The guarantees are accompanied by a set of conditions to ensure the loans are provided to facilitate post-crisis recovery. Guarantees are provided only for working capital loans and only for working capital required in the first 12 months following the application for the guarantee. The latter can cover up to 50% of a loan, the amount not exceeding EUR 850 000. Only primary producers, and only those affected by liquidity problems after July 2008, are eligible. In order to receive government guarantees, banks are required to grant at least a two-year deferral of repayments on all loans that the borrower holds with the banks. This assistance is available until December 2010 only.

EU agricultural support policies

CAP mechanisms support producer prices and incomes, and therefore play an important role in managing producer income risks. The role of various policy instruments has been changing, with a gradual shift from market interventions and price support to income support. Exposure of farmers to price risks has increased, but they have more freedom to adapt their production choices to changing market conditions.

Although the CAP price support system is limited, its principal instruments and mechanisms triggering interventions remain in place. Table 8 shows the CAP's financial contribution to price and income support in the Netherlands. In absolute terms, the SPS is the largest component, although it is a small share of total EU allocations on SPS payments. Dutch exporters are important beneficiaries of EU support to the milk and potato starch sectors. In 2008/09, 40% of total EU export refunds for milk and milk products and substantial shares of funds for intervention storage of milk products were directed to the Netherlands. The phasing-out of the milk quota by 2015 will be the EU market regulation reform affecting the largest number of Dutch producers. In 2008/09, the country received around one quarter of EU allocations for potato starch interventions and for aid to potato growers. Dutch producers were also one of the largest EU beneficiaries of beef payments.

Table 8. EU outlays on market price and income support in the Netherlands in 2008 financial year

Measures	EUR mln	As % of total EU expenditure on the measure
Export refunds	105	16
Milk and milk products	71	39
Non-Annex 1 products	20	22
Sugar and isoglucose	6	3
Fruits and vegetables	0	3
Beef and veal	2	7
Live animals	1	11
Pigmeat	3	5
Eggs	1	34
Poultrymeat	1	1
Cereals	0	0
Operational funds for producer organisations	119	17
Sugar Restructuring Fund	116	4
Intervention for starch	11	27
Intervention storage of skimmed-milk powder	5	7
Intervention storage of butter and cream	8	30
Intervention for pigmeat	0	0
Other measures	4	3
Direct payments	827	3
SPS (single payment scheme)	690	2
Beef slaughter premium — Calves	38	33
Beef slaughter premium — Adults	59	27
Payments to starch potato producers	25	24
Dried fodder	4	3
Other payments	2	0
Additional amounts of aid	11	2

Source: EC 2010.

Market instruments

This section examines risk management practices requiring specific institutional arrangements beyond the farm. Institutions, such as insurance, futures markets, co-operation and vertical integration, and forward contracting, are designed for sharing risks specifically or as part of their broader rationale. Dutch producers operate in the CAP-regulated agricultural market, where price and income risks are generally contained by the policy mechanisms. The CAP price support system (including border and domestic measures), besides maintaining prices at relatively high levels, also reduces the downside price risks, while direct payments ensure minimum levels of farm income. This policy environment inevitably affects producer choices of risk management instruments, e.g. it may create preferences for certain types of insurance or result in a lack of incentives for using some of the risk instruments, e.g. futures trading.

Table 9 illustrates perceptions by Dutch farmers of various risk management instruments, which shows that they distinguish business and personal insurance as the most important market tool for risk-sharing. This is confirmed by the survey on actual use of risk market instruments, indicating the highest frequency of insurance – over two-thirds of Dutch producers have property insurance, nearly one third have crop insurance, and over one third have livestock insurance (Figure 8). These shares are lower than in Germany and Spain, in particular as concerns crop insurance; for Spain, a higher uptake of insurance can be partly explained by the substantial policy incentives provided for the use of this risk tool.

Among other risk-sharing arrangements, Dutch farmers score relatively high on contracts for manure delivery, and for leasing or renting machinery to reduce cost (and income) risks (Table 9). Contracting within or outside the co-operative framework also features among the strategies considered to be relatively important.

Table 9. Perception of market risk management tools by the Dutch farmers

Scores on a 5-point scale from very relevant (5) to not relevant (1)

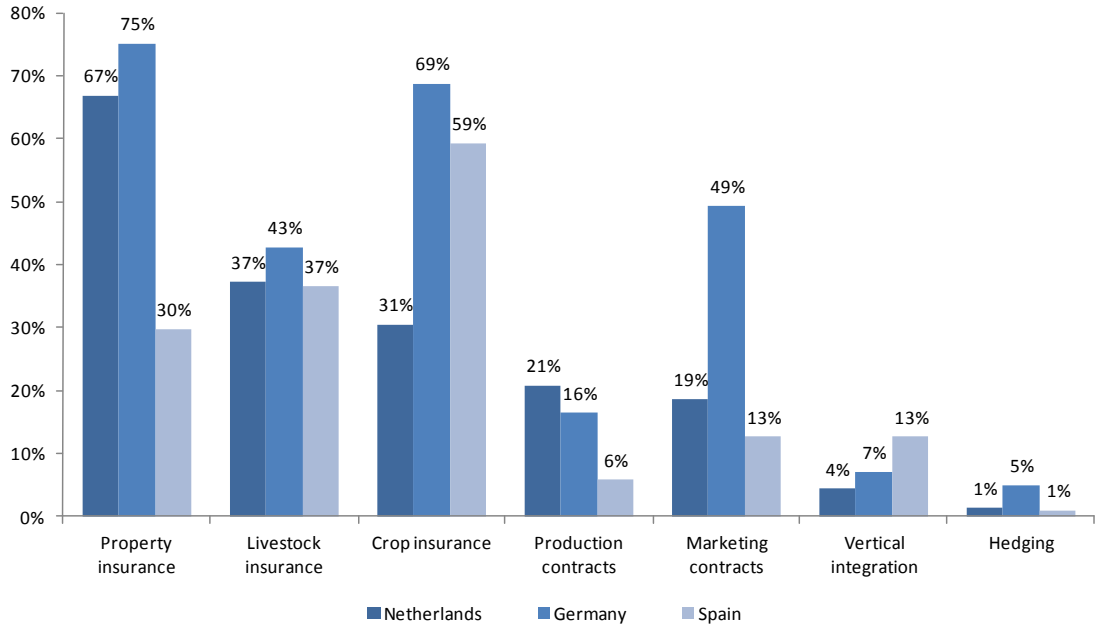
	Livestock farms	**Livestock and mixed farms**
	Meuwissen *et al*., 2001	Huirne *et al*, 2007
Business insurance	4.33	3.80
Personal insurance	4.06	3.71
Manure delivery contracts	..	3.54
Leasing/renting machinery	..	3.44
Vertical cooperation	..	3.40
Horizontal cooperation	..	3.27
Price contracts for farm outputs	2.58	2.88
Price contracts for farm inputs	2.53	2.90
Futures and options market	1.58	2.35
Leasing/renting milk quota	..	2.43
Off-farm employment	1.98	2.27
Off-farm investment	2.12	2.75

Results by Meuwissen *et al.* (2001) and Huirne et al. (2007) are based on farmers' evaluation (n=612 and n=101 respectively) Farmers are livestock farmers and livestock /mixed farmers respectively

Source: Van Asseldonk *et al*., 2010.

Figure 8. Use of market risk instruments by agricultural producers in the Netherlands and selected EU countries

Per cent of respondent applying the strategies



Source: Palinkas and Székely, 2008.

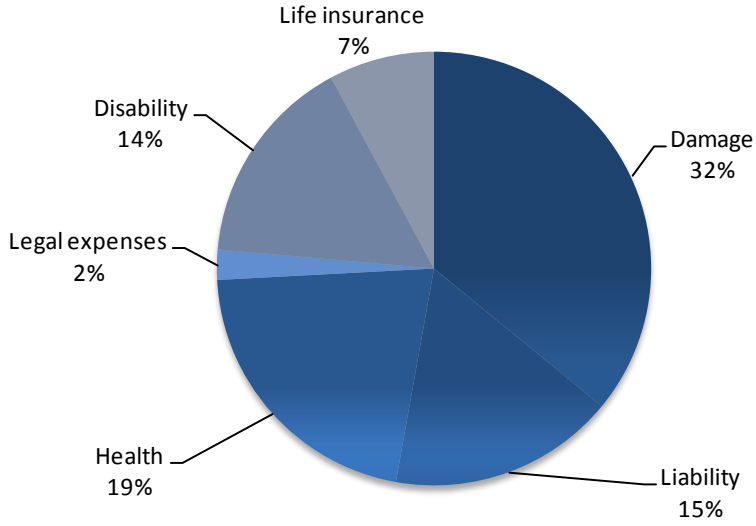
Private and government supported insurance

Most Dutch companies providing agricultural insurance are organised as mutuals, such as Achmea/Interpolis, Agriver and Univé. Some companies provide all types of coverage, while others offer only special, targeted coverage (Table 10).

Based on FADN, insurable risks in the Netherlands are classified as damage, liability, health, legal, disability, and life insurance (i.e. all-risk insurance which aggregates premiums paid for all types of insurance).

The average arable farm spends approximately EUR 8 000 per year on insurance, a level comparable to similar spending by other types of farms. As Figure 9 shows, damage insurance is the largest category, accounting for almost one-third of total insurance premium payments. The other largest categories are health, liability and disability insurance.

Figure 9. Distribution of insurance premiums paid by type of insurance in Dutch arable farms, average for 2002-08



Damage insurance relates to property (structures, vehicles, machines, crops and livestock); disability insurance concerns incapacity to work due to serious injury or illness; legal insurance covers losses incurred in court actions (excluding criminal matters); and liability insurance covers damage caused to third parties.

Source: Van der Meer *et al*., 2007.

Crop yield insurance in the Netherlands generally consists of hail insurance which is offered by a few companies only. The overall value insured is EUR 1.5 billion (about 50% of the total value), with the risk premium reaching 0.50% of the insured amount. Aggregated claim statistics for crop hail insurance show that losses are relatively small: two-thirds of reported losses were below 30%. For the greenhouse sector, the penetration rate is 100%, since hail insurance is requested by banks for protection of their credit risks.

Livestock insurance is typically a part of damage insurance. For example, if livestock is kept in an insured building and the building is affected by the covered event (e.g. fire), the loss caused to animals is treated as property damage. Some insurers also offer coverage against consequential losses related to animal disease, e.g. compensating 50% of the value of the cow in the event of culling.

The agricultural insurance market in the Netherlands is distinct in that there are insurance products that are narrowly targeted to particular risks of particular farm groups. These products are provided by mutual funds representing independent companies, but with links to larger insurance companies (e.g. Interpolis) for reinsurance and advice (Table 10).

Table 10. Types of agricultural insurance in the Netherlands and main providers

Insurer	Farming group	Insurable risks	Penetration rate	Policy support	
				Type of policy	Level
All insurers	All types	Single risks (damage, liability, health, legal expenses, disability); packages (e.g. illness, accidents, and business interruption)	na		
Potapol (mutual)	Potato producers	Specified potato diseases: brownrot, ringrot, and PSTV	63% of total potato area, incl. 92% of seed, 39% of ware, and 74% of starch potatoes (2008/09)	Start-up capital of EUR 0.7 million	National
Avipol (mutual)	Broiler producers	Specified poultry diseases: salmonella, mycoplasma gallisepticum, and hysterie; only producers with Integral Chain and Salmonella Control (ICCsc)	66% of rearing and breeding broilers (2008)		
Porcopol (mutual)	Pig producers	Consequential losses from swine epidemics (FMD, classical swine fever, and Aujeszky): losses due to sales of infected vaccinated animals and culling	6.5% of total number of sows (2008)		
OFH (mutual)	Fruit producers	Hail and frost	na	Re-insurance subsidy, for frost insurance only	National
		Multi-peril insurance since 2010 (hail, frost, storm, snow, extreme drought and extreme rainfall)		Insurance premium subsidy up to 65%	EU co-financed, 75%
OWV (mutual)	All producers of open air crops	Multi-peril insurance since 2010 (hail, frost, storm, snow, extreme drought and extreme rainfall)	na	Insurance premium subsidy up to 65%	EU co-financed, 75%
Agriver (mutual)	All producers of open air crops	Losses from excess precipitation and other perils related to open air production	na	Re-insurance subsidy; *ad hoc* premium subsidy in 2007	National
		Multi-peril insurance since 2010 (hail, frost, storm, snow, extreme drought and extreme rainfall)	na	Insurance premium subsidy up to 65%	EU co-financed, 75%
Aquapol (mutual)	All producers of open air crops	Losses from excess precipitation	na	Re-insurance subsidy; *ad hoc* premium subsidy in 2007	National
Fyto (mutual, no longer existing)	Greenhouse producers	Consequential losses from bacterial diseases in greenhouses; only producers complying with "good agricultural practices" could underwrite	na	Insurance premium subsidy	National

Source: Van Asseldonk *et al*., 2010; LNV 2010.

Potapol Mutual was created in 1997 following the substantial damage caused by Brownrot potato disease in 1995 and 1996. Contagious potato diseases had devastating financial consequences for a limited number of individual producers when infected potatoes were destroyed. The national government partly compensated these losses via a disaster relief program, but stated it would no longer do so. The dominant stimulus to reform the system was the need to reduce government, and ultimately, taxpayer expenditure on disaster relief.

Avipol Mutual covers rearing and breeding broiler production farms in the poultry sector against the risk of specified poultry diseases. The point of departure for this insurance was again that public assistance was no longer available. Only farmers with an Integral Chain Control and Salmonella Control (ICCsc) certificate can participate in this mutual. Certified flocks are considered to have a lower risk of microbial infections, including the insured salmonella types. In order to obtain a certificate, poultry farmers must take strict measures with respect to: 1) construction, lay-out and cleanliness of the enterprise; 2) manner of keeping poultry; 3) supply of animals, (hatching) eggs and feed; and 4) third party visits. If contamination is detected, strict control measures are applied for treatment or destruction of animals and (hatching) eggs, and removal of the contaminated material and manure.

The Porcopol insurance scheme created in 2002 covers consequential losses from swine epidemics (FMD, classical swine fever and Auejszky's disease) on sow farms. Members of the mutual receive a fixed compensation per sow in the case where (i) sows are infected with Aujeszky's disease and need to be vaccinated; (ii) sows are infected with FMD or classical swine fever and need to be culled; or (iii) sows need to be pre-emptively culled because of an outbreak within a sphere of 1 kilometre. Preventive vaccination does not trigger a payment.

OFH is a mutual insurance fund for fruit farmers, already existing for many years. It was created to cover hail risks, but since 2007, it also covers frost.

Aquapol and Agriver mutual insurance schemes were introduced by two insurance companies following heavy rainfall losses in 2002. Agriver insures against losses due to precipitation and also other perils related to outdoor production and livestock. Aquapol offered coverage against precipitation losses only, but ceased to sell new contracts as of 2009. In both insurance schemes, policy holders are the owners of the mutual. These are voluntary insurances, but a substantial part of those insured must participate for at least five years in order to receive disaster relief for losses incurred in 2002. This scheme has not been highly successful as farmers are less willing to participate because of the high and frequent adjustment payments.

Fyto mutual no longer exists but represents an example of an arrangement that has failed. This mutual insurance company covered consequential losses of bacterial diseases in greenhouses. Underwriting criteria included "good agricultural practices." Greenhouse producers with import materials faced additional criteria. Deductibles were differentiated on the basis of the source of the starting material. Premium rates consisted of a fixed amount per greenhouse producer, plus a small initial premium and, if necessary, an additional premium (which is at maximum three times the initial premium).[7] Fyto was first introduced in 1998. However, participation was very low, partly due to lack of

7. Mutuals are allowed to collect additional charges if initial premiums are not sufficient to cover losses.

confidence amongst greenhouse producers about the risk financing capacity of a mutual insurance scheme in the event of very large losses. A new strategy of a "stock mutual" was adopted with stock capital provided by various parties in the production chain, as all had a strong interest in preventing bacterial diseases in the greenhouse sector. This arrangement nevertheless also failed (even with premium support from the government).

In 2010, a subsidised multiple-peril insurance was introduced. The scheme provides coverage against main natural calamities, such as hail, frost, storm, snow, extreme drought and extreme rainfall, and is available for all open-air crops (this insurance is further discussed in section 2.4)

The experience of the Dutch mutuals above is instructive in that it shows that specialised insurance funds can fill the market niches that otherwise would not be filled by larger and more diversified insurers. Perils covered by these relatively small-scale companies are generally not covered by large insurers because of expected problems of moral hazard and adverse selection. Small mutual funds can cope with these problems better because they can better address information asymmetries. There is typically good knowledge of the members and their business, involvement of members in mutual control (e.g. as board members of a mutual), and there is direct access to clients. Dutch mutuals also apply specific rules concerning the premium payments, which may provide certain advantages from the perspective of producers. For example, Potatopol, Avipol, Porcopol and OFH mutuals divide premium payments into advance and adjustment payments, enabling producers to spread premium payments over time. This also creates incentives for risk prevention and to expand the retention level in order to minimise the eventual cost of insurance. If no risk has occurred by the end of the year, the unused premium is allocated to all farmers insured. However, the experience of specialised Dutch mutuals also show a lack of financial robustness and that they tend to be dependent on government support (e.g. for re-insurance).

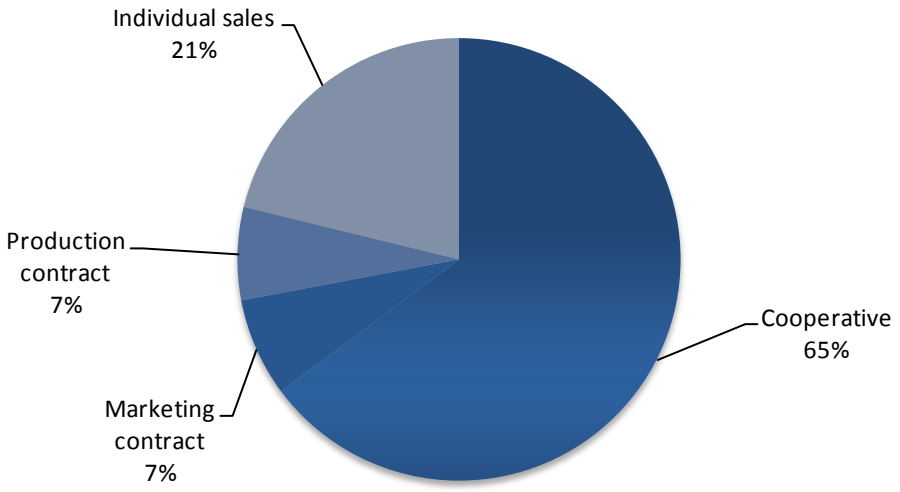
Farmer marketing and processing cooperatives

According to a survey by Palinkas and Székely (2008), over two-thirds of Dutch farmer respondents marketed their products trough co-operatives. Sales through co-operatives were shown to be the most widely used arrangement compared to production and marketing contracts[8] and individual sales (Figure 10). The importance of co-operation varies across sectors. Co-operative arrangements are traditionally dominant in the milk sector (FrieslandCampina processes about 90% of milk produced in the Netherlands), but the importance of co-operatives in less cohesive sectors, such as meat and horticulture, is smaller and there is stronger reliance on more flexible types of supply contracts and on spot sales.

8. It is difficult to make a clear distinction between contract arrangements within and outside the co-operative system.

Figure 10. Importance of various marketing channels in Dutch farming

Per cent of farmers using marketing channel



Source: Palinkas and Székely, 2008.

Co-operatives represent a specific institutional form of a secured contract which implies a number of important risk management functions. In farm processing/marketing, this concerns securing price and quantity (supplied or marketed) to its members. In order to meet this obligation, co-operatives inevitably apply direct strategies to reduce members' risks, such as pooling of prices across time and markets, developing payout regimes to smooth fluctuations of member returns and maintaining the market to ensure continuity of returns. Co-operatives also act as agents of farmers collectively in hedging risks in organised commodity and financial risk markets. Co-operatives also employ indirect strategies which generally consist of diversifying members' investment risks. The most typical investment strategy is integration along the supply chain. Many other forms of diversification can also be employed, such as product and market diversification, geographic diversification and investments outside agro-food business.

Co-operatives in the Netherlands have become larger, more international and more market oriented. Some of them are dominant players on the European and world market (Box 3). The developments in the Dutch co-operatives over the last decade show that they have evolved into key risk management institutions in the Dutch agro-food sector. The many co-operative mergers improved their market position enabling to benefit from economies of scale and develop new technologies. Many of these innovations also have a clear objective to increase resilience and reduce risks of the sector.

Box 3. Dutch agricultural co-operatives as large international agro-food players

VION is a Netherlands-based meat processing and food production co-operative. Measured by volume of meat processed, VION is the largest meat processor in Europe. It has grown into this position through pan-European acquisition. VION is a cooperative of 18 000 farmers. In 2009, it employed 35 000 people worldwide, including 4 200 in the Netherlands.

The cooperative AVEBE is an international Dutch starch manufacturer located in the north of the Netherlands and produces starch products based on potato starch and potato protein for use in food, animal feed, paper production, construction, textiles and adhesives. About 3 500 farmers are member of AVEBE. It is currently the largest producer of potato starch and potato starch derivatives worldwide.

In recent years, the Dutch dairy processing industry has gone through a rapid process of conglomeration. FrieslandCampina is the world's largest co-operative selling its products in 100 countries. It unites 15 300 member farmers in the Netherlands, Germany and Belgium.

The crisis in the early nineties in fruit and vegetable production, led to changes in the market structure of these sectors. The existing vegetable auctions have disappeared and merged to one new market cooperative, the Greenery. Parallel to this, grower unions emerged largely, driven by the need to gain more influence on price formation in order to improve margins. Grower unions unite several producers of a single product, which have contracts with highly concentrated retail organisations. This development has largely contributed to an increasing scale of greenhouse vegetable production. In addition to these developments, product differentiation has been taking place. However, the experience until now is that the influence of growers on price is limited. Product prices are largely determined by the market interactions between demand and supply. The development of growers unions has contributed to supporting the competitive position of the union participants *vis-à-vis* non-participating growers. However, due to the many independent growers the unions are not able to reduce their price risks (Bunte, 2009).

Forward contracting

Approximately 7.2% of surveyed Dutch farmers indicated they used marketing contracts, and 6.8% indicated they used production contracts (Figure 10). Such contracts typically determine the quantity, quality, price, location, and date of delivery. Production contracts may go beyond just product specification to include the production system itself, which is often targeted to meet requirements of specific processors and retailers.

Forward contracts in the Netherlands can be combined into a price pooling contract; for example, arable producers can use several options of price pooling arrangements. The pooling may concern either collective purchase of inputs or selling outputs (i.e. farmers "pool" or combine their contracts for buying inputs or selling outputs). The price pooling arrangements may be operated in various ways but are generally designed to protect an individual from short-term fluctuations in prices by pooling contracts which then use some form of averaging. The pooled contracts stipulate how much of the commodity is sold at what date, and based on what price. The total amount of the (pooled) commodity is thus sold at different dates and different prices, thus reducing price variability. There may also be advantages from increased market power and economies of scale, leading to lower input prices or higher product prices than could be obtained individually. However, these benefits may be partially offset by the administrative costs of the scheme (Anderson, 2003).

Pooling contracts offer opportunities for individual risk preferences. Members of the group may opt for a fixed price, or speculate on the future price or some combination of a speculation (but possibly covering downside risks) and a fixed price. All individual preferences are combined into the transactions made at the group level on the futures

market. Thus the group acts as an intermediary between individuals and the forward/futures market. The advantage of such a cooperative structure, or services offered by private companies, is that sales are spread over time thereby reducing price risks. Of course, farmer's income can remain uncertain because of yield risk (Smidts, 1990).

Commodity futures markets

The use of futures contracts by farmers in the EU, and also by Dutch farmers, is limited. In the survey by Palinkas and Székely (2008) only 1% of producers in the Netherlands indicated they used futures price hedging, which is roughly the same rate as in other surveyed EU countries (except Germany where 5% of farmers used futures).

Futures markets for potatoes and hogs operated at the Amsterdam Exchange, but ceased to exist due to a lack of liquidity. Dutch farmers can currently use Euronext (in Frankfurt) for hedging, where they for the most part trade potatoes and pig meat contracts. Dutch potato producers are exposed to basis risk when hedging in the futures market, however basis risk is relatively small compared to the price risk in the physical market. The hedging effectiveness for the potato futures contract for Dutch producers is estimated at about 80%, i.e. 80% of the volatility in the spot price of potatoes can be eliminated by using futures.

In 2001, Pennings and Smidts reported that 13% of Dutch pig farmers interviewed used futures contracts and 3% used cash forward contracts to cover their price risk. These results suggest that managers were willing to tolerate price risks in the sale of slaughter hogs to maintain upside gains. A total of 64% of the respondents to this survey sold either to traders or directly to slaughterhouses, thereby exposing themselves to price risks; only 23% sold exclusively to a cooperative, thus spreading their risk. The remaining 13% sold their slaughter hogs via a combination of marketing channels (trader, slaughterhouse, and cooperative).

Other futures markets are seldom used by the Dutch farmers. The agribusiness, and more specifically large processors and cooperatives, hedge their risk exposure, although the degree to which they rely on futures trading is unknown.

International practice shows that as a risk management tool, futures trading is not widely used by farmers as it requires particular skills, time and involves a certain financial cost. Commodity price hedging is usually done by large-scale producers, who are often involved in direct sales to end markets. In the EU, the low importance of futures trading for the farm sector is also explained by the fact that most primary commodities for which futures trading exists are eligible for EU price support, which substantially diminishes farmers' incentive to use this price risk management tool.

Government measures related to marketable risks

Government measures related to marketable risks in the Netherlands have been focused on stimulating the development of the insurance market for climatic and disease risks. This policy orientation was driven by the need to reduce budgetary costs involved in disaster assistance by sharing them with the private sector.

Mutual insurance schemes discussed above (such as Potapol, Avipol, Porcopol, etc.) emerged following the government's decision to no longer incur large costs in *ad hoc* compensation of producers. Apart from the general "incentive" to develop specific insurance products following the government's withdrawal, several recent schemes have emerged as a result of an explicit agreement between the industry and the government

when financial incentives were provided by the government to insurers and farmers (Table 10).

Thus, the government provided start-up capital for the Potapol mutual, which at present operates with no other support. The government also supports Aquapol and Agriver, by providing a non-proportional reinsurance cover. With the maximum insured value of EUR 3.5 billion, the cover amounts to EUR 50 million in excess of EUR 50 million. If the total insured sum is below EUR 3.5 billion, the contributions are adjusted pro rata. However, since the introduction of the insurance scheme there has been no financial contribution from the government, as losses did not trigger the reinsurance; only in 2007 *ad hoc* premium subsidies were provided.

The introduction of frost insurance for the fruit sector in 2007 followed a frost event which severely damaged fruit tree plantations. The government undertook to cover losses to the sector on the condition that it finds an arrangement to insure against frost in the future. As a result, frost risks have been incorporated into the existing OFH scheme, together with hail risks, with the government providing a 49% re-insurance subsidy for frost events.

The most recent move of the Dutch government to expand insurance and to shift away from *ad hoc* payments was the introduction of the multi-peril crop insurance in 2010. This was linked to the possibilities opened under the CAP Health Check agreement. According to Article 68 of the Council Regulation (EC) No 73/2009, Member States can now use 10% of their national ceilings for specific support to the sectors in the form of contributions to crop, animal and plant insurance premiums. Article 70 specifies certain conditions related to the design of such schemes. Thus, the premium subsidy may only be granted if a climatic event destroys more than 30% of the average annual production of the farmer over the specified period. The subsidy cannot exceed 65% of the insurance premium and must be paid directly to the farmer concerned. Member states may limit the amount of the premium eligible for the subsidy. The EU finances 75% of the expenditures involved, with the rest covered by member states.

The Dutch multi-peril insurance represents a combination of traditional crop insurance and a weather index insurance. Two triggers must be present for the farmer to become eligible for an indemnity payment. First, a specified adverse climatic event must be observed; second, the actual crop damages must be at least 30% compared to the reference output, as required by the EU regulation. The advantage of this insurance is that it does not suffer from the adverse selection problem as the traditional crop insurance, since the adverse climatic events triggering the indemnity payments are exogenous. But this contract does not have all the benefits of a pure index-based insurance. The transaction costs are increased, since the losses have to be observed and they have to be evaluated on the site. More importantly, farmer incentives to implement own risk management techniques, such as drainage and irrigation, are weakened, since the indemnity payments depend on the observed losses, as in the traditional insurance.

This multi-peril crop insurance is provided by the mutual insurance companies listed in Table 10. One of them, OWV, is a newly created mutual fund with participation of private insurance companies, farmers and farmer organisations. Under this arrangement, private insurance companies which have not been willing to underwrite and supply the multi peril crop insurance contracts on their own have only limited liability and are therefore willing to contribute to this program.

A question arises whether the new multi-peril insurance scheme can result in a decrease in the use of other insurance providing coverage against natural perils. The multi-peril scheme can still be considered as being in the pilot stage; to date, it has been taken up by approximately 500 entrepreneurs, with the total premiums paid reaching EUR 5 million. Producers are stating that this insurance is too expensive – "the premium is too high and the coverage is too low". In addition, farmers are required to pay upfront the full amount of the premium and at the least appropriate time (by 1 August). According to the main insurer providing this scheme, there is uncertainty about its financial sustainability and probably, in the event of a very large calamity, a reduction in the coverage rate may be required. Most likely, the multi-peril scheme will undergo further adjustments.

Catastrophic risk management

Climatic, plant and animal pest and disease risks[9] can be regarded as distinct areas of catastrophic risk management in the Netherlands. They are distinct from the perspective of the government's criteria of what qualifies an event as catastrophic, the set of actions to be taken, the agencies responsible, the triggers for emergency response and the policy instruments to deliver assistance (Table 11).

Table 11. Three areas of catastrophic risk management in the Netherlands

	Source of risk		
	Climatic events	**Plant diseases**	**Animal diseases**
Criteria of catastrophic event	Scale of physical damage: - "severe damage to public safety, environment and economy" - requires co-ordinated response by various agencies	Harmfulness of organism: - quarantine organisms (Q-organisms) - quality organisms (K-organisms)	Harmfulness of organism: - diseases in List A of OIE - zoonoses
Triggering principle for emergency response	*Ad hoc* decision following assessment (subject to EU national support disciplines)	Presence of Q-organism: zero tolerance principle Presence of K-organism: low tolerance principle	Presence of list A disease and zoonoses

Risks related to natural disasters

In the area of risks related to climatic events, there is no formal *ex ante* definition of a catastrophic event. A "Law on Disasters and Severe Accidents" (hereafter referred to as a "Disaster Law") provides a broad definition of a disaster as an event that "causes severe disruption of public safety, when the lives and health of many persons, the environment or major material interests are threatened of affected to a large extend" and which requires a "coordinated effort of various services and organisations" to eliminate the threat or limit the damage. This law also names specific calamities, such as flooding as a result of dike bursts, requiring public action and financial aid and therefore qualified as catastrophic events. These general provisions indicate that the definition of a natural catastrophe is in principle based on the material loss caused by the event, and therefore represents an *ex post* concept. Consequently, qualification of an event as a natural catastrophe and the related government financial and operational assistance are

9. For the sake of brevity, the expression "disease risks" will be used for "pest and disease risks."

determined on the basis of *ad hoc* decisions concerning the provision of assistance, criteria for beneficiaries and compensation procedures. For example, two severe rainfall events occurring in 1998 in different regions resulted in major crop losses (Table 12). The provision of payments under the Disaster Law was based on the rainfall levels. Two regions, with at least 100 mm rainfall in 48 hours, received compensation of EUR 125 million and EUR 82 million, respectively. In other regions, where the rainfall criteria were below those triggering these payments, an additional relief was provided. In this programme, a 30% deductible of the total production value of each cultivated crop was accounted for, with the amount indemnified at EUR 42 million and the estimated total loss to farmers at EUR 118 million. As the decision process related to catastrophic assistance is largely an *ad hoc* process it is traditionally influenced by political pressure from various stakeholders.

It is important to highlight that that EU regulations on national assistance impose explicit limits, in particular on *ad hoc* payments. These regulations include Articles 107 and 108 of the Treaty on the Functioning of the European Union that constrain aids granted by the member states, the subsequent exemption legislation for the *de minimis* aid (Commission Regulation No. 1860/2004) and for state aid to small and medium sized agriculture enterprises (Commission Regulation No. 1857/2006), and the Community Guidelines for State Aid in the Agriculture and Forestry Sector (2006/C 319/01).

The Disaster Law is not specific to agriculture, but since the mid-1970s agricultural producers received disaster relief payments several times under this law (Table 13). As mentioned above, disaster assistance has also been provided outside the framework of the Disaster Law based on specific government decisions following other, smaller natural calamities. More local adverse weather events, although causing large damage to a few individual producers, have generally not been compensated.

Table 12. Management of catastrophic risks related to natural disasters

Types of assistance	Content	Principal responsibility
Under "Law on Disasters and Severe Accidents"	- Implementation of contingency plans, restoration of infrastructure, etc. - Disaster relief payments	State Home Department
Assistance based on *ad hoc* government decisions	- Disaster relief payments	Ministry of Agriculture
Multi-peril crop insurance	- Insurance premium subsidy for producers	Public-private (Ministry of Agriculture and private insurers)
Tax concessions	Cost equalisation and investment reserves	Ministry of Finance

Table 13. Catastrophic events and amount of relief payments provided since mid-1970s

Year	Type of event	Regulatory base	Amount of damage	Estimated frequency
1976	Drought	*Ad hoc* decision	Claimed loss of EUR 225 mln, EUR 132 mln of indemnities paid out	Once in 30 years
1985	Frost	*Ad hoc* decision	Loss estimated are EUR 45 mln.	Once in 25 years
1998	Rainfall	Disaster Law	Severe rainfall affecting one country region and resulting in major crop losses estimated at EUR 210 mln.	Once in 110 years
1998	Rainfall	Disaster Law	Severe rainfall affecting one country region and resulting in major crop losses estimated at EUR 115 mln.	Once in 125 years
1998	Rainfall	*Ad hoc* decision	In regions where the rainfall criteria did not trigger disaster relief under the Disaster Law, alternative assistance was provided. Total loss estimated at EUR 118 mln, with EUR 42 mln of indemnities paid out.	n.a.
2000	Rainfall	Disaster Law	n.a.	n.a.
2002	Rainfall	*Ad hoc* decision	EUR 3.8 mln indemnities paid.	n.a.
2003	Flood	Disaster Law	na	n.a.
2005	Snowfall	*Ad hoc* decision	EUR 3.5 mln indemnities paid.	Once in 50 years
2005	Frost	*Ad hoc* decision	EUR 5.8 mln indemnities paid.	Once in 100 years

Source: Asseldonk *et al*., 2010; LNV, 2010.

As discussed in the previous section, the principal approach of government risk policies in the past years has been to support the development of agricultural insurance for risks that are potentially catastrophic in nature. In what concerns weather risks, the government's effort to shift away from disaster payments has consisted of supporting the development of multi-peril crop insurance. It is estimated that the average occurrence of events that will be covered by this scheme is between once per 50 years to once per 100 years.

General tax policies also offer possibilities to assist businesses in their recovery following a natural disaster. In some cases a company may build up certain reserves by making deductions from its taxable income. Examples of permitted reserves are the cost equalisation reserve and the reinvestment reserve. The former enables recurrent costs to be spread evenly over a period of time. Examples include large-scale maintenance project or recovery from environmental damage. A reinvestment reserve may be created if fixed assets have been lost, damaged, or sold. The reserve is equal to the amount the sale proceeds exceed the book value of sold assets. This amount is not considered as taxable income in the year it was received. To be eligible for this option, the company must have the intention of re-investing and the reserve must be used no later than within three years following the year in which it was formed.

Risks related to plant and animal diseases

In the area of plant and animal disease, catastrophic risk and the related government actions are defined more explicitly. The hazard is generally understood in terms of the harm that the organism may cause based on the (i) potential economic damage; (ii) spill-over effects on other activities; (iii) in some cases, impact on humans; and (iv) ability to manage the disease. Organisms are assessed according to these criteria and grouped by

the degrees of harmfulness. As such, this exercise represents a risk assessment process, which is carried out at the level of the EU as a whole and which largely follows international principles. Therefore, catastrophic risk in the areas of plant and animal diseases is concretely linked with the presence of particular organisms. The list of harmful organisms is established for both plants and animals, with the most harmful groups effectively delimiting the catastrophic risk (Table 11).

Other factors determine the need for a more formal concept of catastrophic risk related to crop and animal disease. One factor is that these risks are managed by treating the EU area as a single space, another is that this management strongly concerns trade activity and affects third countries. It can only be implemented therefore based on explicit formal rules that apply to all members of the Community and third countries.

Activities related to the presence of these organisms are also determined by EU regulations, which lay down the basic obligations and actions of the member states with respect to harmful organisms and, to some extent, the policy instruments that national governments apply to deal with disease risks. These issues are examined under the special focus section in the *Netherlands Review* in Part II.

An overall assessment of government risk management measures and the boundaries between risk layers

The main risk-related policies in the Netherlands are implemented as part of the EU policy framework. Protection from price and income risks is provided within the guarantees established by the CAP. Common EU policies also determine the activity of the Dutch government with respect to the areas of plant and animal health.

The Dutch national policies have focussed on managing catastrophic risks. Until the mid-1990s, a "reactive" *ex post* policy approach to catastrophic risk management prevailed and no explicit contract between the government and producers existed with respect to provision of support. The policy consisted of providing transfers to affected businesses following the event based on *ad hoc* decisions. In recent years, the Dutch government made efforts to discipline the assistance given by engaging producers and industries in developing market instruments to deal with catastrophic risks. The government supported the development of several insurance schemes and new procedures for the veterinary funds for livestock epidemics. These arrangements effectively represent public-private partnerships and allow responsibilities to be more clearly delimited between government and producers, as well as reducing the taxpayer's burden in covering catastrophic assistance.

Finally, Dutch policies place emphasis on risk research, assessment and communication. There is a tradition to invest in quantitative analyses and accumulation of knowledge on climate and production risks, market analysis and forecasting via synergies with industry and farmer organisations, which are important stakeholders and contributors to these activities.

Table 14. Government measures related to farm risk management in Netherlands

		Market creation	Modifying market incentives	Risk reduction and mitigation (income smoothing)	Coping with risk (consumption smoothing)
Ex ante		• Risk research • Information • Training	**EU price and income support policies** **Insurance subsidies**	• Water management • Pest and disease prevention • Taxation: Income tax reservation	
Ex post	*Decided ex post*				• Post-crisis credit guarantees • *Ad Hoc* catastrophic assistance
	Triggered ex post				• Co-financing of livestock epidemics • Safety net for self-employed entrepreneurs (Bbz)

EFFICIENCY

EQUITY

The line delimiting "efficiency" and "equity" in this table indicates the likely underlying rationale for the policies listed: to tackle market failure (efficiency) or redistribution in favour of specific groups of individuals (equity).

Catastrophic risk

From the policy perspective, risks related to natural catastrophes, plant and animal diseases represent different areas and therefore the boundaries of catastrophic risk develop differently in these areas.

With respect to natural events, until recently, no formal criteria to qualify an event as a natural catastrophe (disaster) existed except to associate it broadly with "severe damage" to society, environment and economy. The introduction of the multi-peril crop insurance implicitly sets a lower threshold of a natural catastrophe: an event that results in an output loss that is less than 30% is theoretically not considered a catastrophic event. Thus, the multi-peril crop insurance effectively establishes the boundary of the catastrophic risk layer. However, within this layer there is no explicit delineation between the multi-peril insurance and disaster assistance.

In the areas of plant and animal disease risks, the frontier of catastrophic risk is explicitly determined through a classification of diseases into the most and least harmful. The former are considered to be potentially catastrophic, and the government bears the principal responsibility for these risks by building and maintaining the appropriate protection systems. This responsibility is set beyond the national government, and is a prerogative of EU authorities, who in turn are guided by international regulations and agreements. The frontier of catastrophic risk is not static though because the classification of diseases into most and least harmful is constantly re-assessed. Some aspects of managing catastrophic disease risks also fall under the responsibility of producers – they finance the cost of phytosanitary and veterinary inspections and share the costs with the

(national and European Union) government related to control of disease outbreaks. Producers also assume risks of consequential losses resulting from the disease outbreaks, which have to be contained by producers either individually, or through market or public-private arrangements, such as insurance or collective funds.

Marketable risk

This risk layer is extensive in the Netherlands. The insurance market offers coverage against a variety of production risks, including natural perils, some crop and livestock diseases, personal and other types of risk. Specific elements of the insurance market, however, have emerged and operate with government support. Given the high level of cohesion of Dutch agro-food chains, the majority of producers are integrated into co-operatives, forward contracting and vertical integration – institutions that perform important risk management functions for their participants. These institutions extend the frontier of marketable risk layer to cover large part of output, financial, and market risks of producers. With respect to market risk, these institutions are able to contain risks that go beyond those contained by the CAP price and income support mechanisms.

Normal risk

Normal risks are those that remain outside the catastrophic and marketable risk layers and are the farmer's own responsibility. EU CAP policy is an important factor in this risk layer, as it establishes the systems that reduce price and income risks constituting normal farming risks. Dutch agriculture is strongly export oriented, also towards the third countries, and the sector has been benefitting from the EU instruments to support prices for some of its main agricultural exports. However, these mechanisms are being limited and Dutch exporters are increasingly exposed to price risks.

PART II.

SPECIAL FOCUS ISSUES

3. Management of pest and disease risks in the crop sector

Crop disease risks are a high concern in perception of Dutch crop farmers. According to expert assessments, although these risks have low probabilities, some diseases can potentially cause large damage. The high level of concern accorded to such risks is connected with the domination of intensive production systems in the Dutch agriculture. Infestation can result in a major disruption of production at the farm level with significant spill-over effects on up- and downstream activities. In view of the highly trade-oriented nature of the Dutch agriculture, crop disease risks could have considerable trade and, by extension, macro-economic implications. An incidence of a diseased product could entail overall disruption of imports to the country concerned, thereby affecting all Dutch suppliers. The ability to control diseases and to ensure cleanness of exports, not only has an immediate impact on trading, but broadly affects trade partners' perceptions of the Netherlands as a reliable supplier.

Three groups of plant disease risks

As discussed in the previous section, the management of plant disease risks represents a more formal system compared to that dealing with weather risks. There is a formal classification of risk sources into three groups which ranks the organisms by their harmfulness (Table 15).

The first group of potentially highly damageable diseases are organisms qualified as "quarantine organisms" (Q-organisms), which are non-endemic.[10] They are subjected to a very strict ("zero tolerance") regime to prohibit their introduction into and spread within the European Community. This regime is set out in the Community Plant Health Regime (CPHR); thus, member states are obliged to follow common phytosanitary rules for importing plants and some plant products into the European Union, and their movements within the European Union. An intra-EU trade allows for free movement of plants and plant products between and within member states based on plant passports. In addition, CPHR sets the requirements for monitoring, eradication, containment and control of harmful organisms. This overall EU framework regulation is transposed into the relevant national legislation, i.e. Dutch Plant Disease Law, Resolution on Control of Harmful Pests, and national import and export regulations (Box 4).

10. The list of these organisms is defined in the annexes to the Council Directive 2000/29/EC.

Table 15. System of risk management related to plant pest and diseases

		Groups of harmful organisms	Risk management actions	Principal institutions responsible		Private instruments	
Regulated organisms	EU Plant Health Regime	**Quarantine pests and diseases** (Q-organisms) Non-endemic organisms whose entry into the European Union is prohibited (around 300 organisms) *Zero tolerance principle*	- Prevention: inspections, ban on movements across the EU border and inside the European Union - Eradication, containment and monitoring - Emergency response in the event of invasion and spread	• EU Commission: overall framework • Dutch Government: - Plant Protection Service - Inspection Services • Product Boards	**Catastrophic risks**	Potatoes: Potapol insurance against certain Q-diseases Flower bulbs: fund for one Q-organism based on a compulsory levy on growers	**Marketable risks**
	EU Marketing Directives	Quality pests and diseases (K-organisms) Endemic organisms, regulated with respect to propagation material *Low tolerance principle*	- Prevention: inspections, restriction on movements - Containment and monitoring - Emergency response in the event of spread			None	
Non-regulated organisms		**Other pests and diseases**	- Production practices to prevent, contain and combat infestation	• Producers individually • Product Boards	**Normal risks**	None	

CPHR does not concern the exports of plants and plant products outside the European Union. Therefore, the risks associated with transmission of harmful organisms to third countries and the negative impact on the country's exports that may arise are regulated by individual member states.

Box 4. Risk management for plant quarantine (Q) organisms

According to EU phytosanitary policy, introduction of Q-organisms into EU territory should be banned. All imported products must be free from these organisms. Member states are obliged to take appropriate measures, such as import inspections, treatments, destroying infected lots and emergency measures when infested products are detected. The Plant Protection Service determines the basis of risk assessment and the scope of measures to be implemented (e.g. the number of inspections and the compulsory treatments). These measures do not only affect exporting or importing firms, but could also have an impact on the sector as a whole, or other sectors. Generally, these measures are financed by the importers or exporters, with the government financing surveys and monitoring activity.

In the case of invasion, farmers and growers are obliged to report an infestation with a quarantine organism. Further spread should be prevented and the organism eradicated. When this is no longer possible, the EU Commission may decide to contain it in the areas where it is present. The importance of quarantine risks is perceived as increasing. In an inquiry among 300 entrepreneurs (tomato growers, bulb growers and strawberry growers), it was perceived as the most important risk (Breukers *et al*., in preparation).

The table below presents a summary of phytosanitary notifications of imported products infested with quarantine organisms coming to the Netherlands from third countries and several EU countries. The number of notifications decreased considerably in 2009 because two Q-organisms that were frequently notified in 2008 were withdrawn from the Q-list, and products containing these organisms were no longer rejected.

Number of phytosanitary notifications on imported plants and plant products issued by the Netherlands and selected EU countries

	2008	2009
Belgium	55	49
France	616	702
Germany	140	152
Italy	13	26
Netherlands	**664**	**274**
Spain	82	124
United Kingdom	268	249

Source: Dutch Plant Protection Services.

In 2009, the Netherlands received 67 notifications of infested products with a Dutch certificate from the European Union and 160 from outside the European Union.

The second group includes "quality organisms" (K-organisms), which are endemic and can be just as harmful as Q-organisms. This group is not covered by the Community Plant Health Regime, which deals only with Q-organisms, but is regulated by the EU Marketing Directives. The focus is on propagation material to prevent the transmission of these diseases. This regime is qualified as a "low tolerance" regime, meaning that there should be no presence of the regulated organisms in the propagation material, or that such presence can be tolerated only to a certain level. The management of K-organism risks consists of checks, inspections, and certification of producers and traders of propagation material. To prevent the spread of disease, infected crops and products can be destroyed.

From the perspective of the three risk layers – catastrophic, marketable and normal risk – risks related to regulated (Q- and K-) organisms can be considered as falling under the catastrophic risk layer, as these risks are rare but are nevertheless associated with large potential damage.

Diseases that are not included in Q or K groups are endemic diseases which are not covered by phytosanitary regulations due to the low probability of transmission and damage beyond the affected farm. They are controlled mainly at the individual farm level and therefore represent normal risks.

Division of responsibilities between the government and private sector

The distinction between regulated and non-regulated organisms effectively sets a division of responsibilities for managing the disease risks between the government and private businesses. The government has an explicit responsibility with regard to the regulated organisms. It is responsible for building and maintaining appropriate phytosanitary systems for the prevention, control, and monitoring of diseases. Furthermore, as the Netherlands is part of the single EU economic space, the functions of the national systems are largely set at the EU level. The responsibility of the national government thus goes beyond the national level and is part of the common responsibility of EU member states to manage disease risks within the whole Community. The Community in turn assumes co-responsibility for financing certain phytosanitary actions by its member states. Farmers are responsible for notification, implementation of measures determined by the Plant Protection Service and other regulations, and incur the losses associated with any pest or disease.

The management of risks related to regulated organisms is carried out by several government agencies. The broad responsibility for the development of phytosanitary policy and implementation of EU and international regulations lies with the Ministry of Agriculture, Nature and Food Quality (LNV). The Plant Protection Service is responsible for the implementation of the EU Plant Health Regime. It carries out the assessment of plant pest and disease risks; it is also responsible for identification of harmful organisms, communication, and management of actions against the detected organisms. The Inspection Agencies are primarily dealing with the EU marketing directives, but are also involved in implementation of the EU Plant Health Regime. They execute import, export and field inspections and act under the authority of the Plant Protection Service. The list of Q and K-organisms is revised following EU procedures in which the Dutch authorities participate with other member states and the Commission. It is often a challenge to develop common lists of diseases given the diversity of risk priorities across countries.

As concerns non-regulated diseases, that fall outside the Q- and K-lists, the key responsibility for their management rests with agricultural producers. Prevention, eradication and containment of plant diseases are the principal techniques used by Dutch farmers to manage output risks. Crop protection receives major attention during the growth season, especially in field cropping. Crop protection costs vary from about 1% in greenhouse horticulture to more than 6% in bulb production. The management of endemic diseases is aimed at decreasing the level of pressure due to diseases to an acceptable balance between damage and management costs, within environmental constraints (De Lauwere and Bremmer, 2007). Although there are no government policies directly related to the management of endemic disease risks, pesticide policies have a significant impact on producer crop protection practices (discussed below).

The structure of the disease risk management system in the Netherlands includes the so-called Product Boards, which perform important functions in areas falling both under the responsibility of the government and individual producers. Product Boards (PB) are a specific Dutch type of industry association which effectively operates as a form of public-private partnership. PBs have certain regulatory authority *vis à vis* its members and perform specific functions in implementing public regulations (Box 5).

Box 5. Dutch Product Boards

Product Boards (PB) are vertical industrial organisations unifying businesses involved in the same product, but which represent different levels of the product value chain.1

A Product Board for a specific agricultural product or group of products is composed of representatives from the whole supply chain: from upstream agricultural producers to downstream processors, distributors and traders. PBs have a legislative mandate to collect compulsory levies and surtaxes from all firms within the chain they represent to finance its activities. The Dutch law gives PBs the power to develop binding regulations for all enterprises in the product chain. These regulations may concern such areas as economic transactions between the enterprises, registration of enterprises, provision of information, financial and technical inspections. Another major function of PBs, called "joint administration", gives them the authority to operate on behalf of the government in the implementation of EU and national regulations; for example, by drawing detailed rules and procedures to be followed by the product chain participants. Joint administration function of PBs is particularly important with respect to implementation of EU and national market control regulations. PBs are also important providers of general services to their members; these services include research, advice, and information.

In all these capacities, PBs has a role in the management of disease risks related to their product. For crop products, two Boards operate in the Netherlands: Product Board Arable and Product Board Horticulture. Their principal functions include:

- development and enforcement of industry rules beyond EU/national government regulations (e.g. PB Arable for sets the rules for potato growers on crop rotation and defines the areas for growing resistant varieties).
- promotion of best practices, advice in detecting risk, and optimisation of the timing of protective treatments.
- supporting research in disease risks, collecting and communicating information about diseases, including early warnings via sms or internet facilities.
- development of hygiene codes and promotion of certification schemes, e.g. to maintain high hygienic standards.
- assistance in the quick response to disease outbreaks: e.g. within a few weeks of the detection of a new type of potato wart disease in 2003, PB Arable, Plant Protection Service, growers and downstream industry initiated research and collected information on the resistance of imported varieties to the disease; as a result, several varieties were excluded from the list allowed for import.

There are, however, issues concerning the functioning of PBs in the future. As the industries become more concentrated, the dominant firms are reluctant to maintain the Product Boards for strategic reasons. An additional concern that has been evoked specifically with respect to BP Horticulture is the divergence of interests between the members reflecting the heterogeneity of horticultural business: the PB "has to pull levy for such a different businesses with different risk profiles". Thus, continuity of the PBs in their current form may be uncertain and, as the industries get more concentrated, strategic competition issues likely become more influential also in the preferred risk management approaches.

1. Product Board is an institution existing not only for agriculture-based products but can be created by any product chain. There also exist horizontal industry boards which are formed by enterprises typically operating at the same level of value-added activity (e.g. primary production, processing, retail trade, etc.), but they do not have such a prominent role as the Product Boards do in designing, funding and implementing the risk management programs.

Cost participation and incentives for risk prevention

The Dutch government bears the cost of building and maintaining the phytosanitary infrastructure, as well as expenditures involved in the eradication and containment of harmful organisms. However, financial contribution can be provided by the European Union to strengthen the inspection infrastructure if this is required to improve plant-health checks. In addition, in cases where the presence of Q-organisms has been notified, and is considered as presenting an "imminent danger", member states can receive financial contribution from the EU to cover the costs of executing protective measures, e.g. destruction, disinfection, monitoring inspection, etc., equivalent to up to 50% of their cost. Under certain conditions, EU co-financing is also available for further actions required to combat the presence of harmful organisms. The cost of phytosanitary inspection services is covered by exporters and importers.

The presence of Q or K organisms in crop products may result in the removal of infected consignments, imposition of quarantine, prohibition on movement of products outside the Community, or their destruction. In cases where harmful organisms are detected in crops, crop losses may occur. No government compensation is provided for any resulting direct or consequential losses to businesses (although with respect to Q organisms, Dutch Plant Protection Law foresees the possibility of loss coverage, in practice this provision has been rarely applied).

A few plant disease risks can be insured in the Netherlands (Table 10). Thus, important shares of potato plantings are covered against three Q-organisms – brown rot, ring rot and PSTV – with the insurance provided by Potatopol mutual. In the flower bulb sector, a fund operates to cover losses in the event of detection of a Q-organism *Ditylenchus dipsaci*. The fund is managed by the Product Board Horticulture and is formed of compulsory levies on the growers. It is used to cover the costs of destruction of the infected material. The Fund also provides for compensation of 50% of the market value of the lost bulbs, but this is conditional on observance of hygienic rules by growers.

Phytosanitary policy is based on the zero tolerance principle, which means that efforts are oriented towards prevention and eradication. There are incentives for growers to apply plant protection techniques. Border and field inspections, and measures in the case of disease invasion as well as the fact that no compensation is provided for disease losses and the insurance is limited to specific types of risks and farmer groups – all these factors incite growers to adopt effective plant protection measures. On the other hand, there is crop protection regulation which focuses on reducing the externalities of plant protection practices by establishing limits on the use of pesticides and determining the allowable plant protection products. Thus, there is an issue of balance between economic damage caused by the plant disease and environmental damage caused by the pesticides. Phytosanitary policy is therefore also dependent on the allowed types of pesticides and application limits. In the Pest Risk Analysis performed to assess the risk of a new pest, the availability of effective pesticides is one of the considered aspects.

4. Management of pest and disease risks in the livestock sector

Dutch producers perceive the risk of epidemic and non-epidemic diseases differently. The latter are considered to be less important than, for example, price, regulatory or personal risks, and are estimated to have a relatively small economic impact. Epidemic diseases, on the contrary, rank among the highest concerns of producers and although infrequent, the related damage is estimated to be large. Although the number of contagious diseases is smaller than in the crop sector, the risks tend to be more systemic. Due to the high concentration of livestock, epidemic diseases can spread fast and affect a considerable number of animals and farms. Epidemic disease outbreaks cause serious disruptions across the whole agro-food chains and affect trade. Animal disease risks also have links to human well-being; some of the diseases (zoonoses) can be transmitted to humans and therefore become an issue of public health.

Three groups of animal disease risks and responsibilities of key stakeholders

Animal disease risk management distinguishes three groups of diseases: highly contagious diseases (former OIE List A), diseases transmittable to humans, and other. Diseases in the first two groups are usually subject to obligatory notification, as they are considered to represent high risks. These two groups fall under the responsibility of the government, and thus into the catastrophic risk layer.

As for the plant area, government responsibilities and related actions are largely determined by EU regulations, which in turn are based on international principles (e.g. by the Organisation for Animal Health). Community Animal Health Policy (CAHP) sets the veterinary conditions for the import of animals and animal products into EU territory, as well as requirements for their movement within the Community. CAHP incorporates EU programmes for the control, eradication and monitoring of animal diseases. It also establishes common rules that must be followed by all member states in the case of a disease outbreak. There is a common list of animal diseases subject to obligatory notification to the European Commission in the case of an outbreak. General and specific measures are laid down to control the spread of animal diseases of major economic importance when they occur (discussed further). These provisions are important to obtain or maintain a EU status free of certain animal diseases. CAHP also incorporates principles of co-financing of these veterinary activities by European Union and member states. Thus, a Community Veterinary Fund co-finances many emergency measures, EU and national programmes for eradication, control and monitoring of diseases and technical and scientific activity. These principles are reflected in the national veterinary legislation.

Diseases not included in the list of obligatory notification are in principle outside the responsibility of the government and must be controlled by producers; these constitute normal risks. However, the government can be involved when it concerns animal and product certification for international trade. As the surveys show, Dutch livestock producers attribute high importance to strict hygienic rules, preventive medical treatment of animals, and own breeding of young animals (Table 5). These practices often constitute part of the quality insurance schemes and the requirements imposed on farm-level operations by downstream partners. As in the crop sector, Product Boards (PB Livestock and Product Board and Meat, PB Poultry, Eggs and PB Dairy) and horizontal producer associations develop specific rules, and provide advice and information related to disease control.

Strategies to control livestock epidemics

Livestock disease risk management is a vast area covering many activities, from control of incursions at the border, eradication and containment programmes, to farm-level risk management activities. As elsewhere, an area of particular attention in the Netherlands is the response to disease outbreaks. Fundamental policy issues that arise with respect to livestock epidemics are: what are the optimal government actions to respond to disease outbreaks to intervene not more than it is necessary, how the costs and losses should be shared between government and producers, what are the appropriate incentives to encourage farmers to report a disease, and to respect the rules to prevent its propagation.

Obligatory actions with respect to epidemic outbreak are set by EU directives. In 1992, the European Union adopted a non-vaccination policy. Animals are no longer vaccinated against certain infectious diseases and the management control strategy is to stamp-out an epidemic. This includes a standstill (movement restrictions), followed by the culling of all infected and healthy but susceptible animals within an area of one to three kilometres from the source of infection.

The non-vaccination policy is considered to have certain advantages over preventive vaccination. First, it is considered that this policy can stimulate trade of animal products between countries who have adopted this policy. The reason for this being that vaccinations make it difficult to differentiate between ill and vaccinated animals. Second, it is estimated that preventive vaccination is more costly than are measures to control an epidemic (e.g. Berentsen *et al*., 1992). In recent epidemics that have occurred in the European Union, animals were not protected by vaccination and stamping-out was implemented when not only infected, but also healthy animals were destroyed as part of the disease eradication.

For epidemics such as Bluetongue and Q-Fever, however, compulsory preventive vaccination schemes continue. Table 17 shows the recent outbreaks of epidemics in the Netherlands, which are mostly related to Bluetongue disease and Q-Fever.

The stamping-out strategy is viewed very negatively by the public (Cohen *et al*., 2007). In some member states, there has been increasing pressure for alternative epidemic strategies that would accommodate changing ethical views on culling of healthy animals, animal welfare, and the psychological impact on persons directly involved. This has led to demands for a reconsideration of the EU non-vaccination policy and for discussions of alternative prevention and control strategies.

Emergency vaccination is one possible way to respond to some societal concerns (Box 6). Member states, however, can still opt for stamping-out and (widespread) pre-emptive culling. In any case, they are obliged to take the minimum measures as determined by EU regulations, i.e. destruction of infected herds and (limited) pre-emptive culling of contact herds. The exact combination of measures can be determined on a case-by-case basis. In the Netherlands, as stated above, public opposition to the destruction of healthy animals is strong and it has been decided therefore that in the case of Classical Swine Fever that protective vaccination will be applied in combination with the destruction of infected herds as well as limited pre-emptive culling of contact herds. This is also the case with regard to FMD, although a relatively small epidemic could be controlled without emergency vaccination (Meuwissen *et al*., 2010).

Table 16. System of risk management related to animal diseases

	Groups of diseases	Risk management actions		Principal responsibility		Insurance	
Notifiable diseases Controlled at the EU level	**Former List A of World Organisation for Animal Health (OIE)** Very contagious diseases (e.g. FMD, Classical Swine Fever)	• Preventive measures: - conditions on trade within the EU (health certificates, animal and product checks) - conditions on imports into the EU (health certificates, veterinary controls, veterinary entry documents) • Animal surveillance • Animal tracing system	• Emergency measures in the case of outbreak: - culling of ill animals - preventive culling of animals on contact farms - emergency vaccination - preventive vaccination - movement restrictions • Disease control, eradication and monitoring	• EU Commission: general framework • Government - Food and Consumer Product Safety Authority (VWA) - Animal Health Service (GD) • Product Boards	**Catastrophic risks**	Porcopol: insurance for pigs against three List A diseases and consequential losses from swine epidemics Avipol: insurance against four poultry diseases General insurers (e.g. Interpolis): consequential losses from cattle epidemics	**Marketable risks**
	Zoonoses Diseases transmittable to humans (e.g. Q-Fever, Avian Influenza)						
Controlled at farm level	**Other diseases** (e.g. diarrhea, udder inflammation, claw problems)		• Farm practices to prevent, contain and eliminate disease	• Producers individually • Product Boards	**Normal risks**	None	

Table 17. Livestock epidemics in the Netherlands since mid-1990s

Epidemic	Year	Number of farms affected
BSE (cattle)	1997 onwards	Around 2-10 farms per year. None in 2008-10
Classical Swine Fever (pigs)	1997/98	429
Foot and Mouth Disease (cattle, pigs, sheep, goat)	2001	24 cattle farms + 3 goat farms
Aujeszky's disease (pigs)	-	Free without vaccination from 2009
Bluetongue (cattle, sheep, goat)	2006/7	460 (BTV-8)
	2007/8	6442 (BTV-8)
	2008/9	58 (BTV-8), 14 (BTV-6), 1 (BTV-1)
Q-Fever (mostly sheep, goats)	2007 onwards	Many farms (2007: 168; 2008: 1000; 2009: 2368) and human infections

Source: Asseldonk *et al.,* 2010.

Box 6. Emergency vaccination strategy

Two kinds of emergency vaccinations are used to control epidemic disease outbreaks. Suppressive vaccination implies that after vaccination, all vaccinated animals are slaughtered and their carcass destroyed. In the case of protective vaccination, vaccinated animals and products from vaccinated animals are marketed.

In the case of emergency vaccination, three phases and different areas can be distinguished, i.e. vaccination circles, a vaccination zone around the vaccination circles, and the surveillance zone. Phase 1 relates to the period in which all animals within the vaccination circles are vaccinated. Phase 2 consists of a clinical and serological survey of all farms within the vaccination zone. After a farm is examined, it is "transferred" to phase 3 until the disease free status is recovered from the OIE. During the various phases, different requirements apply, including the channelling of slaughtered animals, deboning meat from vaccinated animals, heat treatments for meat, and special labelling.

The application of protective vaccination in the Netherlands is certain for outbreaks of CSF and FMD, and feasibility studies for AI are underway.

At present, the feasibility of a government co-financed fund for compensation of losses from emergency vaccination is under discussion. As it may be more difficult to sell products derived from animals subjected to protective vaccination, such a fund is believed to ensure farmers' full participation in vaccinations. However, designing the fund is complicated due to the difficulties of estimating losses as supermarkets refrain from making an explicit commitment to sell products from vaccinated animals.

Financial co-responsibility of stakeholders

As shown above, measures to control livestock epidemics imply considerable disruption of farm operations. They also involve *direct control costs*, including: (i) organisational costs of diagnosis; (ii) provision, if relevant, of vaccines and vaccination; (iii) control of transport standstills; and (iv) cost of culled livestock.

Emergency measures also lead to *consequential losses* from business interruption at the farm level and losses in the rest of the product chain. The farm-level consequential losses include various extra costs incurred and revenue foregone (e.g. due to lost animals,

movement restrictions, breeding prohibitions, and lower selling prices for vaccinated animals).

The current policy approach in the Netherlands is that direct control costs of livestock epidemics are shared between the EU, the Dutch government, and producers. In contrast, consequential losses must be assumed by private businesses.

The evaluation of recent livestock epidemics in the Netherlands shows that the economic consequences of such events can be significant (Table 18). The aggregate "cost" of Classical Swine Fever in 1997/98 (including loss estimates at the farm level and the rest of the chain) exceeded EUR 2.5 billion, and the total cost of the FMD outbreak reached EUR 755 million. For these two events, the direct (veterinary) costs to control the epidemic accounted for around two-thirds and one-third of the total costs respectively, with the rest being the consequential losses.

Table 18. Reported epidemiological and damage data on recent livestock epidemics in the Netherlands

	Classic Swine Fever 1997/98	**Foot and Mouth Disease** 2001	**Avian Influenza** 2003
Control strategy	Stamping-out[1]	Suppressive vaccination[2]	Stamping-out[1]
Farms infected	429 pig farms	24 cattle farms 3 goat farms	241 poultry farms
Animals destructed[3]	12 million	85 186 cattle 8 297 goats 32 633 sheep 121 437 pigs	30 million
Total direct costs and consequential losses	EUR 2 519 million	EUR 755 million	n.a.
of which			
Direct control costs	EUR 1 500 million	277 million	270 million
as % of total costs and losses	60%	37%	n.a.
Consequential losses at farm level	EUR 423 million	230 million	n.a.
as % of total costs and losses	17%	30%	n.a.
Consequential losses downstream	EUR 596 million	248 million	n.a.
as % of total costs and losses	24%	33%	n.a.

1. *Stamping-out*: destruction of infected herds and pre-emptive culling of contact and neighbouring herds.

2. *Suppressive vaccination*: destruction of infected herds, limited pre-emptive culling of contact herds, and emergency vaccination of all susceptible herds in a two-kilometre zone around infected herds (as opposed to *protective vaccination* when vaccinated animals and their products can be marketed).

3. Including infected, pre-emptively culled and, if applicable, vaccinated animals.

Source: CSF: Meuwissen *et al.* (1999); FMD: Huirne *et al.* (2002); Mourits *et al.* (2008).

Producer contribution to direct costs of livestock epidemics is operated through a Livestock Veterinary Fund (LVF). The current procedures for this fund were developed following the devastating epidemic of Classical Swine Fever in 1997/98 when the government incurred large expenses in the control measures. The LVF effectively sets the maximum amount of producer contributions to cover the direct control costs in the case of a disease outbreak. Any spending required beyond this limit is equally shared by the Dutch government and the European Union (the latter, through contributions from the EU Veterinary Fund).

The LVF covers all main livestock types: pigs, cattle, poultry, and sheep and goats (Table 19). The accumulation and use of the Fund is managed by Commodity Boards for Livestock, Meat, and Eggs. Producer contributions are raised through levies per slaughtered/exported animal, or per units of milk sold in the milk sector. The size of the Fund, and consequently the levy amounts, are based on a scientific risk assessment and the evaluation of the financial cost of the control measures. However, the definitive size of contributions is also subject to negotiations between the government and the industry. Currently, in deciding the size of the fund only the risks of major diseases are considered (mainly, CSW, FMD and AI). In the event of other large epidemics, additional assessments should be made and additional levies imposed. The combination of measures applied to control epidemics (scope of culling, recourse to preventive vaccination, etc.) constitutes part of the budget assumptions. For example, the different control strategies can explain the differences in the amounts of funds for each of the five-year periods since 2000. For the period 2010-15, almost all maxima were decreased. It has also been agreed that the maxima are reconsidered each year depending on inflation and the number of farms. At present, the possibility to expand the scope of the Fund to deal with the consequential losses of producers in livestock epidemics is being explored.

Table 19. Maximum amounts of producer contributions to the Livestock Veterinary Fund

EUR million

Livestock types	2000-04	2005-09	2010-14
Cattle	226.9	85.0	20.0
Pigs	226.9	125.0	68.0
Poultry	11.3	20.0	26.0
Sheep and goats	2.3	5.6	4.5

Source: Product Boards for Livestock, Meat and Eggs.

Private insurance and other policy instruments

Several insurance products have been introduced in recent years to cover consequential losses resulting from livestock epidemics (Table 10). In addition, cattle farmers can commercially insure their consequential losses as part of their damage insurance. This is a basic type of cover: if a herd is destroyed because of a FMD epidemic, the indemnity includes 15% of the insured value of the damage insurance. There is no deductible and no actual loss assessment. Apart from the products related to epidemic diseases, Avipol provides insurance against some non-epidemic poultry diseases.

Following FMD and AI outbreaks, emergency funds were created by the government for farmers in distress. Those who were severely affected by the control measures and the consequences of livestock epidemics could apply for assistance if they complied with certain criteria. However, the rate of participation has been relatively low.

The negative externalities of an animal disease outbreak can be significant, and therefore quick notification and implementation of control measures are important. For an individual farmer, however, disease notification may imply losses due to the control actions that may follow. Appropriate incentives to align public benefit and private interests must be built in the system of disease risk management (Box 7). Some incentives are already built in the schemes operating in the Netherlands – Livestock Veterinary Funds and specific insurance schemes – others are not, and therefore represent potential areas where incentives can be improved.

Box 7. Economic incentives of insurance schemes for animal epidemics

Risk prevention aims to prevent an epidemic from occurring, and, when there is an epidemic, to minimise its extent. Risk classification with strong price discrimination is likely to encourage preventive behaviour. Classification should be based on risk factors that are manageable by the farmer himself, such as the number of animal contacts, the type of farm, presence of hobby animals and quality of sanitary measures applied.

A further way to stimulate risk prevention is to limit the use of deductibles. Although a standard practice in most lines of insurance, deductibles should be carefully applied in livestock epidemic insurance schemes: incentive problems may arise if large deductibles apply to direct losses from culled animals (see discussion below on rapid disclosure). For consequential losses, such as business interruptions resulting from depopulation and movement restrictions, deductibles are, on the contrary, a useful instrument against moral hazard. Also, the moment premiums are to be paid influences farmers' risk awareness and incentives for risk prevention. A combination of both advance and additional payments into one scheme is likely to have the largest preventive effect, especially if farmers who quit their business after an epidemic must continue to cover the cost of additional assessments.

Incentives for risk prevention are also influenced by the way the insurance is organised; for instance with respect to the retention ("deductible") of the insurance pool. The retention should preferably have some annual basis as this stimulates farmers to prevent the risks — in contrast to a multi-annual retention in which there are no incentives for risk prevention once the retention threshold is exceeded. Incentives for risk prevention can also be affected by the extent and ownership of the insurance pool: local pools, pools that are organised per sector, and mutual pools are likely to have a positive effect on incentives for risk prevention. A direct relationship among pool members reduces problems of asymmetric information — and related costs of monitoring and verification. There is likely to be broader support for risk classification and a critical underwriting policy since farmers – instead of anonymous insurance companies – impose these measures. In addition, at the time of an epidemic, such pools make appropriate loss assessment easier because of social control. A further insurance organisation incentive is to stop selling insurance coverage if epidemics are notified in proximity and communicating this clearly during "peace time". Continuing to sell insurance when epidemics are occurring nearby would lead to moral hazard and adverse selection, in addition to the fact that risk premiums would be set at a higher level.

Rapid disclosure. In order to encourage immediate disclosure, sick animals or dead animals at the time of culling should not be compensated for. Healthy animals, however, should be fully compensated for in order to prevent farmers from selling them before disclosing the outbreak. Furthermore, insurance for direct losses should be obligatory. It is only in this way that all farmers will be alerted in the case of an epidemic.

continued

Compliance with movement standstill. The established movement standstills are too often not immediately acted upon. Farmers still try to get their animals out of the restricted area, which represents a major risk of spreading the disease. There should be, therefore, a link between insurance premiums and indemnities and some national penalty system against breaking the rules. Insurance coverage for losses related to a movement standstill can also be a solution. This becomes especially relevant with the application of emergency vaccination programs in restricted areas, since this will likely lead to a substantial decrease in the value of the animals and their products.

No deliberate infection. With the extended periods of movement standstills, and related supply and delivery problems, it may become more attractive for a farmer to have an infected herd, receive full compensation and have the stables empty for a period of time. To prevent a deliberate infection, culled animals and destroyed animal products should be compensated at the lowest production cost and actual market price.

Source: Meuwissen *et al*., 2006.

PART III.

POLICY IMPLICATIONS

5. Policy recommendations and concluding remarks

The Dutch agro-food sector has developed considerable capacity to manage various farming risks through adoption of advanced technologies, effective co-ordination mechanisms across the value chain, and building industry institutions that design common rules, promote best practices and provide services that support farmers in their individual risk management strategies. The policy focus in the Netherlands is placed on catastrophic risks which are beyond the capacity of individual businesses and industry to cope with. In recent years, the Dutch government has made consistent efforts to shift away from *ad hoc* responses to catastrophes, promoting public-private partnerships and supporting the development of *ex ante* arrangements to deal with catastrophic risks. This is a welcome policy orientation that should be pursued. The key challenge for the Dutch government is to build on the experience gained to date and to develop coherent policy sets to deal with catastrophic risks. Most likely, different sets of policy instruments will be required in areas related to natural disasters, plant and animal diseases.

Policy recommendations for the Netherlands

1. ***Develop an ex ante policy framework for disaster assistance***. Until recently, assistance related to natural catastrophes has been provided on the basis of *ad hoc* decisions, which were largely influenced by political pressures. The subsidised multi-peril crop insurance and other types of climatic insurance introduced earlier were the principal steps to base disaster assistance on a formal contract. However, irrespective of how successfully these insurances will perform, it is unlikely to become a solution to all the potential consequences of disasters. The government will continue to face economic and political necessity to provide disaster assistance. It is therefore important that the government's responsibility with respect to such assistance is explicitly defined.

   a. *Introduce explicit conditions for triggering the disaster assistance*. Disaster assistance should not crowd out other risk strategies. In particular, it should be provided with respect to natural risks that are not covered by multi-peril crop insurance. Such events may be explicitly specified. In addition, the triggering criteria should be linked to the scale of event, e.g. its probability and the level of damage. Criteria could be developed to establish the level of damage that qualify an event as catastrophic, e.g. share of total area/total number of farms affected, magnitude of economic impact, and capacity of producers to cope with the impacts of the disaster.

b. *Establish ex ante procedures for provision of assistance*, including the decision-making process to provide assistance, the type of assistance available (e.g. relief payments or concessional credit, technical services, or business/financial advice). Consider interactions with broader frameworks of public disaster assistance related to natural catastrophes – e.g. under the Disaster Law to avoid duplication of measures.

c. *Consider the possibility of improving access of self-employed farmers to social safety nets* by adjusting the asset test criteria for farmers to take into account higher farm assets.

2. ***Develop medium to long term policy strategy on insurance***. Several types of insurance have been introduced in the Netherlands since the late 1990s to deal with catastrophic risks. Some schemes were initiated by the government after it incurred large budgetary costs disasters and for which it reluctant to once again bear such costs in the future, or, as is the case with the multi-peril crop yield insurance, as a result of new opportunities created by the EU policy framework.

a. *Undertake a comprehensive review of insurance schemes recently introduced*. Explore why some schemes have been successful without or with little government involvement, why some have limited participation and require government support, and why others have failed.

b. *Monitor and evaluate multi-peril crop insurance.* Given that price risk is more important than yield risk in the Netherlands, the potential demand for crop insurance may be limited. Thus, the performance of this program needs to be monitored in terms of administrative costs, financial robustness, timing and amount of the subsidy, and the actuarial soundness of premium rates. Based on the results, *define the future direction for development of multi-peril crop insurance*. Explore the possibility of transforming this program into a broader public/private partnership. Consider construction of a common crop insurance database to reduce transaction costs in provision of insurance and to improve the pricing; phasing-out or reduction of premium subsidies over time; and creation of a reinsurance fund. Insurers, producer and industry organisations should be involved in the process of assessment and formulation of a longer-term strategy through consultations. This will help generate trust and credibility, without which insurance cannot succeed.

c. *Develop guidelines specifying the role of government in supporting insurance*, both with respect to single peril and multi-peril insurance. Define the scope of catastrophic insurance that the government is intended to support and how this translates into premium subsidies and re-insurance. Public reinsurance is an implicit subsidy to the insurance premiums, and its role and scope must be transparent.

3. ***In the area of crop diseases, explore the possibility of increasing the scope of risk management instruments available to farmers.*** Risks of specified diseases are prevented by the national phytosanitary system which functions as part of the common EU plant health system. All other disease risks must generally be managed by producers either individually, or with the assistance of their producer and industry associations. In addition, producers individually bear the principal costs arising from the outbreaks of crop diseases. This is to some extent related to the fact that crop diseases are perceived as more confined to specific farm and with potentially lesser negative externalities than animal diseases. The instruments to transfer the risks of occurrence of plant diseases,

such as insurance, are limited. Insurance exists only in a few sectors and for a few types of diseases. The issue that arises is whether the availability of instruments to manage disease risks in the crop sector can be expanded.

a. *Undertake a comprehensive assessment of profiles of different crop sectors and farm groups with respect to plant disease risk*. Such an assessment is a necessary starting point to evaluate the feasibility of market risk instruments. The range of crop diseases is much broader than in the livestock sector and farmer risk exposure to various disease risks varies significantly depending on their specialisation, production systems and location. This heterogeneity limits the use of market instruments to manage plant disease risks. Thus, for insurance it may lead to the problem of insufficient size of the risk pools. Similarly, the viability of common funds (analogous to the Livestock Veterinary Funds) may also be problematic due to a lack of commonality of interest amongst producers *vis à vis* the disease risks. This, however, does not imply that areas where such arrangements are feasible do not exist (as is shown in the case of disease insurance in the potato sector and the collective fund in the bulb sector). The development of new instruments would involve identification of the types of disease risks and the corresponding producer groups which may constitute sufficient risk pools. The government may provide start-up incentives to implement these solutions where assessment suggests this would be viable.

b. *Continue to promote producer own risk management strategies.* Provide incentives for the adoption of technologies that reduce plant disease risks; expand information, and communication, extension and advice on crop diseases. Encourage industry and producer organisations to promote best practices for plant protection, e.g. concerning crop rotations, use of plant protection products, choice of resistant varieties, and, where necessary, developing compulsory industry practices.

c. *Strengthen the "farm application" focus of R&D on crop diseases*.

4. ***Introduce further improvements in the design of the Livestock Veterinary Fund***. This fund is a positive example of a public-private partnership that enables to share the financial responsibility of parties that deal with livestock epidemic risks. However, there are a number of areas where the effectiveness of this instrument could be improved.

a. *Build additional incentives into the scheme* to strengthen risk prevention, rapid disclosure, compliance with control requirements, and rapid disclosure of infections as identified by the analysis already existing in the Netherlands.

b. *Consider an assessment of a broader scope of epidemic risks to determine the size and use of the Fund*. At present, the aggregate amount of producer contributions to the Fund and the levy rates are based on the assessment of probabilities and the potential direct losses related to only a few major livestock diseases. This implies that the amount of funds effectively earmarked do not account for a large number of potential epidemics. At the same time, all notifiable diseases are eligible for compensation from the Fund, unless they are explicitly excluded. There seems to be a lack of procedure on topping up of the Fund in the case of an emergency deficit, and also how and whether the Fund can be used in the case of an outbreak of a totally new disease. There is, however, a trade-off between the Fund's flexibility to cope with a variety of potential risks and the costs imposed on levy payers.

5. ***Encourage further improvements in risk awareness amongst all participants in the agro-food system***. Support further research, information and extension related to the sources and characteristics of risks faced by farmers and the rest of the agro-food chain. An appropriate level of risk awareness is a prerequisite for understanding by stakeholders of their responsibilities in risk management and their active engagement in the development of individual and collective risk management strategies.

Policy lessons beyond the Netherlands

6. ***Mutual insurance funds targeted to specific risks and specific producer groups can better deal with problems of asymmetric information and moral hazard,*** and therefore offer insurance products which larger and more diversified insurers do not. Such funds may adopt flexible regimes of premium collection, which are better tailored to cash flows of their clients. These companies tend to have a stronger sense of ownership and trust amongst its stakeholders as compared to conventional public stock companies, which can be an important factor of their sustainability. Governments can provide the initial incentives to create such funds by way of start-up capital and attracting private expertise for product development. However, mutual companies may suffer limited financial robustness due to their relatively small size and the small scope for diversification in their risk portfolio, requiring sometimes re-insurance support from the government. Their business decisions may also be more susceptible to stakeholder pressure.

7. ***Industry organisations can assume important functions in the design and implementation of risk policies***, particularly by developing industry-specific rules, best practices and advice. They can also be instrumental in emergency responses to catastrophes. Common funds to share the costs of diseases risks is a potentially important activity that can be performed by industry organisations. Integration of producer and industry organisations in the risk policy process can contribute to policy efficiency and clearer division of responsibilities between the government and private business for risk management. However, it is also important to avoid that the policy design process is captured by industry interests.

Annex 1.

List of institutions and persons visited during the OECD mission to the Netherlands

Ministry of Economic Affairs, Agriculture and Innovation
(previously Ministry Of Agriculture, Nature And Food Quality)

H. Maurice, Policy Manager of Cluster Farm Animals

J. Schotanus, Policy Coordinator CAP

R. Gravemeijer, Senior Policy Advisor Social Economic Affairs

H. Schollaart, Senior Policy Advisor Phytosanitary Affairs

Plant Protection Service of the Netherlands (PD)

D.J. van der Gaag, Plant Protection Expert

Product Board Horticulture

N. Quadvlieg, Market Research and innovation

Product Board Arable

B. Waterink, Policy advisor

Rabobank International

H. Smit, Advisor to the Global Head/Dutch Agriculture

OFH/POTAPOL/ Brede Weerverzekering (mutual insurance companies)

J. Meijs, Secretary Director

Product Boards Livestock (PVV)

J. Klaver, Sector Co-ordinator, livestock diseases

Interpolis

J. de Hoon, Agricultural insurance, Sector Manager

Dutch Federation of Agriculture and Horticulture (LTO Nederland)

J. van Wenum, Policy advisor

Dutch Federation of Agriculture and Horticulture (LTO Nederland)

S. de Groot, Policy advisor animal health, animal welfare and zoonoses

Rijnplant (Greenhouse Firm)

Plant grower's risks

Ruud van Uffelen

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