SUMMARY

RESEARCH CONTEXT

During the past decades the problem of pollution entered the agenda of policy makers at the national as well as the international level. Increasing concern for the environment has entailed that the agricultural sector and the negative consequences of agricultural production have become the subject of both public and political discussion. One of the main problems the farming sector is faced with concerns the production and usage of manure. Since the 1950's, livestock levels in the Netherlands has rapidly increased resulting in the extreme intensity of agricultural production of today (Frouws, 1993). This development has brought with it the problem of the overproduction of manure, which in turn, has seen the application of manure to land in too large quantities. Huge amounts of nutrients, such as phosphate, nitrogen and ammonia, not absorbed by crops leach into the environment, causing serious environmental problems.

It was only in the 1980's that recognition was given to the fact that farming environmental issues deserved serious concern by the Dutch government and thus entered the political agenda. In 1984, a policy programme was set up aiming to reduce the emission of nutrients to a level which was considered to be environmentally acceptable. This programme became known as "The Manure Policy Programme". Environmental goals were formulated by the Dutch government and used as a guideline for filling in the programme. The government decided that the leaching of nitrogen and phosphate should be decreased to a level that would not exceed EC-standards for drinking water and that by the year 2,000, ammonia emissions should be reduced by 70% of the 1980 levels.
The Manure Policy Programme covered three phases to be completed by the year 2000. Phase one (1987-1990) aimed at the stabilisation of the manure problem and the application of possible solutions (via fodder and the distribution and conversion of manure). Phase two (1991-1994) aimed at a gradual reduction of the environmental problem by gradually bounding the maximum of manure application per ha. Phase three (1995-2000) aimed at the further bounding of the maximum of manure application per ha to a level that equals the amount of manure utilised by the crops (ie application equals withdrawal).

However, the elaboration of the Manure Policy Programme experienced some difficulties. While the institutionalised practice of consultation between the Ministry of Agriculture and the agricultural sector made it possible for the sector to put its agricultural stamp upon the realisation of the necessary manure measures, this also led to a delay in the policy process. Technical solutions to solve the manure problem were not realised in time by the sector and the traditional working relation between the Ministry of Agriculture and the agricultural sector came under pressure. Additionally, conflicts of interest over the Manure Policy Programme arose within the sector itself. Not satisfied with the representation of farmers' interests by official agricultural organisations, individual farmers formed new pressure groups.

RESEARCH QUESTIONS AND METHODS

In this research, we have taken the developments we mentioned above as our starting point to study the support for some of the measures that have been taken in the third phase of the Manure Policy Programme. We have studied the support for these measures from two different angles.

First, we have studied the decision-making process of a set of environmental measures that have been taken in the third phase of the Manure Policy Programme. We questioned to what extent these measures were supported at the political level. For this first part of the project our research question was:

What is the political support for measures that have been taken in the third phase of the Manure Policy Programme?

SUMMARY

To answer this question we took a decision-making, the (Mesquita et al., 1985; the outcome of a set of the simulated decision-

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FARMERS' DECISIONS

To answer this question we applied a formal simulation model of decision-making, the Conflict model of Bueno de Mesquita (Bueno de Mesquita et al., 1985; 1994). With this model, it is possible to predict the outcome of a set of measures. Furthermore, it is possible to study the simulated decision-making processes in-depth.

For governmental policy to be successful, it is of vital importance that the group at which the policy is directed, supports the measures that constitute the policy. In the case of this research, this means that individual farmers must be willing to change their production behaviour and implement the policy measures on their own farms. This notion brought us to the second part of our research, in which the support for the Manure Policy Programme at the level of the individual farmers is questioned. For this second part of the project our research question was:

Can it be expected that the positions of individual farmers and their management decisions are such that individual farmers will support the governmental measures that have been taken in the third phase of the Manure Policy Programme?

To answer this question we have chosen two different approaches. In both approaches, we have taken one central policy issue from the third phase of the Manure Policy Programme, the so-called nitrogen loss value for grassland for the year 2000.

First, we have focussed on the knowledge of farmers, asking whether individual farmers are willing to decrease the nitrogen surplus on their farm and whether they consider the possibility to do so as feasible. To answer these questions we have developed an interactive simulation. A central part of the interactive simulation was taken up by a management advisory system; a computer programme called Environment-Detector, developed by Hennen (1995). With this programme, an individual dairy farmer can choose measures that might decrease the nitrogen surplus on his farm. If one or more measures are chosen, the programme calculates the environmental and financial effects of these measures for the farmer in question. A group of 28 dairy farmers has participated in the interactive simulation. These farmers were selected from the Farm Accountancy Data Network of the Agricultural Economic Research Institute.
Secondly, we focussed on the social network of individual farmers, asking to what extent advisers in the social network of farmers influence the position of farmers with regard to the nitrogen surplus on their farms. For this second part, we again applied the Conflict model of Bueno de Mesquita. With the help of this model we could describe the advisory network of individual farmers and moreover we could quantify and simulate the influence of their network. We did this for a group of 16 dairy farmers that were involved in a special project called ‘Management Duurzame Bedrijven’ (the MDM-project).

RESULTS REGARDING THE POLITICAL SUPPORT FOR THE MANURE POLICY PROGRAMME

The Manure Policy programme consists of a large set of measures. We selected nine measures or issues to simulate with the Conflict model. The data gathering and the simulations of these issues have been carried out at two points in time. In 1994, six issues with regard to the phosphate, nitrogen and ammonia policy were simulated. In 1995, three issues were simulated. These three issues were central issues of the third phase of the Manure Policy Programme, namely the loss values for phosphate and nitrogen for the year 2000.1 The results of our study on the political support for the selected measures are described in two parts.

Forecasting the outcome of decisions

The Conflict model generates predictions of the outcomes of issues. In the model the predicted outcome is based on the median voter position of the final simulation round. Comparing the predicted outcomes of the issues with the real outcomes of the issues, it turned out that the Conflict model generated the best predictions in 1995. In that year, the model predicted a phosphate loss value of 34 kg/ha and a nitrogen loss value of 275 kg/ha. The actual outcomes of these issues were respectively 35 kg/ha and 276 kg/ha. This means that the political round had to be divided. The issues we selected, the Agriculture and the Environment Ministries did not take the loss values for the year 2000. This would be difficult for the Ministry. Comparing our results with these issues it turned out to be agreement by making a few adjustments. 1) they changed the technical loss values. The phosphate loss value of 275 kg/ha was increased to 300 kg/ha in the decision-making process. 2) only farms with a high phosphorus and nitrogen concentration share the loss values; 3) in the light of the Environment Programme, a fund would be set up. By introducing these ‘special rules’ the Conflict model produces better results. For the remaining issues these rules were divided on the issue. For the nitrogen as well...

1 We carried out two simulations for the phosphate issue. While gathering our data in 1995 the coalition parties PvdA, VVD and D66 joined together and took one position on the phosphate loss value. We simulated the decision-making process of this issue both with and without the coalition position.
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REPORT FOR THE MANURE POLICY

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For the nitrogen as well as the phosphate issue. While gathering our data in ed together and took one position decision-making process of this issue

tively 35 kg/ha and 275 kg/ha. By using the median voter position it is assumed that all the actors involved in the decision-making process have voting power. In our research however, this was not the case. This means that the positions of the decision-makers in the final simulation round had to be taken as the predicted outcomes. For all the issues we selected, the final decision-makers were the Ministry of Agriculture and the Ministry of Environmental Affairs. These ministries did not take the same positions on all the issues concerning the loss values for the year 2000. Based on these results we predicted that it would be difficult for the ministries to come to an agreement in reality. Comparing our results with the real decision making situation, this turned out to be a good prediction. The ministries came to an agreement by making a package deal entailing the following elements: 1) they changed the time schedule for implementing the final loss values. The phosphate loss value of 35 kg/ha and the nitrogen loss value of 275 kg/ha would be introduced in 2000, but not as the final loss values. The final loss values would be implemented in 2008/2010; 2) only farms with a high stocking rate were to be confronted with the loss values; 3) in the light of a new policy programme, the Restructuring Programme, a fund was set up by the size of 475 million guilders. By introducing these 'new' issues, the Ministries of Agriculture and Environmental Affairs were able to reach an agreement on the Manure Policy Programme.

The simulated processes of decision-making

To get a better insight in the process of decision-making we gave a detailed description of the simulated processes of five issues. The integral description entailed the simulations of two central issues of the third phase of the Manure Policy Programme, the loss values for phosphate and nitrogen for the year 2000. As mentioned earlier, the data for these issues were gathered in 1994 and 1995.

In both years the simulations showed that the Ministries of Agriculture and of Environmental Affairs were divided on the phosphate issue and could not reach an agreement. With regard to the nitrogen issue the simulations showed in 1994 that the ministries were not very divided. This was in contrast with the situation in 1995 where they were divided on the issue and stayed divided during the simulation. For the nitrogen as well as the phosphate issue the decision-making
process was troublesome and the conflict rate was reasonably high.
Compared to 1994 the conflict rate had even increased.

The agricultural sector played an important role with regard to
the phosphate issue in 1994. The sector could persuade the Ministry of
Agriculture to alter its position in their direction. However, while it
still played a role in the simulation, the sector had less of an influence
when it came to the nitrogen issue. It was striking to see that the
influence of the sector had totally disappeared in the 1995-simulation:
the sector gave in to the Ministry of Agriculture on the nitrogen issue
but held firm on the phosphate issue without convincing others.

During the data gathering in 1995 the coalition parties PvdA,
VVD and D66 joined together and took one position on the phosphate
loss value. Given this new information, we carried out an extra simula-
tion. This showed that the joint position of the coalition had a negative
effect on the decision-making process. The conflict rate increased in the
simulation. The Ministry of Environmental Affairs changed its position
somewhat in the direction of the Ministry of Agriculture, but the two
ministries remained divided on the issue.

With reference to the support for the expected outcome (the me-
dian voter position) of the issues, we found that the average support for
the phosphate as well as for the nitrogen issue had decreased in 1995
compared to 1994. This was especially the case for the predicted phos-
phate loss value. In 1995 the political actors supported the predicted
phosphate loss value somewhat more than the nitrogen loss value.
This was in contrast with the support from the agricultural sector.
Among the agricultural actors there was more support for the pre-
dicted nitrogen loss value. In the extra simulation we carried out for
the phosphate issue, we saw that the political support had increased
and the agricultural support had decreased further.

Compared to reality it appeared that the roles of the Ministries of
Agriculture and Environmental Affairs were well reflected in the simu-
lations. They could not reach an agreement, and, as outlined, a pack-
age deal had to be formed in order that a compromise be reached.

With regard to the other actors in the simulations, it was more
difficult to find out what their roles had been during the real decision-
making processes. For our findings concerning the diminished role of
the agricultural sector in 1995 compared to 1994, we found a confirm-
ation in a report of the Strategic Policy Making Bureau of the Ministry
of Agriculture. In this report it was stated that the Ministers of Agri-
culture and of Environmental Affairs wanted any official consen-
sus to be put aside. The crucial phase of the final Manure Policy Programme. But the
problems with regard to the support was also visible when compared to 1994.

RESULTS REGARDING THE
AT THE LEVEL OF THE IN-
dividual farmers

As explained above, two parts of our study are also
about the influence of knowledge and decision making processes. We have
investigated the support for the nitrogen loss value for grassland
farmers. We have related the data gathered during the second part of the
phase of the Manure Policy Programme to the importance of the farmers
to decrease the amount of nitrogen. Interest in the question of whether
farmers would also take action to decrease the nitrogen surplus was also
difficult for the farmers to answer. The figures - especially of the
figures are the phosphorus surplus was estimated s
SUMMARY

RESULTS REGARDING THE SUPPORT FOR THE MANURE POLICY PROGRAMME

As explained above, two different approaches have been worked out for the second part of the project. In both, the same issue from the third phase of the Manure Policy Programme has been used, the nitrogen loss value for grassland for the year 2000. The results of this second part of our study are also described in two parts.

The influence of knowledge of farmers on decreasing the nitrogen surplus

We have investigated to what extent farmers have knowledge about their farm. We have related the knowledge of the farmers to the extent to which they pollute the environment and to the possibilities they see to decrease the nitrogen surplus on their farm. We were especially interested in the question whether farmers, who know their own farm well, would also take better measures to decrease the nitrogen surplus on their farm.

We measured the knowledge of the farmers who participated in the interactive simulation by their estimation of a number of technical, economical and environmental figures relating to their own farm. It turned out that the farmers gave the best estimations of the technical figures - especially of the milk yield per cow and per hectare. It was surprising to see that they had difficulties in estimating the economical figures like gross margin per hectare and cost of purchased feed stuffs. In the light of the Manure Policy Programme, two important figures are the phosphate and nitrogen surplus. These two figures were also difficult for the farmers to estimate. Yet, on average the phosphate surplus was estimated somewhat better than the nitrogen surplus. On
average, the phosphate surplus was overestimated and the nitrogen surplus was underestimated.

Except for one, all of the twenty-eight farmers had a higher nitrogen surplus at their farm than the loss value of 275 kg/ha that the government had prescribed for the year 2000. However, with regard to their phosphate surplus the farmers performed better. Thirteen farmers had a phosphate surplus of 35 kg/ha or lower. Additionally, there was a strong positive correlation between the phosphate and nitrogen surplus. The knowledge of farmers of their surpluses seemed not to be related to the amounts of phosphate and nitrogen surplus. Only the farmers with a high phosphate surplus were able to give a good estimation of it.

Most of the farmers stated they would be willing to strive towards a nitrogen surplus of 275 kg/ha for the year 2000. Their expectation was that this would have a negative effect on their income. No strong relation could be found between the knowledge of farmers of the technical, economical and environmental figures and the nitrogen surplus they strive towards and the farmers' expectations of the income effect. The sign of the correlations pointed in the direction that farmers with less knowledge of the technical and the environmental figures were willing to decrease the nitrogen surplus more but also expected to experience more negative financial consequences.

During the interactive simulation, the farmers were able to choose a number of measures to decrease the nitrogen surplus on their farm. The most popular measures were 'decrease the manuring with nitrogen', 'increase the milk yield by breeding measures', 'increase the area farm land (grass) by purchasing ground' and 'decrease the number of young stock'. The measures the farmers had chosen and the economical and environmental effects they had achieved with these measures were not related to the farmers' knowledge as we had measured it in this research project.

During the interactive simulation, the farmers could choose measures in five separate rounds. Although they were already able to decrease the nitrogen surplus on their farm and maintain a good income in the first round, on average we found that the farmers did better in later rounds. By examining the data of their own farms, farmers got a good insight into the effects of the different measures chosen. Although the farmers did very well in the course of the simulation, they could have reached the same effects with less radical measures.

**SUMMARY**

Independent of the farm, the Environment Detector had individual farm. For the generated also the two measures and 'improve feed and advisory system general. Comparing the average Environment Detector we could not find a sign.

Based on our findings, implement the Manual programme will be im-
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the persons in the social
Independent of the farmers, the management advisory system Environment Detector had generated a package of measures for each individual farm. For the majority of the farms Environment Detector generated also the two measures 'decrease the manuring with nitrogen' and 'improve feed and grassland management'. Besides these, the advisory system generated more simple measures such as 'decrease the protein content of feed' and 'decrease the amount of concentrates'. Comparing the average economic and environmental effects reached by Environment Detector with the average effects reached by the farmers, we could not find a significant difference.

Based on our findings we concluded that farmers are willing to implement the Manure Policy Programme. The support for the programme will be increased when they receive information about possible (cost saving) measures and about the effects of these measures for their farm.

The influence of the social network of farmers on their nitrogen surplus

Every day farmers have to make many management decisions. We assumed that they do not make these decisions on their own. Within the agricultural sector, many different channels exist through which farmers talk with each other about the different aspects of farming. Farmers are part of a social network of actors that give them advice. These actors have different opinions and interests, and farmers will consider the opinions of some more than others.

As mentioned above, we have carried out our research on the role of the social environment for a group of dairy farmers that has been engaged in a special project, the MDM-project. This project especially focussed on the mineral management of these farmers. Because these farmers participated in the MDM-project, they were very well informed about their farm and the possibilities regarding environmentally friendly farming. We questioned the extent in which these well-informed farmers were influenced in their management decisions by actors in their social environment.

The MDM-farmers formed a group that was indeed very consciously engaged in the mineral management at their farm. Fourteen of the sixteen farmers strived towards a nitrogen surplus that was lower than the loss value of 275 kg/ha. With regard to the positions of the persons in the social network of the farmers, we formed the follow-
ing picture. On average, the farmers got most support for their position from their direct relatives and their MDM-colleagues. Their non-farming friends and the MDM-workgroup preferred lower surpluses. Their professional colleagues, colleagues they met in study clubs, professional advisers and informants preferred higher surpluses.

Besides the positions of the farmers and their professional and nonprofessional advisers, both the potential power and salience of all the actors were estimated. We used these data to get a picture of the power distribution over the different positions of all the actors with regard to the nitrogen surplus issue (see chapter 5, pages 211-213). We found three different structures. Eight farms had a one-apex distribution over the different positions of the actors. Five farms had a distribution with two or more apices and three farms had a J-shaped distribution.

For each farm we simulated the decision-making process for the nitrogen issue. The simulations showed that the farmers were particularly influenced by the actors in their network when they had an extreme position (J-shaped distribution) or when they were in a polarised power field (distribution with two or more apices). Depending on the positions of the influencing actors, the farmers shifted to a higher (influenced by the feed sellers) or lower (influenced by the MDM-workgroup) position in the simulations. The farmers who held on to their positions, influenced the actors in their environment and were in most cases able to convince these actors of the validity of their position. These farmers found themselves in a power field that had a one-apex distribution.

From our findings of the interactive simulation, we concluded that it is important to inform farmers about possible measures and about the effects of measures. Based on our findings in this part of the project we concluded that it can also be important to include especially professional advisers when informing farmers on how to implement the Manure Policy Programme at their farm.