The Dutch Approach to the Implementation of the Nitrate Directive: Explaining the Inevitability of its Failure

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Abstract: *The article provides an analysis of the Dutch approach to the implementation of the European Union's Nitrate Directive (91/676/EC). According to the Nitrate Directive, member states were obliged to implement certain mandatory measures with the aim of achieving the environmental target of the Directive, the reduction of nitrates in groundwater to 50mgN/litre in line with the World Health Organisation's guidelines for safe drinking water. The article seeks to explain why the Dutch government chose not to implement one of these mandatory measures, a manure application standard, preferring instead to use an alternative system, known as Minas, which combined a tax on nutrient losses with nutrient accounting. The reason for the selection of the Minas system was that it promised to reduce the costs of achieving the environmental goal of the Nitrate Directive. However, despite the perceived advantages, Minas failed and was replaced in 2006. The article explains the reasons for this failure and points to two errors of judgment which made failure inevitable from the outset. This article is based on a study carried out on Minas in 2003/2004, which included empirical research and the conclusions presented here are derived from interviews with researchers, policy makers and representatives from the agricultural industry in The Netherlands.*

Keywords: Minas, cost-effective, Nitrate Directive, environmental tax, nutrient accounting, policy failure

1. The Dutch Minas System

The Minas system was an attempt to tackle the problem of diffuse nutrient pollution of groundwater originating from agricultural sources and was the preferred approach of the Dutch to reduce the amount of nitrates present in groundwater to 50mgN/litre, the environmental goal of the EU Nitrate Directive.

The Netherlands is the most intensively livestocked country in Europe. In the pig sector alone, the number of animals increased from 2.95 million in 1960 to over 11 million in 1984 (Derikx 1998). Due to its intensive nature, the Dutch livestock sector exerts a significant pressure on the environment contributing to acidification, greenhouse gas emissions and nutrient pollution. Particularly high stocking densities occur in the south and east of the

country where most of the intensive pig production is located (MANMF 2001). This means that the pollution of groundwater with nitrates and phosphates from agriculture is a significant problem in these areas due to the large surplus of manure produced but also owing to the sandy soils in these regions, which are particularly prone to nutrient leaching (Verschuur *et al.* 2003). This is then compounded by the fact that 60% of the drinking water supply for the Dutch population is abstracted from these areas (RIVM 2002), which necessitates its expensive treatment. The annual cost of treating drinking water polluted with nitrates was estimated to be NLG 50 or approximately €23 million (Brinkhorst and Pronk 1999). The sheer number of pigs in The Netherlands, coupled with the intensity of production with the majority of farms having little land and the main centres of production being located in the South and East of the country, on sandy soil prone to nutrient leaching, makes the pig industry the most polluting sector regarding nutrients from manure. Therefore, any policy measure implemented with a serious intention to address groundwater pollution from nutrients should target this sector.

Minas essentially combined nutrient accounting with a tax on nutrient surpluses and was therefore an economic instrument. Farmers were required to register all nutrient inputs and outputs on their farm, which were reported as kg of N and P in an annual Minas return. Ideally, the amount of nutrient inputs to the farm system should have equalled the nutrient outputs from the farm in which case a balance would have been achieved. However, if the total kg/N and P leaving the farm was calculated as being lower than the total kg/N and P that had entered, then this indicated that the difference had been lost to the environment somewhere on the farm, the implication being that it would then leach into watercourses and cause pollution. The various inputs and outputs of the farm and the simple accounting formula are illustrated in Figure 1.

Yet, some nutrient loss was permitted as it is unavoidable and so farmers were allowed to loose a certain amount of kg N and P per hectare of agricultural ground, depending on the nature of the soil. However, anything above this level, known as the levy-free surplus (LFS), was subject to a tax per kg N and P.

The reasoning behind implementing Minas was the desire to regulate N and P from both artificial fertilisers *and* animal manure (Oenema and Berentsen 2005). Alternative systems were ruled out as being inferior, such as a tax on N and P inputs. Taxing surpluses makes the levy difficult to avoid through the use of substitutes, as would be the case if the levy was imposed upon N and P inputs, because pollution itself is targeted. A tax on artificial fertilisers was deemed unsuitable because farmers would have been able to avoid paying the tax by substituting purchased fertiliser with manure. Additionally, such a tax does not guarantee a reduction in the amount of N and

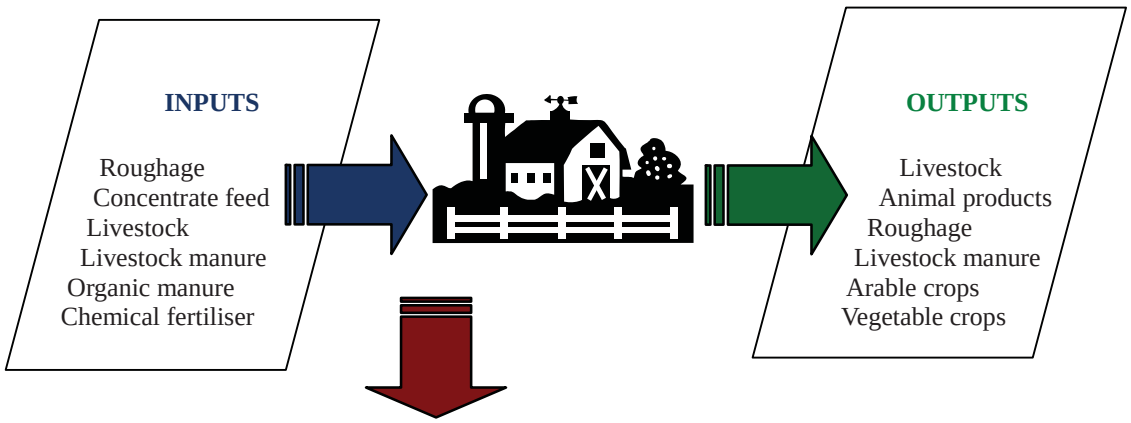

Figure 1. *Nutrient Input and Outputs on the Farm Under Minas (adapted from MANMF, 2001).*

P leached into the environment because the farmer can still be inefficient with regards to their use. There was also a need for an instrument that would provide an incentive for good nutrient management at the farm level (Oenema and Berentsen 2005). Minas was considered to be both a management and regulatory instrument for farmers to improve nutrient management at farm level and for the government to regulate N and P losses from agriculture to the wider environment, respectively.

The aim of Minas was, therefore, to reduce the excessive amounts of nutrients applied to agricultural land by providing farmers with an economic incentive to both lower the import of N and P in fertilisers, animal feed and/or animal manure, and to increase the export from the farm of harvested products and animal manure. Measures open to farmers included increasing the accuracy of nutrient use by, for example, improving feeding and grassland management, reducing N fertilisation from inorganic fertiliser or more drastic measures such as decreasing farm intensity (Ondersteijn 2002).

The loss standards were progressively lowered as illustrated in Table 1. This gradual tightening of the policy was phased in over a number of years to allow farmers to adjust. Upon implementation in 1998, the tax rate for each kg N and P per hectare over the levy-free surplus was €0.68 and €2.6 - €10.4 respectively (Oenema and Berentsen 2005). The level at which the levy-free surpluses are set and the stringency of the levies determines the losses of N and P to the wider environment. Minas assumes a relationship between the level of the levy-free surpluses and the size of N and P losses to the wider environment. To ensure that the Minas system worked, the nutrient content of all inputs and outputs of the farm had to be calculated.

Farmers were obliged to keep accurate records of their commercial mineral inputs and outputs using official documents for sales and purchases from accredited firms only. The nutrient content of livestock and other animal products, vegetable products and other crops was based on government issued standards. This 'minerals return' was then submitted to the Levies Office of the Ministry of Agriculture, Nature Management and Fisheries on an annual basis. These obligations were imposed to ensure the accurate registration of the chain of production, transport, storage and use (MANMF 2001).

This left manure, which was by far the largest output for intensive livestock farms. Every truckload of manure exported from the farm had to be weighed and sampled by manure transporters with the sample being sent for analysis to an authorised laboratory to establish the mineral content.

As mentioned, Minas was implemented to achieve the environmental goal of the Nitrate Directive. However, the Directive stipulated certain measures that member states were obliged to implement, the main ones being a manure application standard of 170kg N from manure/hectare/year, mandatory codes of good agricultural practice and the designation of nitrate vulnerable zones. Thus, the Nitrate Directive can be defined as a command-and-control regulation as it specified the methods by which the environmental goal should be achieved (Perman *et al.*, 2003). In The Netherlands, the whole country was designated a nitrate vulnerable zone and the mandatory codes of good agricultural practice were also introduced. However, the Minas nutrient loss system was perceived as having a number of advantages over the manure application standard.

Table 1. The Loss standards under MINAS in kg/ha (Adapted from RIVM, 2002).

Year	P Loss Standard		N Loss Standard				
	Arable	Grass	Arable			Grass	
			Clay/peat	Dry sands	other	Clay/peat/other	Dry sands
1998	40	40	175	175	175	300	300
1999	40	40	175	175	175	300	300
2000	35	35	150	150	150	275	275
2001	35	35	150	125	125	250	250
2002	30	25	150	100	110	220	190
2003	20	20	100	60	100	180	140

1.1 The Advantages of the System

According to economic theory, the Minas system was a standards and pricing procedure (Baumol and Oates 1988), which is *theoretically* both practical and cost-effective (Wallart 1999). It is practical because it avoids the not insignificant problem of having to calculate, in monetary terms, the precise damage delivered upon the environment, which is necessary to determine the economically efficient level of pollution reduction (Andersen 1994). An 'arbitrary' pollution reduction standard can be selected instead, the choice of which can be due to various considerations besides economic efficiency, such as one which reflects, to the best of scientific knowledge, a sustainable level of pollution. For nitrates in groundwater the level of 50mg/ltr was selected on the grounds of protecting human health; 50mgN/ltr being the World Health Organisation's guideline for safe drinking water (WHO 2003). The tax then provides the economic incentive for the target group to reduce their pollution. In order to provide an economic incentive, the tax rate has to be higher than the marginal abatement cost of the sector (Tietenberg 2006). The tax level must be set high enough so that it provides an economic incentive for pollution reduction, which is sufficiently strong to achieve the environmental standard. Governing authorities can monitor the effect of the tax by reference to pollution levels and can adjust the rate accordingly, increasing it if need be.

The approach is also theoretically cost effective as it minimises the abatement costs across the sector by allowing individual farmers to decide for themselves what measures are most suitable for tackling the nutrient losses within their operations. Farmers are given an incentive to balance the costs related to the various on-farm measures, against the decrease in nutrient losses and the resulting decrease in taxes to be paid. Farmers will only reduce their nutrient losses up to the point where the tax rate per unit of pollution generated becomes equal to the marginal abatement cost per unit of pollution. Beyond this point it becomes cheaper for the farmer to simply pay the tax rather than continue to abate. Some farmers will have higher abatement costs than others, which means that those farmers for whom it is cheaper to abate will abate more than those who have higher abatement costs, the end result being, assuming that the tax rate is high enough, is that the pollution reduction target is reached by the agricultural sector as a whole.

In contrast, command and control regulations, such as the Nitrate Directive, which set a uniform method for achieving the pollution reduction target for the sector as a whole, in this case the manure application standard, are not generally cost effective (Tietenberg 2006). This is because the application standard does not equalise the marginal abatement costs over all farmers. Every farmer must reduce his application of manure to the level of 170kg N/hectare and this means that, in contrast to the situation with a tax, farmers who have high abatement costs have to abate to the same extent as those with low abatement costs. Therefore, the aggregate cost of achieving the pollution reduction target for the sector as a whole is higher. Indeed, it would have been much higher in the specific case of The Netherlands.

By way of an explanation, the implementation of a uniform application standard of 170 kg N from manure per hectare across The Netherlands would have had a significant impact on certain agricultural sectors. Due to the favourably long growing season for crops and grass in The Netherlands, farmers have been used to applying more than 170 kg N from manure per hectare in order to obtain the optimum crop production per year. Therefore, the imposition of this standard would have reduced the economic productivity of the arable and dairy sectors. Minas, on the other hand, did not directly regulate the amounts of manure applied to the land. Rather, it was the amount of mineral losses that were controlled. Indeed, Minas allowed arable and dairy farmers to apply significantly more nitrogen from manure than the 170kg stipulated under the Nitrate Directive. Accordingly, the Dutch preference for the Minas system can be interpreted as a wish to protect their agricultural sector from a reduction in productivity.

Therefore, Minas appeared to have some distinct advantages over the command and control approach of the Nitrate Directive. The tax element of the Minas system provided flexibility and promoted the most cost-effective measures by providing Dutch farmers with an incentive to implement technologies and management practices that increased nutrient efficiency rather than farmers being forced to comply with the application standard. The nutrient account-

ing element was intended to provide farmers with a management tool allowing them to gain a better understanding of their nutrient use and to see where they could increase efficiency. Furthermore, whereas the Nitrate Directive only focused on the input of nutrients through manure, Minas targeted surpluses, which are in fact the direct cause of pollution. Thus, Minas was more comprehensive as farmers had to be careful with all sources of nutrient inputs and it therefore offered the prospect of a greater environmental benefit.

Therefore, it is easy to understand why the Dutch chose the Minas system as it promised to deliver all the theoretical advantages that economic instruments are supposed to have compared to command and control regulations.

2. Methodology

Despite the perceived advantages of Minas, initial research into the policy during the latter half of 2003 revealed that severe problems had been experienced with the system and it was seriously eroded, in that the functioning of the policy was significantly undermined.

Therefore, the study aimed to identify the problems that occurred with the system, how and why these problems transpired and the manner in which they contributed to the erosion of policy; essentially to explain the failure of Minas.

It was considered that the only way to answer the research questions was to conduct interviews with key personnel within organisations involved with Minas. This was considered necessary due to the exploratory nature of the questions being asked, which ruled out the possibility of obtaining explanations from secondary literature sources. The search for suitable interviewees was guided by the objective of obtaining as broad a perspective on the Minas situation as possible. With this in mind, a research trip to The Netherlands was organised in late 2003 comprising 7 semi-structured face-to-face interviews with the following personnel and their respective organisations.

- A policy advisor in the Minerals and Ammonia department of the Agricultural Directorate, Ministry of Agriculture, Nature and Food Quality (LNV).
- A senior bureaucrat and contact person for The Hague at the Levies Office *(Bureau Heffingen),* the Government's administrative organisation for manure policy.
- The Secretary for Livestock Farming and Environment at LTO Nederland *(Land- en Tuinbouw Organisatie Nederland),* the main Dutch Farmers Union.
- A pig farmer and Vice chairman of the NVV *(Nederlandse Vakbond Varkenshouders),* the Dutch Pig Farmer's Union.
- The director of the DLV Advisory Group, a commercial advisory group. Formerly the Dutch government's Agricultural Extension Service.
- Program leader for Agriculture and Environmental Interactions at Alterra, Wageningen University and Research Centre and part-time professor in Soil Fertility and Nutrient Management.
- A scientific researcher at LEI (Agricultural Economics Institute).

Thus, interviews with representatives from relevant sectors, including the central administration, academia and the agricultural industry were secured. Attempts were also made to interview additional stakeholders linked to Minas including, amongst others, individual farmers. It was considered that this would be useful in order to obtain the very relevant viewpoint and experiences of the 'layman' in order to balance the otherwise expert-orientated interviews. However, due to the short timescale available to organise the interviews it was not possible to arrange interviews with representatives from certain organisations whilst it was only possible to arrange one interview with a farmer.

Despite this it was considered that the scheduled interviews would be sufficient to provide a balanced investigation into the problems occurring with Minas, whilst also broadening understanding of the range of issues involved. As well as the face-to-face interviews, contact was also made with an employee within the Ministry of Spatial Planning, Housing and the Environment (VROM) who agreed to complete an initial questionnaire and subsequently provided opinions and comments on aspects of the study as did an additional employee within the Ministry of Agriculture.

According to Yin (2003), the convergence of two or more sources of information on a given finding

then serves to increase the quality of that finding. Therefore, a conscious attempt was made to verify the data collected during the study. This was done in a number of ways. Whilst the discussion and conclusions drawn rely mainly on the information collected during the interviews, wherever possible this was combined with data from published sources as a means of corroboration. For example, end of year financial reports from the Levies Office provided important data, which supported interviewee statements concerning the increasing administrative cost of the Minas policy. With regards to the empirical research, an attempt was made during the interviews to corroborate data from previous interviews in order to increase the validity of any conclusions made on the basis of the information collected. Furthermore, communication was maintained with the interviewees and contacts in order to acquire their comments on the identified problems, their significance and causes with a view to ensuring that no important explanations etc were overlooked.

2.1 Analytical Framework

An institutional framework of analysis was considered appropriate for the study. This approach takes institutions as the basic unit of explanation and maintains that public policies need to be understood in the light of the specific configuration of institutions and organisations that exist within the political system (Weale 1992). According to Rhodes (1997:65), the institutional approach employs the "techniques of the historian and explores specific events, eras, people and institutions". It was considered that the problems that developed during the implementation phase of the policy could best be explained by an analysis of the contextual setting of Minas and therefore the explanations for the erosion of Minas are framed in this perspective. Thus, the study sought to embed the Minas policy in the Dutch political and socio-economic context of the 1990s examining, for example, such factors as the change in government, the influence of the EU Commission, the onset of recession and economic pressures on the intensive pig sector. It was considered that an understanding of the political and socio-economic context would help to explain the failure of the policy, perhaps highlighting particular factors that acted as external pressures, serving to problematise Minas.

3. Results and Discussion

The subsequent discussion will attempt to explain why a policy, which appeared to be theoretically sound, ended in failure.

4. The Incompatibility of Minas

Firstly the choice of the Minas system was in direct contravention of the mandatory implementation of the application standard under the Nitrate Directive. It appears that the requirements of the directive were interpreted differently in The Netherlands.

The Dutch government had the opinion that member states should be allowed some flexibility in implementation of the directive to take into consideration the differing environmental conditions within member states under the provision that the environmental goal be realised, thus facilitating, although not guaranteeing, the achievement of the target at least cost. Therefore, it was the result, the reduction of nitrates in groundwater to 50mg/litre, which was considered to be the most important part of the directive not the means, the application standard.

The possibility exists that the Dutch government deliberately intended to influence the design of EU policy presenting Minas, along with the theoretical advantages of the approach, as an alternative to the application standard. This is in recognition of the two-level character of regulatory policy-making in the EU and the generally held perception of The Netherlands as being one of the motors of EU environmental policy making (Liefferink and Andersen 2002), seeking on occasion to influence the formulation of European environmental regulations through its own superior national policy, involving a higher level of environmental protection.

However, the European Commission was unconvinced by the argument and was unsatisfied with the Minas system, considering it to be insufficient for protecting groundwater from nutrient pollution and it initiated infringement proceedings against the Dutch government with the European Court of Justice.

The Court judgement was to be based on the status quo on the 6th December 1999 and the legislation enacted until then (ECJ 2003). The preliminary action plan submitted by the Dutch government for

implementing the Directive, of which MINAS was the chief instrument, was deemed insufficient by the European Commission on a number of points. Subsequent proposed changes to the manure legislation did not satisfy the Commission, and legal action was taken against the Dutch government in August 2000. During the course of the court litigations, various changes were made to the manure policy in an effort to bring it in line with the requirements of the Nitrate Directive but these were not taken into consideration.

In 2003 the Court ruled that the Dutch government had "failed to fulfill its obligations under the Directive" (ECJ 2003). In the opinion of the Court, the loss standards under Minas were a means of control which was applied too late in the N cycle. The Nitrate Directive aimed to limit and prevent the pollution of water by N and was therefore focused on prevention i.e. combating pollution at source. The Court decided that this obligation could only be satisfied by using an application standard system. The Netherlands was fined €250 million (Oenema 2004) and ordered to replace Minas in 2006 with a system based on application standards for manure and total N fertilisation on farms in line with the Nitrate Directive. The Court judgement was based on the status quo on the 6th December 1999 and the legislation enacted until then (ECJ 2003).

So the failure of the Minas system can be attributed to the fact that it was incompatible with the mandatory requirements of the Nitrate Directive. If this were not the case then perhaps the policy would have been a success as predicted by economic theory? On the contrary many problems were experienced with Minas, which were so pervasive that at the time of the interviews in late 2003, the policy was seriously eroded (Mallia and Wright 2004). Amongst the problems that were encountered were widespread fraud with farmers exploiting loopholes in the system, refusals to pay taxes amongst farmers, litigation proceedings against the governing authorities, a very low percentage of taxes collected and refunds and exemptions made to farmers (Mallia and Wright 2004: OECD 2006). As an indication of the scale of the problem, in 2002, 11,000 Minas related objections and appeals were received by the levies office (the organisation responsible for the administration of Dutch manure policy), which accounted for 96% of the total (Bureau Heffingen 2002). Under these circumstances then, the judgment of the European Court of Justice represented the final nail in the coffin of a policy that would have been replaced anyway. This information then begs the question, 'what caused the serious erosion of the Minas system?'

5. Dutch Manure Policy: Increasing Stringency and Controversy

The reasons for the erosion of Minas can be partly explained through an analysis of the development of manure policy within The Netherlands. Therefore, this section will briefly focus on the main events that occurred within Dutch manure policy up until the implementation of Minas in 1998.

The conservative Christian Democratic Appeal (CDA) dominated Dutch politics through the majority of the twentieth century. The CDA are recognised for their traditional religious and rural affiliations and agricultural policy was created by a consistent group of actors who enjoyed a cooperative relationship based on consensus of which the Ministry of Agriculture and the farmer's lobby were the main partners. This agricultural policy community shared the objective of the productivist expansion of the agricultural industry (Frouws 1997). As an indication, between the early 1960's and the mid-1980's, the "number of cattle, pigs and poultry increased by 1.5 million (+40%), 10 million (+450%) and 50 million (+125%) respectively" (Frouws 1997:210).

However, by the early 1980's, the seriousness of the manure surplus, and the associated environmental consequences, had become obvious. The agricultural policy community faced increasing pressure to address the problem, as the environment developed into an important political issue, mirrored by the growing influence of the Ministry of the Environment (Frouws 1997). However, the initial stages of manure policy-making were characterised by a conflict of interests between the Ministry of Environment on the one hand and the Ministry of Agriculture, supported by the farmer's lobby on the other, with agricultural interests proving to be the stronger (Frouws 1997). The outcome of this conflict was the successful postponement of effective measures to address pollution resulting from nutrient surpluses (Frouws 1997).

For example, The Interim Law on Limitation of Hog and Poultry Production was enacted in 1984 with the aim of limiting the growth of these particular livestock sectors. It prohibited the start of new livestock farms and the expansion of existing intensive livestock farms (by more than 10%) in the south and southeast regions (Breembroek *et al.* 1996). However, this law did not manage to stop the increase, and the national manure surplus in 1987 was in the region of 16 million metric tonnes (Wossink 2003).

The Soil Protection Act (SPA) and the Fertiliser Law replaced the Interim Law in 1987, with the aim of stabilising the situation. However, this legislation also failed to address the manure problem. The Fertiliser Law regulated the production of manure by setting application standards based on kg of phosphate per hectare. Livestock farms were assigned manure quotas, based on their animal stocks and acreage, and were obliged to maintain a manure book-keeping system, detailing their acreage, land use, number of animals and production of manure. Farms with manure production in excess of the phosphate application standards, termed surplus farms, had to pay a tax on their production of surplus phosphate and were also obliged to provide documents proving that their surplus manure had been removed from the farm (Wossink and Benson 1999:5). However, the phosphate standards adopted ensured that no surplus existed at the time of implementation, in order to safeguard the pig and poultry industry, with the result that "the permissive norms on manure deposit and production led to an increase in livestock during the years" (Bremmers 2000:2).

Whilst the agricultural policy community succeeded in nullifying drastic measures to tackle nutrient pollution in defence of the intensive livestock sector, conflicts began to emerge due to the increasing stringency and restrictiveness of manure policy, which no longer stimulated growth and intensification. Disputes arose between the Ministry of Agriculture and the farmers lobby due to the realisation that the manure problem was greater than anticipated, demanding considerable investments in manure disposal, manure storage and spreading machinery (Frouws 1997).

Furthermore, disputes arose between farmers' leaders and their constituency and within and between farmers' unions due to discontent with the manure regulations. This resulted in frequent failure to legitimise the negotiated policies and to discipline the union membership, illustrated by the setting up of rival action groups (Frouws 1997).

Essentially, the controversy was due to the search for those responsible, and therefore liable to pay, for the pollution (Frouws 1997). The manure issue proved to be a serious obstacle to building consensus between the Ministry of Agriculture and the farmers' lobby and the split between these two traditionally close working partners grew as the Ministry bowed to pressure to accommodate environmental interests, whilst the farmer's lobby continued to support the intensive livestock sector (Frouws 1997). The Ministry of Agriculture gradually broadened its narrow productivist perspective, due to continuous and increasing public and political pressure, and this policy change "implied imposing severe restrictions and financial burdens on agriculture" (Frouws and van Tatenhove 1993:224). For example, between 1987 and 1993, trading in manure rights was only possible by land acquisition and subject to strict terms. The restrictions halted the expansion of existing livestock farms in the South and the East (Wossink 2003). A closely co-operative working relationship developed between the Ministry of Agriculture and the Ministry of Environment with policy formulation becoming "less dependent on the support of the farmers' unions" (Frouws 1997:213). Thus the objective of the productivist expansion of the livestock industry was joined by, what were perceived by agricultural interests, as being conflictual environmental objectives to tackle nutrient pollution from manure.

A mineral accounting system was made the basic principle in the next stage of manure policy in 1993 after an agreement between the Ministry of Agriculture the Ministry of Environment and the Landbouwschap, an organisation which represented the farmers' unions. This was the "final convulsion of neocorporatist policy-making" and was followed by "massive protests by farmers, which forced union leaders to distance themselves from the agreement" (Frouws 1997:216). As a consequence of the competition that existed between the various actors within the agricultural policy network, rival action groups were set up, one result of which was the formation

in 1994 of a radical union of pig farmers; the Nederlandse Vakbond Varkenshouders (NVV).

In 1994, the system of phosphate rights was modified with the rights thereafter being termed 'manure production rights'. The new system was more complex and made a distinction between the different livestock sectors. Quota allocated to pigs and poultry could be used for the production of other animal categories, but the reverse was not possible. The intention was to prevent a further increase in the pig sector, which was "perceived to be the source of the most serious environmental problems" (Wossink 2003:5).

A year later, in an effort to reduce the pig and poultry population, the government cut the pig and poultry quota by 30% with a further 25% cut for the pig sector planned for 1997. This however elicited strong protests from the NVV and the 30% cut was later revoked (Wossink, 2003). Also in 1995, the government presented a new policy approach (Minas) combining mineral accounting with a tax to be launched in 1998. This provoked the farmers' organisations to "protest and attack with renewed vigour" and during the last months of 1995, a nationwide agrarian protest movement took place (Frouws 1997:217).

With the enactment of the Pig Farming Restructuring Act in September 1998, the pig quota was separated from that of poultry, and a generic 25% reduction was imposed on the pig sector: 10% in 1998 and 15% in 2000. The NVV took legal action and in January 2000 the Court declared the first 10% cut as legitimate, whereas the remaining 15% was withdrawn (Wossink 2003).

Finally in 1998, the Minas system became operational, which was viewed by many farmers as being,

"Another piece of centralist bureaucracy, an administrative burden which did not stimulate environmental responsibility and was largely inadequate" (Frouws 1997:219).

This section demonstrates the highly controversial nature of the manure issue. Whereas up until the mid-eighties, the livestock sector had enjoyed support from the government in its productivist expansion this support gradually eroded due to an increasing desire within Dutch society in general, and within government in particular, to address the significant environmental consequences of intensive livestock production. This translated into stringent policy, such as reductions in the pig quota and Minas itself imposing taxes on farmers, both of which met with fierce opposition from farmers' organisations, specifically the NVV. Thus, it becomes apparent that Minas was born amidst an atmosphere of intense conflict. It is considered that this resulted in a delegitimisation of the system even before its implementation. An appreciation of the political context within which Minas was created helps to explain why the policy met with so much opposition during implementation, opposition which played a significant role in the erosion of the system.

6. The Uncertainties Within the System

The RIVM report evaluating the Dutch manure policy for the period 1998-2003 (RIVM 2004) describes Minas as "conceptually well-thought-out", but admits that it involved "too much differentiation and ambivalent numbers" which was unacceptable (RIVM, 2004:12). This corroborates the view that emerged from the interviews; that a major weakness of Minas was the uncertainty involved in determining the true mineral content of the various mineral inputs and outputs on the farm. This was a major cause of policy failure as the result was that farmers could receive unjustified taxes as the erroneous figures meant that their Minas return inaccurately recorded fewer nutrients leaving the farm than had entered. The uncertainty was due to both biases and errors that occurred as a result of the following,

Sampling uncertainty – The slurry sample was obtained whilst siphoning slurry from the storage pit onto a transport truck. A certain amount of error is inevitable given the inhomogeneous nature of slurry and the large volumes involved. Hoeksma *et al.* (1998) found a 16.1% random error for phosphorous, if the sample was taken during loading, and a 7.1% error if taken during unloading. Although random errors should theoretically go to zero over time, if these were large and moreover combined with small systematic deviations, sampling errors could give rise to apparent mineral surpluses on the farm.
The Laboratory Analysis – Manure had to be sent for laboratory analysis to establish its mineral content. The procedure was subject to systematic error in the region of 5%, due to the sedimentation of

phosphorous. However, there were significant variations in the performance of the certified labs. An investigation (Timmerman *et al.* 2002a) which sent a homogenized sample of pig manure to 9 different laboratories established significant variations, up to 26%, in the mineral content calculated.

Mineral sedimentation in the manure storage pit - The slurry on intensive pig farms is collected in a pit, below the stables. The bottom layer of slurry in this pit contains a high concentration of phosphorous, as a result of the sedimentation of this dense compound. This layer was often left in the pit when the manure was removed. This meant that, in these cases, the exported manure contained less phosphorous than the manure which originally entered the pit, and this discrepancy was then assumed to have been lost to the environment on the farm (Timmerman and Smolders 2003).

Mineral Contents in Feed - Another impediment to the farmer's goal of balancing the inputs and outputs in Minas was the accuracy of the measurement of the mineral content in animal feed. Despite the error in calculating the mineral content of dry feed by industrial feed suppliers being small, these small errors were the prevalent source of uncertainty. According to Timmerman *et al.* (2002b), the overall estimated mineral content calculated could deviate from the real content due to the deviations in the raw materials used. This could result in less minerals entering the farm than recorded, leading to a deficit in the mineral balance, interpreted as a mineral loss to the environment.

The Mineral Content in Pigs - Standard norms were utilized for the estimation of the mineral content of animal products. These norms were issued by the government, based on scientific studies. However, Jonbloed and Kemme (2002), found that the norms used were inaccurate as the original mineral norm was based on the tissue and organ composition of the animal, neglecting other mineral outputs associated with the animal during transport off the farm, e.g. droppings made in transit and the stomach contents. The difference in the revised mineral content of the pigs was minimal – about 1g N and 0.4g P2O5per kg/live weight. However, even such small errors could build up when the animal throughput was large. A farmer calculating his mineral output based on the original norms, specifying lower mineral contents for both N and P2O5, appeared to have exported fewer minerals than in reality, thus contributing to a mineral surplus.

7. An Unjust Policy

Errors and biases can have significant effects when they occur in a system that is used as a tax where the discrepancy between the total nutrient input and the total nutrient output (over and above the allowed losses) is subject to a levy. Minas was not a fair system as a farmer who had followed the rules, optimized on-farm efficiency and had legally disposed of the manure produced could still have a large mineral surplus. Such a surplus was a problem for landless farms, chiefly those in the pig and poultry sectors, which could incur unwarranted levies by virtue of having very little land upon which to spread the manure sustainably and thus practically no permitted surplus, which could absorb the errors, in particular with regards to phosphate. For example, the average pig-fattening farm in The Netherlands with approximately 1000 pig places possesses 5.2 ha of agricultural land. Such farmers had to pay to transport their manure off the farm to arable farmers. The uncertainties related to determining the mineral content of manure had significant repercussions on the mineral balance for intensive livestock farms, because manure was such a large mineral output thereby magnifying the inaccuracies and the size of the unjustified levies.

7.1. Contributing Factors

Whilst the occurrence of the unjustified levies was a significant cause of the erosion of Minas other contributing factors were identified which exacerbated the significance of their financial impact. A significant development occurred in 2002 when the Dutch government increased the tax levies substantially and brought forward the date of the implementation of the final levy-free surplus from the original date of 2008 to 2003 by order of the EU Commission who rejected Minas as being sufficient for tackling the nutrient pollution of groundwater; the original tax levels being too low to provide an adequate economic incentive for farmers (Brinkhorst in Ondersteijn 2002). Thus the levies were increased in order to make them prohibitive from the initial level of €0.68 to €2.53 - €5.07 per kg per hectare for N and from €2.6 - €10.4 to €20.60 per kg per ha for P. The new levies represented approximately

5 to 10 times the price of N fertiliser and 50 times the price of P fertiliser, respectively (Oenema and Berentsen 2005).

A further major development of manure policy was also made in 2002 with the implementation of a Manure Transfer Agreement System, or MAO (*Mest Afzet Overeenkomsten*). MAO was introduced in an effort to appease the EU Commission, its aim being to achieve a production ceiling on a national basis, in line with the manure application standard of 170kg N/ha as defined in the Nitrate Directive (MANMF 2001). The policy required livestock farmers to annually calculate the expected manure production of their farm in terms of kg N for the subsequent year. If the farm did not possess sufficient land to dispose of the estimated manure production within the nitrogen application standards under MAO (300/250 kg N/ha grassland, 170 kg N/ha arable land and 210/170 kg N/ha land under maize) the farmer had to provide a guarantee for the disposal of the surplus by entering into a 'manure transfer agreement', or disposal contract, with another farmer. Failure to do so would entail a reduction in the farm's livestock numbers (MANMF 2001). Following the verdict of the EU Court of Justice, the MAO policy was to be abandoned by 1st January 2005, as manure transfer agreements would become redundant with the implementation of crop and soil specific N fertilisation standards (Oenema and Berentsen, 2005).

A study by Ondersteijn (2002:34) found that the fines resulting from the increase in the levies could be as high as over €800 per ha and over €45,000 in total for certain individual farms. The increase in the tax levels magnified the consequences of the uncertainties considerably with some farmers now receiving very large unjustified levies, which were substantial in some cases, ranging up to 150,000 NGL for pig farmers (€ 70,000). The farmers that were adversely affected to some degree constituted approximately 50% of pig producers in The Netherlands. The unfair levies seriously threatened the viability of pig producers.

The effect of the unjustified levies was to trigger wide-spread opposition to Minas. The intensive pig producers were hardest hit as the costs of Minas coincided with a period of deteriorating economic performance (LEI 2000), which was due to a 10% reduction in the pig quota, the outbreak of swine fever, expensive animal welfare requirements and poor market conditions all of which magnified the financial impact of the costs of Minas. The radical Dutch pig farmers union (NVV) commissioned a series of investigations by the Animal Science Group at Wageningen University Research Centre into the suspected uncertainties in Minas (see section, 'The Uncertainties within the System'). The results of the studies were used by a number of farmers with a mineral surplus to dispute the resultant levies, taking the Dutch government to court. Across the agricultural sector, farmers then refused to pay due levies on the basis of the report conclusions and fraud became widespread with farmers exploiting loopholes in Minas as they became accustomed to the system.

8. Increasing Bureaucracy and Administrative Costs

The concrete manifestation of the widespread resistance was a dramatic increase in the administrative burden due to the increasing complexity of the system, as adjustments were made to address various loopholes, and the sheer number of complaints. Over 11,000 MINAS-related objections and appeals were received by the Levies Office in 2002, accounting for 96% of the total (Bureau Heffingen 2002:35). The increasing administrative burden had a dramatic adverse effect on the capacity of the Levies Office to administer the policy. Indeed, the Levies Office was described as, "drowning in paper".

The number of personnel employed at the Levies Office increased significantly subsequent to the implementation of Minas (Figure 2) from approximately 100 in 1996, to 678 in 2001, to cope with the increased workload involved in administering the policy.

The cost of maintaining the policy increased hand-in-hand with the number of personnel. With the implementation of Minas, the cost of the Dutch manure policy was forecast to increase from €12.9 million in 1996 to €24.2 million (Ecotec 2001:18). The administrative cost of the Levies Office alone was expected to be €12.7 million. Although budgetary figures for the first years of Minas were not available, the balance statement of The Levies Office for 2002 shows an expenditure of €52 million, four times the 1998 estimate (Bureau Heffingen 2002). The forecasted budgets of the Levies Office for 2003

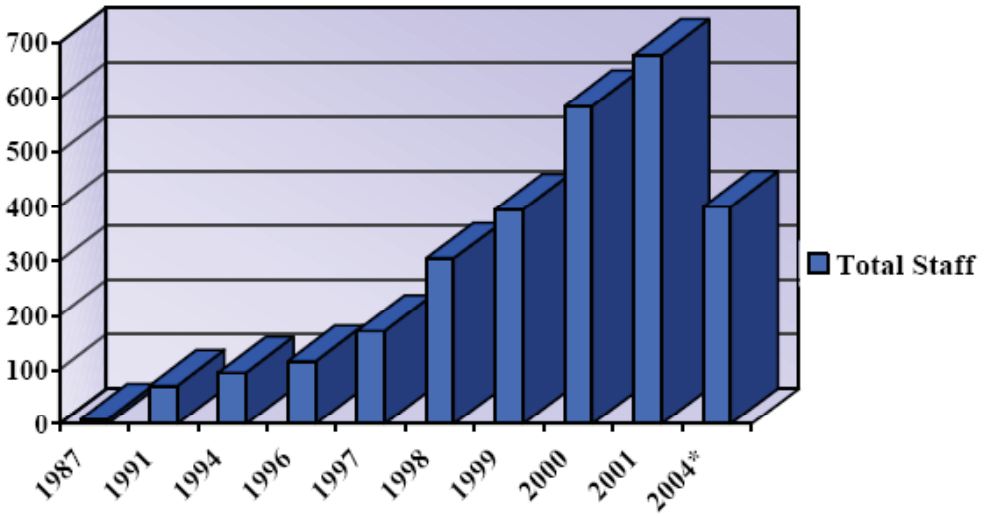

Figure 2. *The number of Staff Employed at the Levies Office. *Estimated figure.*

and 2004 indicate persistently high costs of €48 million and €36 million respectively, of which €28 million (in 2003) and €25 million (in 2004) were for the administration of Minas (Bureau Heffingen 2003). In 2003, Dutch manure policy included 3 instruments; Minas, MAO and the Quota system. The administrative costs of Minas equated to between 60% and 70% of the then current overall costs, and were double the cost of the whole manure policy in 1998. It certainly appears that Minas proved to be more expensive than anticipated. This conclusion is supported by an evaluation report of the manure policy, which admitted that, "The system proved to be costly for the government" (RIVM 2004:11). A report by the OECD (2003) concluded that the Dutch manure policy (Minas) to be both intrusive and costly to administer.

The fact that The Netherlands was going through a period of economic recession and the coming to power of a centre-right coalition government headed by the Christian Democratic Appeal (CDA), which traditionally has had strong ties to the agricultural sector, increased the significance of the problems and costs of Minas. The government downsized the Levies Office in 2004 (Figure 2) with plans to reduce the administrative cost of manure policy by 40%.

In short, the widespread resistance to Minas within the agricultural sector, the increase in the bureaucratic burden and the complexity of the system and the dramatic increase in costs, resulted in the serious erosion of the policy;
"The other very important thing why Minas is going to be dead is that, even if the Commission said ok, it's that the system is becoming more and more complex… there's too many (sic) checking, there are too many variabilities in the system, too many points to criticise the whole system…It's now over. It's now finished, I think… now more farmers are against it, then you can stop." (Oele 2003, pers. comm.).

Table 2 provides a timeline of the various events that occurred in the development of Minas.

9. Why Sample Manure?

Given the uncertainties involved with manure sampling and analysis, not to mention the cost and labour-intensive aspects of weighing and sampling each and every truckload of manure, the decision to adopt such a system may seem incomprehensible. However, the decision was based on the variability in the composition of manure and the concern that significant errors would ensue if average standard figures for the nutrient composition of manure were utilised instead (Derikx *et al.* 1997).
For example, the use of multi-stage feeding can reduce N and P emissions by 3 – 11% (Den Ouden *cited in* Wossink and Benson 1999), whilst water management on the farm will also influence the volumes of slurry produced and the dilution factor of the outgoing nutrients (Derikx *et al.* 1997). A study by Derikx *et al.* (1997), based on sampling manure, provides an indication of the level of variation that can be present in the composition of manure. 68% of the samples taken varied by up to 47% away from

Table 2. Timeline of Significant Events, Introduction of Legislation and Status of Minas.

Year	Event/Legislation/Status
1984	Interim Law on Limitation of Hog and Poultry Production. Prohibits start of new livestock farms and expansion of existing intensive livestock farms (by more than 10%) in the south and southeast regions.
1987	Soil Protection Act and Fertiliser Law. Fertiliser Law - application standards based on kg of phosphate (as P2O5) per hectare.
1991	Introduction of the EU Nitrate Directive, system of application standards. Target 50mg N/litre groundwater.
1993	A mineral accounting system is made the basic principle in next stage of manure policy. Followed by massive protests by farmers.
1994	NVV (the radical Dutch pig farmers union) founded System of manure production rights introduced to prevent further increase in pig sector
1995	Reduction in the pig and poultry quota by 30% with a further 25% for the pig sector planned for 1997. Strong protests follow from the NVV and the 30% cut is later revoked. Government presents new policy approach (Minas) combining mineral accounting with a tax to be launched in 1998. Nationwide agrarian protest movement takes place during last months of 1995. Dutch submit first action plan for Nitrate Directive to EU Commission
1997	Start of swine fever epidemic (Feb 97 – March 98) Dutch revised action plan for implementing the Nitrate Directive submitted to EU Commission (December)
1998	Minas system of loss standards connected with a tax implemented on farms with at least 2.5 livestock units per hectare Complete action programme submitted to EU Commission (July). Commission takes view that action plan insufficient The Pig Farming Restructuring Act. Pig quota is separated from that of poultry. A generic 25% reduction imposed on pig sector: 10% in 1998 and 15% in 2000. NVV takes legal action against cuts.
2000	First 10% cut in quota judged legitimate, remaining 15% is withdrawn. Commission starts court proceedings against the Dutch government NVV Commissions studies on Minas from the Animal Science Group
2001	MINAS extended to all farms
2002	Animal Science Group reports published. Results reveal Minas to be an unjust system seriously undermining its legitimacy. Date when the levy-free surplus should be achieved brought forward from 2008 to 2003 and taxes under Minas significantly increased from €0.68 to €2.53 - €5.07 per kg per hectare for N and from €2.6 - €10.4 to €20.60 per kg per ha for P Significance of unjustified levies increases (up to €70,000) Implementation of MAO policy New CDA government comes to power with traditional links to agriculture.

2003	The Minas policy is seriously eroded. Farmers refusing to pay levies and exploiting loopholes. Administrative costs escalating. Government plans to reduce cost of manure policy by 40%. The European Court of Justice rules that the Nitrate Directive requires application standards, not loss standards and orders the Dutch government to replace Minas at the start of 2006. The Dutch government is fined €250 million for the infringement (October). The Dutch submit 3rd action plan for Nitrate Directive including application standards system
2005	MAO policy abandoned
2006	Minas replaced by an 'application standards system' setting a limit on the total usage of fertilisers and animal manure for both N and P.

a mean value of 1.5g P/kg, and the remaining 32% of the samples diverged by an even greater extent. The high level of variation between the slurry on one pig farm to the other indicates that the use of average values for estimating the mineral output in manure would inevitably have lead to "gross errors" that would result in either the over-estimation of the mineral surplus, leading to incorrectly high taxes, or in an under-estimation, which would give rise to "undesirable environmental risks" (Derikx *et al.* 1997:77), stemming from excessive nutrient application by arable farmers. This is why the use of standard figures for the nutrient content of manure was ruled out as a basis for the mineral accounting system. However, in retrospect, significant errors also ensued when using sampling and analysis as a basis for estimation.

In light of the reputation of The Netherlands as being at the forefront in the creation of environmental policy in the European Union, it appears anomalous that a system that contained so many significant inaccuracies came to be implemented in the first place. Apparently there was a certain bias during the policy conceptualisation phase in that the focus of researchers was predominantly on the effects the policy would have on the dairy sector whilst a thorough investigation into its effects on the intensive livestock sector was neglected, despite their being an awareness of the inaccuracies and, therefore, their potential consequences were not appreciated. This may be attributable to the fact that nutrient accounting had been shown to be effective in making dairy farmers aware of their nutrient use and to have the potential to stimulate win-win situations. Indeed, win-win situations were realised within the dairy sector as some farmers could achieve the levy-free surplus by increasing their nutrient use efficiency, thereby saving money whilst reducing their environmental impact (Wright and Mallia 2003).

10. Conclusion

Whilst it is easy to understand the reasons behind the choice of Minas it seems that two errors of judgment occurred, which were to have significant results.
The first error of judgment was on the behalf of the Dutch government in its implementation of the Nitrate Directive in that it misinterpreted the mandatory nature of the measures stipulated. It appears that the Dutch government thought that it would be possible to avoid implementation of the manure application standard by persuading the European Commission that their flexible approach, whereby the manner in which member states achieve environmental targets is left open, was superior for the reasons discussed above. Of course, the actions of the Dutch government amounted to non-compliance and therefore the ruling of the European Court of Justice was inevitable. Nevertheless, it is interesting to note that member states are given flexibility in the selection of measures to achieve the environmental target of good ecological status in the new Water Framework Directive (2000/60/EC), something which echoes the earlier Dutch argument. Perhaps then in this respect the problem was that the Dutch were just ahead of their time.

The key causal factor in the erosion of Minas and the second error of judgement was the fact that researchers overlooked the significance of the inaccuracies in the system for intensive livestock producers. This meant that the opportunity to implement an alternative policy was missed and once Minas

was in operation the erosion of the policy was inevitable and gained a momentum of its own due to the unjustified levies and aggravated by a series of events and external pressures. The unfairness of Minas, coupled with the large increase in the tax levels were the two crucial factors, which fuelled the widespread resistance. Even if the Minas system had been acceptable to the EU Commission, the policy became so seriously eroded that it would have been replaced anyway.

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