WHY ARE FARMERS GOING MULTIFUNCTIONAL?

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Abstract

The European farm model is aimed at stimulating and facilitating multifunctional agriculture. This paper presents the results of research into the factors determining the adoption of multifunctional activities. In the paper survey results from 495 farms, spread all over the Netherlands, were used. Binomial logit models were estimated for multifunctional activities in general and four specific activities. Trust in the government is an important explaining factor for participation in nature conservation and recreation, however, less important for services and selling products. Location of the farm is important for nature conservation, services, and recreation. Attitude variables are particularly important for participation in nature conservation and day and stay recreation.

Keywords: multifunctionality, land use, agricultural policy
JEL classification: G18 Government and policy regulation

1. Introduction[1]

Agriculture in the European Union is experiencing a phase of transition. The traditional agricultural policy, with its focus on price support, is to an increasing extent being replaced by a system of lowered price support and compensating direct income payments. Due to pressure from the World Trade Organization (WTO) there is a tendency to decouple these direct payments (as seen in the Luxembourg Agreement). These payments are also used to realize environmental, wildlife and landscape objectives. Developments in other sectors in the economy, such as higher incomes, more free time and higher mobility, have led to an increase in the demand for wildlife, landscape, leisure and outdoor recreation. Alongside the traditional agricultural model, oriented on the production of marketable and cheap food, a new paradigm has arisen in which agriculture contributes to a number of other functions of land use. These changes imply not only a change in policy, but also a change in the institutional environment. The rules of the game for the agricultural sector are changing, and the agricultural sector must adapt in order to meet these new challenges.

Multifunctional land use and multiple value creation can create new challenges. How should the CAP be adjusted to effectively guide farming in the new direction? Are the recent adjustments in agricultural policy effective in stimulating farmers to go multifunctional? What factors motivate farmers to adopt multifunctional activities? Which activities are chosen and for what reasons? This paper is focused on two main questions. (1) Why do farmers participate in multifunctional activities and what types do they prefer? (2) What is the relation between undertaking multifunctional activities and the attitude of the farmer towards farming?

The paper is organized as follows. In Section 2 we give an overview of the body of economic theory regarding good characteristics, we outline the theoretical conceptual framework and the utility maximization model of farmer behaviour used in the paper and provide a brief overview of the findings in the literature regarding participation in multifunctional agriculture. Section 3 presents the empirical model and the data used. Section 4 covers the generation of explanatory variables and includes the results of the factor analysis of farmer attitudes. The estimation results of the explanatory logit models are presented and discussed in Section 5. Finally, the paper closes with a concluding section.

[1] The authors thank Natasha Longworth for her help in the writing and editing of this text.

2. Multifunctional land use

Characteristics of goods or attributes of multifunctional agriculture

Multifunctionality in agriculture is directly, although not exclusively, linked to the different functions agricultural land can fulfil. Agricultural land is optimally allocated if it fulfils the mixture of functions demanded by society. Societal demands are not constant, but are influenced by a large number of factors including changes in income level and population density, productivity induced relative price changes, etc. The functions that agricultural land can fulfil include traditional production functions, an ecological function, a cultural function and a recreation function. Multifunctional agriculture can simultaneously fulfil different combinations of these functions. The various goods and services produced by agriculture can be marketable (food, raw materials, ornamental plants etc.) or non-marketable (nature and landscape). These marketable and non-marketable goods can also be seen as diverse attributes of land-use. Often these attributes are by-products of the type of land-use or the result of joint production. A classification of goods or attributes of multifunctional agriculture based on the concepts of rivalry and excludability, with four 'ideal' combinations is the following: pure public goods (non-exclusive, non-rival), common goods (non-exclusive, rival), impure public goods (exclusive, non-rival) and private goods (exclusive, rival) (see Jongeneel and Slangen, 2004 for a more detailed discussion).

Based on the properties of non-rivalry and non-excludability we can investigate which governance structure is suitable for which type of good. Governance structures are concerned with how decisions about transactions are made, i.e. the exercise of authority, guidance and control, and with the allocation of income rights (cf. Hendrikse, 2003: 243). We consider here four types of governance structures: market, in-house production of the government, or hybrids such as contracts, and clubs or environmental cooperatives (cf. Slangen and Polman, 2002: 70-77). Direct government provision (*in-house* production) is the preferred structure for the provision of pure public goods. For pure individual goods the market is the preferred governance structure. For the provision of common goods and impure public goods other institutional arrangements are appropriate where:

a) Private firms/farms offer these goods and the government contributes in the financing. The financing can consist of giving a subsidy on the basis of a simple contract, a reward on the basis of delivered achievements within a contractual relationship between the government and a private firm/ farm, or a contractual agreement within a public- private partnership project[1].
b) Goods are offered by a 'club'[2]. For example, in the Netherlands wildlife and landscape is provided by nature conservation organizations, environmental cooperatives of farmers, etc.

A relatively new body of theory provides considerable insight into the problems involved in contracts, termed the "new property rights approach" (Foss and Foss, 2001:21) or incomplete contract theory. Incomplete contracts are contracts that do not take into account all future contingencies, because of incomplete foresight of what the future will bring. The incompleteness of the contracts results in a number of economic implications (hidden information, hidden actions). Hidden information is an *ex ante* information problem, which can lead to adverse selection. In the case of membership of an environmental co-operative, the board of an environmental co-operative does not know if one of the (potential) members possesses private information which, if known to the environmental co-operative, would influence the attitude and conduct of the board. A way to reduce the problem of hidden information is making use of screening or self-selection conditions.

Hidden actions is an *ex post* phenomenon. Time inconsistency of the government is also a form of hidden action. The problem of hidden actions from the viewpoint of the contract giver could be resolved by monitoring and incentive contracts and from the viewpoint of the contract taker by long term contracts. An alternative solution would be to require posting of bonds to guarantee performance, to be paid back if the performance is satisfactory or if targets are reached. Using such solutions may still lead to incomplete contracts, but some self-enforcing elements will be incorporated. In homogeneous groups the incidence of hidden action can be reduced by common norms and values (CPB, 1997: 74).

In incomplete contract theory, the possession of residual control rights is virtually taken to be the definition of ownership (Hart, 1995: 30). In many cases, the holder of residual control rights will, to a

large extent, also have the residual income rights. This is particularly important for incomplete contracts. When a contract is incomplete, not all the costs and benefits of certain events will be specified. This leads to the question: who will bear the costs of the not-specified events and who will appropriate the benefits?

These problems make farmers vulnerable and can raise reservations about carrying out transactions for nature and landscape management and recreation. Important in this context is the phenomenon of time inconsistency (Kydland and Prescott, 1977: 474 -475). Time inconsistency refers to a government's propensity to modify policy or the rules of the game of the institutional environment, and people's awareness of the likelihood and implications of this. It implies that for the completion of contracts with the government, a high level of trust in the reliability of the government must exist.

To overcome the problems of incomplete contracts it is important to consider non-contractual elements, such as trust, shared norms (social beliefs), and social networks. Collectively, these are referred to as 'social capital'. Social capital is "the shared knowledge, understandings, norms, rules, and expectations about patterns of interactions that groups of individuals bring to a recurrent activity" (Ostrom 2000: 176). Trust is perhaps the most important component of social capital. If one's confidence in an enforcement agency falters, one does not trust people to fulfil their agreements and agreements are not entered into. There is an element of trust in any transaction where one has to make a decision before being able to observe the action of the other party to the transaction. Trust is the catalyst that makes an economy function efficiently. In addition to trust, other elements of social capital include social norms, or behavioural strategies (always do *p* if *q* occurs) subscribed to by everyone in a society, and networks of civic engagement (membership in swim clubs, church organizations, etc.) that enhance cooperation. In our analysis of the factors underlying participation in multifunctional activities, we hypothesize that higher participation in societal activities, such as being an active member of agricultural or non-agricultural organizations will increase the likelihood of multifunctional activities (cf. Beugelsdijk, 2003: 60-61).

Theoretical model

In this paper a framework is developed to analyze (a) general farming attitudes; (b) farm characteristics (location, size, etc.); (c) individual farmer characteristics (age, education); and (d) level of social capital as factors explaining involvement in multifunctional activities, taken into account the type of the goods or services arising out of the fulfilment of functions of cultivable land. This conceptual framework is presented in Figure 1. The level of social capital is depicted in block A which influences the individual farmer's characteristics and general farming attitudes in block B. Blocks A and B can be seen as internal factors influencing the farmer's decision. Block C depicts the farmer decision-making process; the outcomes of which are input and output allocations. The theoretical model developed further in this section focuses on this process. Block D represents external factors that also influence the decision. Aspects of the governance structures of markets (prices etc.) and contracts/clubs (compensation, time-inconsistency of government etc.) influence the farmer's decision. As discussed in section 2.1 the type of governance structure is suggested by a typology of good characteristics.

The analytical framework chosen for analyzing the decision-making behaviour of the farmer is a farm household model. In this model the household members undertake actions and make choices to maximize the household's expected utility (Sadoulet and de Janvry, 1995:116). Farm households are assumed to not only maximize a single variable like profits, but also take into account their preferences for certain types of farm and labour activities as well as social interactions. Social interaction is defined as participating in a social network, so that higher levels of network participation can be labelled as a higher level of social capital. The expected utility function approach makes it possible to introduce farmer's attitudes, trust in the government, social capital and education level as explicit factors in explaining participation in multifunctional activities (see Drake *et al*., 1999; Dupraz *et al*., 2000 and Vanslembrouck *et al*., 2002).

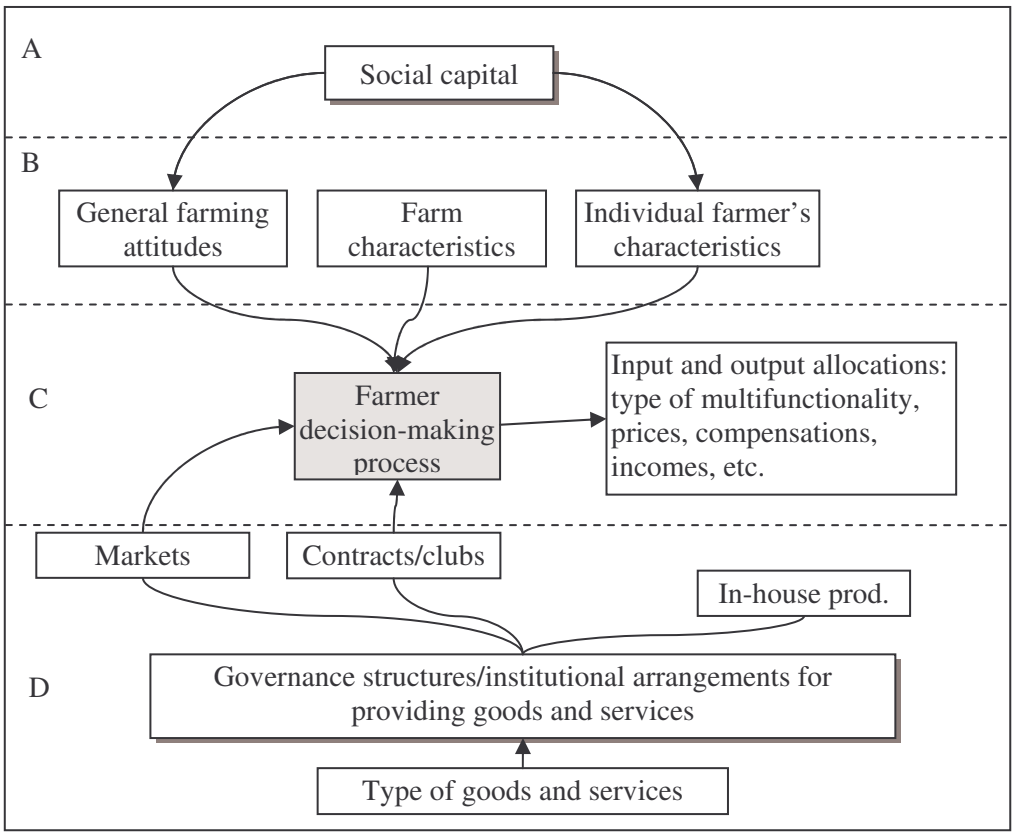

Figure 1. Framework for explaining type of multifunctionality

Assume that the farm household maximises an expected utility function *U(.)* dependant on a composite consumption good, leisure, a vector of farm and non-farm activities (denoting the utility derived from these activities), full income and a vector of farm household characteristics. The vector of farm and non-farm activities accounts for the possibility that certain activities generate a positive (or negative) psychic income. For example, producing impure public goods (e.g. preserving wildlife) can increase the utility of the farm household via positive psychic income as well as by income compensation. Full income is assumed to be directly included in the utility function to account for risk aversion (*U(.)* is a concave function in full income). Since the different activities experience different degrees of risk and uncertainty, by adjusting the activity mix the household can influence the variability of full income (e.g. increasing the share of off-farm employment probably creates a more stable stream of income than producing a speculative arable crop, which faces both a price and quantity risk).

The household has to take into account two constraints. The first constraint is the budget constraint, which states that the money spent on the consumption good should be less or equal to the money earned with productive activities. The latter include the production of (traditional) agricultural commodity outputs (food and fibre), the production of (multifunctional) private good outputs (green services), the production of impure public goods and off-farm employment. The aggregated net-revenue of these activities is the total amount of money available for consumption. Investment and the possibility of borrowing are ignored for the sake of convenience.

The second constraint the household faces is a time constraint. The time spent on the on-farm activities, off-farm employment, and leisure should be no more that the total time that is available to the household. As is often done in household models, the two constraints can be combined into one so-called full-income constraint (Deaton and Muellbauer, 1983: 88). According to this constraint the money spent on the consumption good plus the money spent on leisure (opportunity cost of labour times the amount of leisure time consumed) should be less or equal to full income. Full income is equal to the profits earned with all on-farm activities plus the monetary value of the total time endowment (total time available by the household multiplied by the opportunity costs of labour).

The farm household's problem is to choose the level of variable input and the allocation of labour time so as to maximize utility. Solving this optimization problem yields consumption and leisure demands, labour supplies, output supplies, and variable input and factor demands. These netputs are all are a function of the output prices for traditional agricultural outputs, the multifunctional private good outputs and the remuneration for the produced impure public goods, the prices for all the variable inputs used in the production process, the opportunity cost of labour (off-farm employment wage), the total time endowment and a vector of household characteristics (a more formal derivation of this model is available from the authors upon request).

From this framework it can be derived that the allocation of traditional commodity outputs, multifunctional private good outputs (green services) and impure public goods will depend on:

1. the product prices for the traditional agricultural commodity outputs (depending on whether they are substitutes, a decline in the price for traditional agricultural outputs is likely to increase the amount of multifunctional private goods outputs);
2. the willingness to pay for multifunctional private goods output (green services). An increase in its price will increase its supply, ceteris paribus);
3. the compensation for management of impure public goods (increase in compensation will lead to an increase in the production of impure public goods)
4. the contract specification for the impure public good or non-commodity output. The remuneration scheme for impure public goods can be complex and highly non-linear in the output level of impure public goods*;*
5. the farmer's utility derived from pursuing certain activities (an intrinsic valuation of nature preservation is likely to positively influence the uptake of nature conservation, or a household which enjoys working with other people is likely to become involved in providing recreational services);
6. the form of the production possibility curve, or more precisely the production technologies for traditional outputs, green service outputs, and non-commodity outputs, viz. the production technologies associated with agricultural outputs, multifunctional private good outputs and impure public good outputs;
7. the required inputs or efforts to manage the impure public goods, or to produce green services and traditional commodity outputs;
8. the farmers preferences towards full income (risk attitude);
9. attitudes towards activities (which make them generating a kind of psychic income or costs); and
10. a vector of household characteristics including variables such as household composition, age structure, education level, trust in governance structures and contract partners, etc.

It is worthwhile to emphasize that the 'risk considerations' relevant with respect to multifunctional activities go beyond their impact on the full income variable. As an example, if the government often changes the contract requirements (time-inconsistent government behaviour) with respect to the impure public good, it will be seen as an unreliable partner and households are likely to stay rather independent of the government (Slangen, 1997: 516-517). If income support through compensatory payments results in a reduction of uncertainty regarding farmer income, because they become less dependent on the market, this may have a positive influence. However, in most cases shifting to other production practices increases uncertainty (lock-in-effect due to investments made). This is the case for prices in innovative joint commodity markets or for long term perspectives on compensatory payment arrangements. If there is a danger that contracts will not be renewed or that voluntary measures will become compulsory in the future, farmers will hesitate to change practices. As an additional factor influencing the equilibrium between commodity outputs, green services and impure public, the risks involved in these activities and/or the trust in parties involved in the contractual agreements can therefore be mentioned.

Existing literature

Most of literature in the area of multifunctionality focuses on environmental measures only (e.g. Bonnieux *et al*., 1998; Vanslembrouck *et al*., 2002; Mathijs, 2003). For their conceptual model of the willingness to participate in environmental measures Vanslembrouck *et al*. (2002) distinguish

between: (1) product characteristics (required changes in practices and their effects on costs and benefits); (2) market characteristics (consumers' demand for agricultural goods and environmental goods respectively). However, multifunctionality is much broader than environmental measures alone. Translating the elements in the literature relating to environmental measures to other multifunctional activities is not trivial, since the characteristics of goods and governance structures and the role of the government are different for different activities. Our approach uses a more extended concept of multifunctionality, but includes some elements from the existing literature regarding farm enterprise characteristics and individual farmer characteristics. For this reason we give a short overview of the findings in this literature.

Bonnieux *et al*. (1998), Vanslembrouck, *et al*. (2002), and Mathijs (2003) found that younger farmers are more likely to enter into agri-environmental schemes. Bonnieux *et al*. (1998) and Mathijs (2003) did not find a positive effect for farm size. In contrast, Drake *et al*. (1999) found a positive influence of farm size on participation. They provided several explanations such as economies of scale and savings on transaction costs. Higher agricultural education and education in general often have a positive effect for entering agri-environmental schemes (Vanslembrouck, *et al*. 2002); Bonnieux *et al*. (1998) found that formal education above the level of junior school decreased the likelihood of participation in agri-environmental schemes. Succession perspectives are also often believed to have a positive effect on participation in countryside stewardship schemes. Mathijs (2003) takes general farming attitude or farming style explicitly into account. Others focus on the attitude towards the environment as an explanatory factor (Morris and Potter, 1995; Drake *et al*., 1999; Wynn *et al*., 2001).

Based on estimates from the LEI (2004b: 36) it appears that in the Netherlands about 16 per cent of dairy farms and 20 per cent of arable farms participate in multifunctional activities. For intensive livestock farms the participation rate is much lower. This could be because intensive livestock farmers desire to keep people from their farmyard because of the possible spreading of infectious diseases. In terms of participation in multifunctional activities, there is a strong distinction between land-based types of agriculture (dairy, arable farming) and 'factory farming' (intensive livestock, horticulture); this distinction is even more obvious when the multifunctional activity 'sales at the farm' is excluded. There is some evidence that the farmer's uptake of societal activities, being an active member of agricultural or non-agricultural organizations - i.e. the level of social capital - will increase the likelihood of the uptake or presence of multifunctional activities (cf. Beugelsdijk, 2003: 60-61 and Mathijs, 2003). Several studies found that location matters in multifunctionality. Because of the expanding urbanization in the west of the Netherlands, we expect that farmers in this region are more likely to have multifunctional activities.

3. Data and empirical model

Based on the implications from the utility maximization model in Section 2 and the existing literature, a set of variables was developed that were thought to be relevant to the choice of multifunctionality on farms. A survey was used to obtain information regarding the relevant variables. The sampling strategy used was a random sampling among all farms in the Netherlands, with the exception of glasshouse growers. The sample consisted of 2595 farms. A questionnaire was developed and pre-tested by experts in the field of multifunctionality and by individual farmers. After pre-testing the questionnaire was adapted. The highly structured questionnaire prevented deviations from the central research questions. The mail survey was one of the first and most intensive surveys concerning side activities on farms across the whole of the Netherlands. After about three weeks, all farmers to whom a questionnaire had been sent received a reminder letter. In total, 596 out of 2595 Dutch farmers sent back the filled-in questionnaire; a response rate of almost 25 per cent. After incomplete questionnaires were discarded, a sample of 508 farmers remained.

The survey was structured as follows. A first set of questions was asked to clarify the farm type (crop and animal activities) and location of the farm. A second set of questions asked about the farm's participation in multifunctional activities: stay and day recreation, producing 'local origin' products, selling at farm, nature conservation, care-activities, and others. A third group of questions concerned off-farm activities and off-farm employment. Fourthly, questions were asked about the (land)

ownership structure of the farm area. A fifth set of questions asked about the income earned at the farm. This was then followed by a number of questions about the farmer's attitude towards risk. Thereafter a block of questions were asked in order to obtain a more general idea about the farmer's attitudes, by asking his or her opinion on 31 statements, which were judged to be informative in signalling farmer attitude. Finally, a number of questions were asked about the age structure of the farm household, their education level, time allocation, continuation of the farm (succession) and the farmer's trust in the government[3].

Table 1 provides an overview of a number of important characteristics of farms in the sample. From a closer examination of farm type and farm scale (number of hectares) it appears that the sample averages do not correspond to the national averages. As such the sample might not be fully representative.

Table 1. Sample characteristics

		Sample		% share
Number of farms		508	a	
Type of farm	Dairy farming	181		36 %
	Arable farming	75		15 %
	Other (including combinations)	252		49 %
Average farm size (ha)	Dairy farming	(47)		25.43*
	Arable farming	(119)	b	158.76*
	Other (including combinations)	(46)		59.90*
Number of farms with multifunctional activities		147		29 %
Multifunctional activities**	Selling agricultural products at the farm	40		
	Nature conservation	40		
	Services in agriculture, production and trade	48		
	Day and stay recreation	24		
Number of farms with a farmer having an outside job		90		18 %
Income (weighted average) of all the farms in sample (in €'s)		34,174		
		Percentage		Std. dev
% share of income from multifunctional activities in total income (multifunctional farms only)		23.10 %		26.80*
% share of income from multifunctional activities in total income for all farms (including farms with no multifunctional activities)		12.50 %		23.90*

a Estimations were based on a sample of 495 estimations, due to non-response for some questions.
b The sample contains one farm with a size of 1300 ha. Without this observation, the average size for arable farms is 103 ha.
* Figures reported are standard deviations, not percentage shares
** More than one multifunctional activity possible at the farm

The relative shares of dairy farms and arable farms at national level are about 27 per cent and 15 per cent respectively (calculation based on LEI, 2004a). The sample share is consistent with the national share for arable farms but dairy farms are overrepresented in the survey sample. The corresponding (national) average number of hectares of these farm types are estimated to be 39 hectare for dairy farms and 54 hectare for arable farms (idem LEI, 2004a). The farms present in the sample are relatively large farms.

About 30 per cent of the farms in the sample have multifunctional activities, and about 20 per cent of the farmers have a job outside the farm. For farms with multifunctional activities about 23 per cent of the total income is obtained from multifunctional activities. Table 1 also provides further insight into the types of the multifunctional activities. Frequently farms participate simultaneously in more than one multifunctional activity. The income estimates presented in Table 1 are not calculated, but were directly asked. The same holds for the share of multifunctional activities in total income.

The answers to the survey questions are analyzed in a two-step procedure. Firstly, a factor analysis is applied to the answers given to the attitude statements. This allows us to reduce the information given by more than thirty questions into four attitude-characteristics. Secondly, binomial logit

regressions are estimated, which explain the participation in a certain multifunctional activity as a function of the four attitude-variables and a number of other variables, including location, farm scale, off-farm employment, etc.

4. Generating the explanatory variables

Based on the findings in the literature and the theoretical framework, a set of explanatory variables was chosen. These were variables reflecting farmer attitudes and social capital, farmer characteristics as suggested by the literature (age, education etc.) and farm characteristics (size, specialization, location etc.)

Farmer attitude factors

A host of questions about attitude were asked to farmers. In order to single out a limited number of attitudinal characteristics factor analysis was applied to these questions. This technique, which can be considered as a kind of data-reduction, makes it possible to measure the answers given to the original questions on a limited number of 'new dimensions'. These 'new dimensions' can subsequently be interpreted as common denominators reflecting shared underlying factors. The basic idea in factor analysis is that from a set of N variables (answers to specific survey questions) a set of N correlated descriptors (principle components) can be described. Each principal component is a suitable linear combination of the original variables. The first principal component accounts for the maximum variance in the original set of survey questions, the second is uncorrelated with the first and has the second largest variance and so on. Only those components with variances above a critical level are retained, thus reducing the original data set to a few variables (see Wichern and Johnson, 2002).

A rotated factor analysis was carried out on the data concerning the attitude of farmers using the STATA/SE-package (2003). The Kaiser (1960) criterion was used for selecting the number of underlying M factors or principal components explaining the data. As a consequence, only factors with eigenvalues larger than 2 were retained in the analysis. From the factor analysis on the attitude of farmers, we retained four orthogonal factors reflecting independent reasons to explain the farmer's choice for multifunctional agriculture. The eigenvalues can be used to evaluate the explanatory power of the extracted factors (see Table 3).

Collectively these factors accounted for 33 per cent of the variance. This indicates that the answers given provide a somewhat dispersed picture, which cannot be comprised in one or two underlying attitude-characteristics. After a varimax rotation and inspection of the pattern of factor loadings, the four factors were labeled as 'farmership', 'land (ownership)', 'trust' and 'expansion drive', respectively.

Detailed results are provided in Table 2. In the cell of the first column and seventh row there is a value of 0.705, which represents the correlation between the seventh variable and the first factor. The factor loading of 0.705 indicates that the seventh variable is strongly correlated with the first factor. So for a farmer who has a positive attitude towards farmership, the issue of being free and independent is relevant. Moreover, the positive sign (0.705) indicates that in principle there is a (significant) positive relation between the answer given on the seventh question and the 'farmership' attitude. A farmer who finds 'being free and independent' very important (and who would have marked the eighth question with a '5') will typically be a 'farmership' type of farmer. This seems plausible. Farmers who enjoy the life of a farmer will find aspects of freedom and independence an important part of farming life. For each selected factor, indicators (original variables) with factor loadings of (-)0.60 or more are included (see numbers printed in bold). The factors showing high loadings (high correlation) are the most interesting (and influential) ones. Questions which had a factor loading smaller than (-)0.60 on all of the four factors were not included.

The first factor is a measure for the attitude to 'farmership'. Variables with high loadings include the statements that 'being free and independent' and 'being your own boss' are important aspects of farmer life. The first factor also scores highly on the statements 'being proud of the farmers' profession' and 'enjoy farmer life'. All of these variables reflect the special characteristics of freedom and independence which represent 'farmership'.

Table 2. Four aspects of the attitude of farmers

	Component			
	Farmership	Land (ownership)	Trust	Expansion drive
A farmer without land is not a farmer	0.073	**-0.614**	0.015	0.041
Without land I don't feel like a farmer	0.050	**-0.670**	0.060	0.108
Land ownership will yield to higher earnings	0.001	**-0.605**	0.031	0.080
To master your own land	0.304	**-0.635**	-0.073	0.006
Striving for a larger farm/holding	0.099	-0.148	-0.072	**0.645**
Desire for business growth	0.128	0.038	0.010	**0.620**
Being free and independent	**0.705**	-0.185	-0.114	0.018
Being your own boss	**0.736**	-0.222	-0.152	-0.018
Enjoy farmer life	**0.734**	0.082	0.089	0.037
Being proud of the farmer's profession	**0.648**	0.112	0.052	0.176
Trust in the local government	0.029	-0.005	**0.710**	0.016
Trust in the national government	0.068	-0.045	**0.776**	-0.044
Trust in the EU government	-0.153	-0.028	**0.707**	0.051
Eigenvalue	4.708	3.126	2.671	2.061

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
A rotation converged in 6 iterations.

The second factor is a measure for the attitude towards 'land ownership'. Variables with significant loadings (correlations) include the statements that 'a farmer without land is not a farmer' and 'without land I don't feel like a farmer'. Also the variable concerning the statement that 'land ownership will yield to higher earnings' has a significant loading. Finally the desire of farmer's to 'master their own land' has a significant loading as well. All of the factor loadings concerning land ownership are negative. Because high values to the questions underlying this factor mean that the respondents don't find the statements very important, the scores on the factor land ownership have to be interpreted the other way around. In other words, farmers who find of all of these four aspects important will have a low (or negative) score on the factor land ownership.

The third factor is labelled as 'trust' of farmers. Variables heavily loading on this factor are 'trust in the local government', 'trust in the national government' and 'trust in the EU government'. The fourth and last factor, labelled as 'expansion drive', is interpreted as a measure of the farmer's desire to expand his farm. It includes the statements 'desire for business growth' (*viz* increasing earning capacity) and 'striving for a larger farm/holding'.

The results of this analysis show that farmers can be characterized by four attitudinal characteristics: farmership, land ownership, trust and expansion drive. The ranking of the factors followed the magnitude of the associated eigenvalues, reflecting their relative power to explain the variance in the sample. So far this analysis could suffice to create a kind of farmer typology. However, it does not yet provide a clear linkage between a farmer's choice for (a type of) multifunctional agriculture. The next step therefore is to include the farm-attitude variables into an explanatory analysis. As was indicated in the methodology section, besides farmers' attitudes a number of other factors are likely to be relevant for understanding multifunctionality.

Other explanatory variables

Besides the variables concerning the attitude of farmers, the data set also contained a number of other explanatory variables, which are explained in Table 3 below.

Table 3. Additional relevant explanatory variables

Variable name	Measurement and explanation
Working hours	Measure of business size. Number of working hours by farm heads and employees
Land area	Measure of business size. Land area in hectares
Main activities	Total number of main farming activities present in a farm
Education level	Highest level of education attended by one of the farm heads
Continuation	Included to see whether the farm will be continued by a family member of some other person, or not. The variable values 1 if the farm will be continued and 0 otherwise.
Age farm head	A variable based on the average aged of the heads of the farm and is divided into four categories (<35, 35-45, 45-55 and >45)
Income	Measure for the company income of the farm, as reported by respondents in the survey. The company income is a categorical variable which is divided into four categories, with the first category containing the highest incomes.
Outside job	A dummy variable for whether one of the farm heads has a job outside the farm
Active membership	A dummy variable for whether one of the farm head (or the farmer?) is an active group member of an agricultural organization or not
Land ownership	The percentage of land owned by the farmer
Location	A dummy variable for the location of the farm. If the farm is located in one of the western provinces (Noord-Holland, Zuid-Holland or Utrecht), the dummy variable is equal to one, otherwise zero.
Low costs	A dummy variable that refers to cost minimization. If minimizing production costs is one of the main goals of the farmer, the variable is equal to one, otherwise zero.
Specialization dairy or arable	Number of DSU (Dutch Size Units) in dairy or arable divided by the total number of DSU. The DSU is a standard unit of measurement in Dutch agriculture based on gross margin per animal or hectare crops.
Future strategy: expansion	A dummy variable representing the farmers' future survival strategy. The variable was a one if this strategy included increasing the farm by either increasing production, buying another farm in the Netherlands or through cooperation with other farmers.

5. Explaining multifunctional farming

Explaining the adoption of multifunctional activities

In this section five models are presented in order to explain multifunctional activities in agriculture. First a binomial regression model is used where the dependent variable is 'multifunctional farming' with a value of 1 relating to the presence of multifunctional activities and a value of 0 if not. After that a set of four binomial models are estimated to explain the specific types of multifunctional activities (on farm product selling, nature conservation, day and stay recreation and services) picked up by farmers (see section 5.2). It was not possible to use a(n) (unordered) multinomial model to explain the presence of the four major types of multifunctional activities, because of the presence of more than one multifunctional activity at certain farms. Distinguishing more types of multifunctional activities (combinations of the major types of activities) would decrease the explanatory power of the model.

Maximum likelihood estimation method (MLE) was used to estimate several specifications for the model to explain the choice for multifunctional farming. We started with a model specification which included all the variables simultaneously. Subsequently we tried to simplify the model by eliminating variables based on their theoretical and statistical significance. The statistical significance was based on the test results of the null hypothesis that the effect of an individual explanatory variable is not different from zero, using p-values. For comparability and symmetry reasons the same set of explanatory variables is used in all models. If a variable appeared to be significant in one of the models, it was also kept as an explanatory variable in all other models, even if it was not always significant there.

The set of explanatory variables contains the farmer attitude characteristics (see Table 2) and the selected structural variables (education level, continuation, etc) shown in Table 3[4]. The variable selection process resulted in the elimination of the variables continuation, income and land ownership, which were not significant in any of the models estimated, although the literature suggested they would influence the choice of multifunctional activities. The two measures of business size (number of working hours and land area) were dropped for theoretical reasons, since they did not appear to provide good measures of business size. The variable income is also to some degree a measure of business size. The final estimates for the five binomial ordered logit models are presented in Table 4.

Table 4. Estimation results for the general model and four activity-specific models

	All activities (general model)	Selling agricultural products at the farm	Nature conservation	Services in agriculture production and trade	Day and stay recreation
Intercept	0.017	-3.089**	-4.823***	-0.352	-4.944**
Farmership	-0.050	-0.114	0.153	0.105	-0.640**
Land ownership	0.125	0.035	0.373*	0.056	0.303
Trust & governance	0.155	-0.065	0.583***	0.080	0.504**
Expansion drive	0.259**	-0.128	0.600***	0.424**	0.605**
Outside job	-0.448	-0.409	0.768*	-1.221**	-0.081
No. main activities	0.256	0.552**	0.431	0.283	0.168
Active membership	0.680***	0.509	0.588	0.153	0.842
Location	0.635**	-0.392	1.219***	0.459	1.079**
Low costs	-0.144	-0.136	-1.268***	0.818*	-0.680
Specialization dairy	0.208	-1.791***	1.820**	0.989*	1.688*
Specialization arable	0.565	-1.230**	0.671	2.087***	1.544
Highest education level	-0.070	0.190	0.201	-0.412***	-0.022
Average age farm heads	-0.025*	0.001	-0.002	-0.051**	0.007
Future expansion	-0.536	-0.712*	-1.538***	-0.160	-1.396**
Number of obs	495	495	495	495	495
Chi square	40.72	36.45	64.19	40.43	41.27
Count R2	73.1%	92.5%	92.7%	90.1%	96.0 %
Pseudo R2 (McFadden)	0.068	0.134	0.244	0.128	0.222

Legend: * significant at the 10% level, ** significant at the 5 % level, *** significant at the 1 % level.

The low pseudo-R^2 in the general model might be due to the large variety in the nature of the multifunctional activities, which we here try to explain with one general model. The pseudo-R^2 for the activity-specific models varies between 0.134 (selling agricultural products at the farm) and 0.244 (nature conservation), which is still rather low. It appears that multifunctional activities are hard to explain given the choice of explanatory variables. The goodness of fit for the four activity-specific models is fairly reasonable. All four models have significant Chi-squares, indicating that all variables are jointly different from zero for each model. This confirms the relationship between the dependent and explanatory variables in the model. Overall between 90 per cent (services in agriculture, production and trade) and 96 per cent (day and stay recreation) of all the farms were correctly classified as having a certain type of multifunctional activity or not.

The results of the general model and the individual models for each explanatory variable are discussed and interpreted in more detail below.

Farmership

Farmership has a negative effect on the probability of participation in multifunctional activities (general model), on-farm selling and recreation, but this effect is only significant for the recreation model. Farmers who value farming life and its accompanying activities highly are less likely to offer day-and-stay recreation. Provision of recreation activities implies a lot of interaction with customers

on the farm, which can be interpreted as reducing farmer independence and freedom. Farmership has a positive effect on participation in nature conservation and services in agriculture, although this effect was not significant. This seems to suggest that these activities are considered as a part of normal farming life and that they do not restrict farmer freedom and independence.

Land ownership
The attitude variable land ownership has a positive effect on participation in multifunctional activities and on participation in the four specific activities modelled here. This positive effect was only significant in the model for nature conservation. Due to the inverted scoring for this question, this implies that if farmers value land ownership highly, they will be less likely to have multifunctional activities. A possible explanation for this finding is that farmers want to use the land they own more intensively, and therefore they are less likely to be engaged in multifunctional activities. This explanation would support the significant effect found in the nature conservation model (farmers who value land ownership highly are less likely to participate in nature conservation activities).

Trust in the government
The attitude variable trust has a positive effect on the probability of participation in multifunctional activities (general model), nature conservation and recreation activities. This effect was significant for nature conservation and recreation activities, confirming expectations. Farmers who value trust highly or have a lot of trust in the government are more likely to become involved in these multifunctional activities. Since these activities will be dependent on (the rules of) the government (green agricultural policies, local rural planning policies etc.) trust in the different levels of government is an important condition. In particular for day and stay recreation specific investments have to be made which require some kind of security on the public policy side.

The signs of the coefficients for trust in the models for on-farm selling and agricultural services are negative, although not significant. Farmers with low trust in governmental arrangements are more likely to choose multifunctional activities that rely most on private organization and which avoid dependency on the government.

Expansion drive
The attitude variable 'expansion drive' has a positive and significant effect on participation in multifunctional activities (general model) and in particular on participation in recreation provision, nature and conservation activities, and agricultural services. This implies that farmers who have a positive attitude towards expanding their business are more likely to be engaged in these multifunctional activities. These findings are in compliance with Jongeneel and Slangen (2004), who found that one of the important reasons for the uptake of multifunctional activities was the wish to increase the income generating capacity of the farm. It indicates that expansion drive for farmers relates to a broader approach than only specialization in existing activities (if expansion drive related only to specialization one would expect a negative effect on participation in multifunctional activities).

Expansion drive has a negative but insignificant effect on participation in on-farm selling activities. A factor here could be that on-farm selling is a relatively labour intensive activity, with, as compared to the other activities, a low remuneration per hour.

A second variable relating to expansion 'future expansion strategy' was included in the models. This variable is also discussed here, though it represents the actual future survival strategy of the farm (as reported by farmers) and therefore differs from the attitude factor 'expansion drive'. This variable has a negative coefficient for the general model and all four activity-specific models and is significant in all models except services in agriculture. Farmers, whose survival strategy for the future is expansion by means of increasing production, purchase of another farm or working together with other farmers, are less likely to be involved in multifunctional activities. At first glance the opposite signs for the coefficients of the two expansion variables appear confusing. However the expansion strategy variable focuses on enlargement of traditional agricultural production (and not expansion to multifunctional activities), while the more general expansion attitude variable includes the possibility of expansion via multifunctional activities. In this sense the coefficient signs confirm expectations.

Outside job
The variable outside job has a negative effect on participation in multifunctional activities in general, and on participation in on-farm selling, agricultural services and recreation provision. This effect is only significant in the agricultural services model. If one of the farm heads has a job outside of the farm, it is less likely that he/she will participate in multifunctional activities. This is quite logical because there is then less time available to participate in other activities. Moreover, as far as multifunctional activities are used to generate additional income, off-farm employment and multifunctional activities are competing.

An opposite and significant effect was found for participation in nature and conservation activities. This result implies that a job outside of the farm for one of the farm heads and nature conservation are complementary. This fits with the observation that off-farm employment (or part-time farming) is often combined with relatively less labour intensive methods of farming. Extensive farming practices lend themselves easily and quite naturally for combination with nature conservation activities.

Number of main activities
The effect of the number of main activities on participation in multifunctional activities is positive in all five models; however it is only significant for the on-farm selling model. For farms with multiple main activities, it is relatively easy to add another activity to their line of operations. Farmers who already have experience with multifunctional activities have already developed the required organizational capacities. Alternatively, the (mental) barrier to add another activity is less for farmers who already have multiple main activities.

Active membership
The results for the general model indicate that active (group) membership of an agricultural organization has a significant positive effect on participation in multifunctional activities. A positive but insignificant effect was found in all activity-specific models. These findings correspond with our expectations and the findings of Beugelsdijk (2003: 60-61). This suggests that farmers who are socially active in society are more 'open' to new societal demands on agriculture and are more likely to begin an extra (multifunctional) activity. Moreover, this variable could pick up the membership of environmental or nature co-operations. These relatively new regional farmers' institutions play an important role in the organization of multifunctional production activities. In that respect there is a direct pay-off of participation in such an organization and one's multifunctional activities. One might have expected that if this variable picked up membership of an environmental group, that the active membership variable would be significant for the nature conservation model.

Location
The coefficient for the dummy variable 'location' is positive and significant in the general model. This implies that farms located in the west of the Netherlands are more likely to have multifunctional activities, which corresponds with our expectations (see Section 2). This variable also has a positive and significant influence on multifunctional activities in the individual models 'nature conservation' and 'day and stay recreation', and a positive but insignificant influence in the 'services in agriculture' model. An explanation for these findings is that expanding urbanization in the west of the country puts pressure on farmers to make adjustments to their farming activities. More positively, this urbanization implies an interesting and concentrated market with attractive 'selling'-opportunities.

The dummy variable location has a negative coefficient sign in the model for selling agricultural products at the farm, although not significant. This is an unexpected and strange result.

Low costs
The dummy variable representing farmers with a cost minimization strategy has a negative effect on participation in multifunctional activities in general and on participation in nature conservation and recreation provision. This effect was only significant for the nature conservation model. As we would expect, farmers who have a strategy of minimizing their costs will be less likely to participate in

multifunctional activities. To minimize their costs farmers will be focusing on their main activities and specialize and intensify rather than being engaged in other (multifunctional) activities.

In contrast, cost minimization has a positive effect on participation in on-farm selling and provision of agricultural services. This effect is only significant for provision of services in agriculture. One possible explanation is that farmers involved in this activity will deploy their machines (and labour) not only at their own but also on other farms. This will lead to a relative reduction in (average fixed) costs, because machines are used more economically.

Highest education level

A higher level of education has a negative but insignificant effect on participation in multifunctional activities in the general model and in the recreation model and a negative but significant effect on participation in services in agriculture. Given the competing nature between an outside job and multifunctional activities, farm members with a higher education level may take a higher remunerating outside job rather than participate in multifunctional activities. The coefficient was positive but insignificant in the nature production and on-farm selling of products models. Although not significant, the coefficient sign for the nature conservation model is in line with the findings of Vanslembrouck *et al.* (2002).

Average age farm heads

The average age of farm heads variable has a negative and significant sign in the general model: the older the farm heads the less likely they are to participate in multifunctional activities. This effect was also found in Bonnieux *et al*. (1998), Vanslembrouck *et al*. (2002) and Mathijs (2003) for agri-environmental schemes. The result for the general model is also found in the individual models 'agricultural services' and 'nature production' (insignificant). In contrast, older farmers were more likely to participate in the selling of products on farm and in day and stay recreation (both insignificant).

Specialization in dairy and arable farming

The variables representing specialization in dairy and arable farming both have positive but insignificant coefficients in the general model. Farmers who specialise in these two activities are more likely to participate in multifunctional activities. Specialization in dairy farming had a positive (and significant) influence on participation in nature production and provision of agricultural services. Specialization in arable farming also had a positive effect on participation in these activities, but the effect was insignificant with the exception of services in agriculture. This would appear logical as arable farmers can lower their costs by also using their machines and labour to provide contracting services. Specialization in both dairy and arable farming had a negative and significant effect on participation in selling products on-farm. Again this seems plausible given the labour intensive nature of on-farm selling and the relatively low remuneration per hour.

6. Concluding remarks

This paper analyses multifunctional farming activities. As compared to other studies, its main contribution is that it decomposes multifunctionality into a number of differentiated activities. Comparing the results of the general model with the four activity-specific models, a key finding is that it is difficult to adequately explain multifunctionality on farms with only one general model. For this reason we estimated four separate models for multifunctional activities: (1) selling products at the farm; (2) nature management; (3) day and stay recreation; (4) services in agriculture and trade. Clearly the differences between activities are important when explaining farmer choice. Our results suggest that the results for a particular multifunctional activity (such as participation in environmental schemes) cannot be easily extended to other activities. The attitude variables seem particularly important for participation in nature conservation and day and stay recreation. Other farmer characteristics (age, education, active membership, outside job, cost minimisation strategy, expansion

strategy) varied in importance across these activities. Farm characteristics (particularly specialization) were important for all activities.

One theoretical framework used in this analysis to analyse the differences between activities or goods is the non-rival/non-excludable typology. The implications of these characteristics for the governance structure have in turn implications for the importance of variables such as trust in choosing multifunctional activities. The results of the models for nature management and recreation validate the use of this framework approach.

In general, not every farmer likes multifunctional activities. In terms of the utility maximization framework, some farmers may derive a negative psychic income from some activities, depending on the attitudes of the farmer. This seems to be particularly relevant in the provision of recreation activities; farmers who value freedom and independence highly appear to find recreation provision as an invasion of their farmership.

Finally, we found that social capital plays an important role in the transition of agricultural to a more multifunctional business. Partly this already became clear because of the importance of trust for some activities (where the government has a significant role in the governance structure), but also engagement in societal activities and active membership of societal organizations appeared to be an important factor. Interestingly, this effect was not significant in any of the activity-specific models.

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Endnotes

[1] For an overview of the possibilities and difficulties of public-private partnership projects see Germis and Vermeylen (2002; 860-863).

[2] Clubs are an important phenomenon in various areas in the Netherlands. The goods and services that they provide are quasi-collective goods. The exclusion mechanism is the contribution. Those who do not pay are not members and are not allowed to participate.

[3] The survey is not included in the paper because of space limitations, but is available from the authors upon request.

[4] According to the theoretical framework prices should also be included as explanatory variables. However, the survey on which this analysis is based is a cross section sample, which did not allow for the construction of farm specific prices. The alternative is to use general market prices, but since they will be the same for all farms, they are not useful to include since their lack of variation over farms. Therefore it was decided to ignore the price variables.