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The economic impact of multifunctional agriculture in The Netherlands:

A regional input-output model

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Abstract

Multifunctional agriculture is a broad concept lacking a precise and uniform definition. Moreover, little is known about the societal importance of multifunctional agriculture. This paper is an empirical attempt to fill this gap. To this end, an input-output model is constructed for multifunctional agriculture in the Netherlands. The definition used includes four multifunctional agricultural activities: (i) green care, (ii) tourism, recreation and education, (iii) on-farm sales, and (iv) green services. Multiplier values – indicating the chain impacts of these multifunctional activities in the rest of the economy – are calculated for four Dutch regions. The results show that, in terms of output and employment, multifunctional agriculture is not a main driver for economic growth. Moreover, from the input-output model it appears that multifunctional agriculture leads in particular to more expenditures in the agricultural sector itself, rather than in any other economic sector. As such, the indirect feedback effects of multifunctional agriculture on the non-agricultural sectors in the Dutch economy are rather small. The input-output model also show that multiplier values differ over the regions, mainly due to differences in the composition of multifunctional activities. And although the absolute size of employment in multifunctional agriculture is very small, the employment per unit of output is high, especially when compared to the employment/production rate in primary agriculture.

Key words: input-output modelling, multifunctional agriculture, regional economics, multipliers, Netherlands

1. Introduction

The term 'multifunctional agriculture' was coined at the Earth Summit in Rio de Janeiro in 1992. It was meant to refer to various developments and changes in agriculture worldwide, and to provide a consistent framework for understanding and addressing these developments and changes. As such, the term multifunctional agriculture is characterised by a common focus on the production functions of agriculture apart from food and fibre, often consisting of non-commodity (and non-marketed) goods and services (e.g. Randall, 2002; Huylenbroeck et al., 2007a; Renting et al., 2009; Thenail et al., 2009). However, as the body of literature on this topic grows, it becomes increasingly clear that a clear and uniform definition of multifunctional agriculture is lacking. It is obvious that ambiguity of a concept does not – to put it mildly – help to facilitate research into the concept. Case-studies, for example, are difficult to compare, and a lack of understanding of the concept may impair the search for relevant literature (Huylenbroeck et al., 2007a).

The concept of multifunctional agriculture contains a broad range of activities. It is hence difficult to come up with a workable definition. An often cited one is the definition by the OECD (1998: 3): "*Beyond its primary function of producing food and fibre, agricultural activity can also shape the landscape, provide environmental benefits (…) and contribute to the socio-economic viability of many rural areas. Agriculture is multifunctional when it has one or several functions in addition to its primary role of producing food and fibre.*"

In later elaborations of the OECD, the importance of *jointness* is stressed, i.e. the function of producing food or fibre should be linked directly to the other functions, such as green or blue services[2] (e.g. OECD, 2001). However, it remains ambiguous what kind of activities should be included. Some authors argue that the non-food functions of agriculture should be direct outcomes of the agricultural production. Vatn (2002: 309), for example,

[2] Green services are services in nature management, blue services in water management.

asserts that multifunctional agriculture "implies that several public goods or positive externalities are attached to agricultural production." According to these authors, agri-environmental schemes are a part of multifunctional agriculture, whereas the production of energy by a wind turbine installed on the farm is not a multifunctional activity. A combination of different activities (both agricultural and non-agricultural, such as a wind turbine) on one farm is then often referred to as diversified agriculture (see e.g. Huylenbroeck et al., 2007a). The 'definition problem' is further complicated by scale issues. In the Dutch literature, for instance, the term 'broadened agriculture' is often used if the farm is the level of analysis. For analysis at the level of society, however, one refers (not only in the Dutch but also in the international literature) to 'multifunctional agriculture' (Venema et al., 2009).

In order to illustrate the rich diversity of definitions attached to the concept of 'multifunctional agriculture', Table 1 provides a (far from exhaustive) overview of the crucial elements and the multifunctional agricultural activities that various authors have included in their interpretation of the concept.

<<Table 1 around here>>

Although there is a large (and burgeoning) body of literature on some aspects of multifunctional agriculture, there is remarkably little empirical work available on its socio-economic impact. Even for very basic indicators such as value added and employment there are hardly any reliable estimates for the Netherlands – the country we are most familiar with. Especially work on the impact of multifunctional agriculture on sectors outside the area of resources and food is scarce (e.g. Huylenbroeck et al., 2007a). In this article it is tried to make a start towards filling this gap. In order to do so, for several Dutch regions the indirect effects of multifunctional agriculture (both on turnover and employment) to the regional economy are

estimated by using an input-output model. In brief, such a model uses a registration of all money flows in the economy (the so-called input-output table) to calculate the effect of an increase in demand for the output of one sector, for all other sectors in the economy. Inherently to the method used, only 'real' money streams are considered. In other words, non-commodity outputs that are produced as an (positive or negative) externality are not taken into account.

Already since a long time, input-output modelling is frequently used for the task proposed by us (Isard, 1960, 1998; RUG/CBS, 1999; Heijman et al., 2010). Using this approach implies two challenges: 1. To derive a regional input-output table from a national one and 2. To divide the sector "Agriculture" into "Primary Agriculture" and "Multi-functional Agriculture". The advantage of the model is that in doing so it is possible to estimate in a reliable way the impact of even relatively small sectors on the whole regional economy. Further, it provides us with a standard way of computing that will allow for future evaluation of the socio-economic development of MFA. This is important because of the national political aims with respect to MFA and the change in focus of the future Common Agricultural Policy from the first pillar to the second.

The structure of this paper is as follows. In Section 2, the input-output model, and its assumptions, will be explained in more detail, and attention will be paid to the selection of regions and multifunctional activities to be included in the analysis. After that, the main findings are reported and interpreted in section 3. Then, section 4 provides discussion and insights, and section 5 concludes the paper.

2. Methodology

2.1 Input-output model and input-output tables

As mentioned above, we use an input-output model to identify and measure the socio-economic importance of multifunctional agriculture. This input-output model is based on input-output tables. These tables show the flows of output from and to all sectors in the economy. All intermediate use, final consumption, taxes and subsidies, value added etcetera are registered by statistical bureaus and other official organisations. In its essence, the input-output table is a matrix framework that records transactions of industries. Columns of the matrix represent purchases by an industry to produce its goods and services. Rows of the matrix represent the distribution of the production of an industry throughout the economy. All flows are measured in monetary units. The input-output table can consequently be inverted and used, for example, to show what the results are of an investment impulse in one sector for all other sectors in the economy.

For the set up of input-output tables, several classifications of industries exist. Worldwide, the ISIC of the United Nations is most well known. Based on this, the European Union developed the NACE classification. NACE consists of four digits codes, of which the first two are identical to those of ISIC. The Dutch SBI is identical to NACE, with the addition of a fifth digit for more details (CBS, 2007). Neither of these has specific categories for (activities in) multifunctional agriculture. Yet, information on the flows of output to and from the multifunctional activities is required to be able to isolate these activities from the rest of the economy, allowing for a multiplier analysis. Hence, expert knowledge is needed on the production structure and output of the multifunctional agriculture. National estimations on turnover of multifunctional agriculture are available (Roest et al., 2009). However, as far as we know, national data on the expenditures of multifunctional agriculture do not exist. Therefore, data on firm level are used for expenditures. On the basis of a spatially explicit version of the annual agricultural statistics, the number of farms that are involved in the activities of interest were counted per municipality and per NUTS3 region using GIS tools.

This allows for the aggregation of firm data to a regional or national level. In a later step, these aggregated data were refined by using expert knowledge on the capacity of multifunctional farms in the regions of interest.

Because the collection of the data required for an input-output table is a time-consuming and expensive process, data are usually only provided at a national scale. However, there are ways to transform these into regional tables without requiring additional surveys or extensive handwork, and with rather reliable results. The Cross Industry Location Quotient (CILQ) method is employed to accomplish this. It is based on the ratio between the national and the regional employment in both the supplying and the demanding sector. If the proportional regional employment is larger in the demanding sector than in the supplying sector, imports from outside the region are assumed to meet all regional demand. Although this method does not account for all differences between regional and national economic structures, it is generally seen as a viable method (e.g. Johns and Leat, 1987). The outcomes are complemented with expert information on the multifunctional agriculture. Combining mechanical methods like the CILQ method with expert information is generally known as the Generation of Regional Input-Output Tables (or GRIT) method (Jensen et al., 1979). A slightly adopted version of the commonly known approach is used for this study (see Leeuwen, 2006, for a description). As a spatial unit for the regionalization the NUTS3 level is selected. This level amounts to 40 regions in the Netherlands, with 150,000 to 800,000 inhabitants each (Eurostat, 2009).

The input-output analysis is used to calculate multipliers. Multipliers indicate the effect of a change (to be more precise, they are the ratio between an initial change in a variable and the total effect of this change). There are several possible multipliers, the ones for output and employment are provided here. The output multiplier is convenient and useful in showing the interdependencies between sectors in an economy. Employment multipliers

are a good indication of the total employment created by an economic activity. This can be helpful for policymakers.

In order to derive the output and employment multipliers, we calculate the direct and indirect effects of an economic activity. In more formal terms, we calculate a type I output multiplier and a type I employment multiplier.[3] The direct effect is the output (or employment, or whatever variable is considered) of the activity itself. Indirect effects arise as the sector which increases its production demands additional goods and services from other economic sectors. Thus, an increase in the output of the activity under consideration also increases the output of other sectors. To give an example, if a farmer starts activities in tourism accommodation, (s)he will need – besides many other things – more water, electricity, etc. Hence, utility companies face an increase in demand due to this new multifunctional activity of the farmer.

For the type I output multiplier and the type I employment multiplier, we analyse the effect for the backward linkages in the economy (i.e. purchases from suppliers rather than sales to buyers). As such, backward linkages are linkages to suppliers of inputs and are thus different from so-called forward linkages to customers of outputs. Analysing forward linkages is useful if a large part of the output of the sector of interest is used as an input in other sectors, as is the case in, for example, the leather and apparel industry. For multifunctional agriculture, however, the calculation of forward multipliers is not very meaningful, as most of its output is used directly by consumers. Our focus on backward linkages is, by the way, in accordance with recommendations in the literature (see, for example, Miller and Blair, 2009). Not

[3] The literature makes a distinction between multipliers of type I and of type II. Whereas multipliers of type I calculate the direct and indirect effects of an economic activity, multipliers of type II also include the so-called induced effects. Workers may have a higher income as a result of the new economic activity. Part of this income will be spent, thereby increasing the demand in some economic sectors again. This effect is called the induced effect (Miller and Blair, 2009). Given the current state (and paucity) of data availability, the induced effects are virtually impossible to quantify. Therefore, we restrict ourselves in this study to multipliers of type I.

surprisingly, the resulting type I output and type I employment multipliers are known as backward multipliers.

2.2 Model assumptions

An input-output model can provide valuable insights in the structure of a regional economy, and more specifically in the contribution of certain sectors to the total output of the regional economy. However, it has some limitations. Most obvious is the inherent rigidity of the model. As it is directly based on the observed intersectoral money flows in an economy, it is linearly homogeneous in inputs and outputs. In other words, input ratios are assumed to be fixed, regardless of the scale of the output. This assumption is however not unreasonable if only marginal changes are considered (Loveridge, 2004). Given the small size of multifunctional agriculture in the Netherlands (in comparison with other sectors), one may suppose that investments in this sector will not lead to a dramatic change of regional input-output ratios.

More importantly however, the linear homogeneity of the model also implies that it does not allow for more efficient use of inputs. It is not unlikely that multifunctional activities to a large extent are the direct outcome of utilising available production factors in a more efficient way (e.g. employing surplus labour). This is probably best illustrated in activities in on-farm nature management (also known as green services or agro-environmental measures). There is virtually no multiplier effect for this kind of activities. It is simply implemented in the management of the farm; an additional output is created without requiring any new inputs. As the pay-offs per farm are rather small (roughly 7,000 euro per annum) large investments cannot be expected: the payments are too small to invest in sophisticated equipment if this equipment cannot be used elsewhere in the firm as well.

A last implication of the rather rigid assumption of linear homogeneity is that a higher use of inputs will always lead to higher (sales of) outputs. This is questionable for many

sectors; in the specific case of multifunctional agriculture in the Netherlands there are, for example, some signs of what seems to be market saturation (Provincie Limburg, 2009; Roest et al., 2009).

An input-output model is as such not an appropriate instrument to reveal changes in consumer behaviour. It is likely, however, that particular activities in multifunctional agriculture induce such changes. For instance, Slee et al. (1997) have shown for a case in Scotland that people who spend their holidays in a region, also have other expenditures in that region (e.g. on catering, entertainment, etc.). Thus, if farms with campsites attract people to a region, the regional economy is not only stimulated because of the turnover of these camp sites and its multiplier effects, but also because of the additional spending by consumers in other sectors. This effect is difficult to measure, and there are hardly any data available. It would hence be difficult to integrate it in an input-output model, although the effect might be of considerable importance to the regional economy.

It is not obvious to what extent consumers view the products of multifunctional agriculture as interchangeable with 'traditional' products from conventional sectors (e.g. regular health care, regular tourism activities, etc.). It might be that consumers substitute some regular goods with products from multifunctional agriculture. In that case, the effects for the regional economy would be overestimated in a input-output model. To account for this in a model, assumptions on e.g. substitution elasticities need to be made. (see e.g. Loveridge, 2004). This would require very detailed datasets that are not available. Therefore, this effect is currently ignored in our model.

Despite these limitations, it is worthwhile to conduct an input-output analysis. Input-output models are the most realistic macroeconomic models conceivable, in the sense that all formal transactions in the real economy are taken into account. This implies that interdependencies of industries can be shown very clearly. Moreover, regional differences in

these interdependencies can be explicated. This can be helpful in detecting promising areas for investments or subsidies. On the other hand, it may also indicate in what regions multifunctional agriculture has a relatively low impact. This could be a reason to investigate if there are any policy reasons that impair using the full economic potential of multifunctional activities (e.g. local or regional policies on tourism or health care that are apparently so prohibitive that innovative ideas cannot be realized). An input-output analysis is hence a valuable instrument to evaluate current policies and practices, and can also be helpful in initiating relevant new policies to stimulate the development of an economy.

2.3 Multifunctional activities

In Dutch policy, there is a lot of attention for the multifunctionality of agriculture. In 2007, the Minister of Agriculture, Nature and Food Quality wrote a letter to the Parliament to inform on recent policy developments in this field. She announced that the turnover of multifunctional agricultural should double in the next four years. The letter stated that this implied a growth from 600 million euro in 2007 to 1.2 billion euro in 2011 (Verburg, 2007). However, Roest et al. (2009) estimated the annual turnover at approximately 300 million euro in 2007[4]. In addition, the Minister informed that the focus of her ministry would be on six multifunctional activities; namely green care (health care in an agricultural setting), regional products, green services (nature management), tourism, childcare, and education (Verburg, 2007). Several research projects were induced by the ministry; most of them aimed at these activities To increase the comparability of research we will use the definition of the Dutch ministry in this article. Hence, in this paper, multifunctional agriculture will initially consist of the six activities mentioned above. However, because child care and education are (yet) very small in annual turnover, these two activities are combined with other

[4] In 2009, the Minister sent another letter to the Parliament, stating that the estimations of Roest et al. (2009) would function as a basis for the goal of doubling the turnover. Moreover, she stated that researchers considered ten years a realistic term to achieve this goal (Verburg, 2009).

multifunctional activities. More specifically, child care is taken together with other forms of green care, and education with tourism. The latter because education often consists of, for example, excursions on the farm. Comparable activities are found in tourism. Moreover, in order to determine regional products, on-farm sales is taken as a proxy. The reason for this is that regional products are not strictly defined – neither in geographical nor topical terms – and no data are available.

It is well known that the value of multipliers differ considerably between sectors (RUG/CBS, 1990). Given the heterogeneity of the six MFA activities and the complexity of the computations the multipliers and input-output coefficients to be computed can only be averages of a ranges of values that remain largely implicit.

2.4 The regions

Four regions of specific interest are selected, namely (i) Flevoland, (ii) Noordoost-Noord Brabant, (iii) Overig Zeeland, and (iv) Zuid-Limburg. The location of these four regions in the Netherlands is shown in Figure 1. The selected regions differ strongly in development path in multifunctional agriculture. Moreover, also the current size and focus of the multifunctional activities vary over these regions.

<<Figure 1 around here>>

In Zeeland, there is a relatively long tradition in multifunctionality, initially mainly in touristic activities. Cooperation between farmers and a supportive institutional environment also have a longer history here than in most other regions. The link with cities seems to be rather weak (as there are virtually no cities in the surroundings of the area). The region of Noordoost-Noord-Brabant (also known as ‘het Groene Woud’) has a much shorter history in

multifunctional activities, although the starting point was also in tourism. The city of ‘s Hertogenbosch is part of the area and the links with the urban environment seems to be rather strong. The contribution of multifunctional activities to the income of the farmers is somewhat smaller than in other regions, and the institutional support is only from recent years. Flevoland is a very young area, only created in the first half of the 20th century by reclaiming land. Large parts were designed to be agricultural land. There is no long history of multifunctional activities, and there is a relatively weak regional identity. Zuid-Limburg is characterised by relatively small farms. The relatively sloping area is less suitable for primary agriculture but is visually attractive. The region is known for its tourism, has a strong regional identity and quite some links with urban areas (Oostindie, 2009). Not only is the city of Maastricht part of the region, but it is also surrounded by large urban areas in Germany (Aix-la-Chapelle or Aachen) and Belgium (Liege).

For each of the four regions we created an input-output table, and estimated the multipliers as described in subsection 2.1. The detailed calculations and the data files are available, upon request, from the authors.

3. Results

3.1 Results

The most important findings of the input-output model are reproduced below. Table 2 provides insight in the national output of primary agriculture (including forestry and fisheries) and various activities in multifunctional agriculture. In addition, national employment in both sectors is given. From this table, it follows that multifunctional agriculture is a relatively small sector when compared to primary agriculture.

<<Table 2 around here>>

Table 3 gives insight in the specific results of the analysed regions. Per region, both the output and multipliers of multifunctional agriculture are given. As described in the methodological section, these multipliers are backward output multipliers of type I. The interest of the study is in the effect for the regions. As the regional data were aggregated from data at firm level, it is difficult to account for 'leakages' out of the region (as these leakages are not registered at firm level). Leakages are expenditures from the multifunctional agriculture in region *x* to a firm in another sector in region *y*. As only the effect for the region itself is analyzed, the leakages should not be added to the backward linkages of the multifunctional agriculture. For some categories of expenditures, it is rather obvious that they will not flow to the region itself (think of insurance premiums and interest on mortgages). For other expenditures it is not always clear whether these are expenditures of goods and services bought within or outside the region (e.g. the purchase of products that are sold in the on-farm shops). Given these uncertainties about what exactly constitutes the expenditures made in the region, Table 3 shows the multiplier values for different sets of assumptions. The regional multipliers for primary agriculture are given for comparison.

<<Table 3 around here>>

For the second set of assumptions in Table 3, the breakdown of the multiplier is shown in Table 4, to make clear what sectors benefit from the demand of the multifunctional agriculture. It appears that especially suppliers within the agricultural and forestry sector reap the benefits of the spending by multifunctional farmers. That is, the demand of multifunctional farmers

leads in particular to more expenditures in the agricultural sector itself rather than in any other economic sector.

<<Table 4 around here>>

The multiplier analysis can also be used to investigate the number of jobs created by the activities in multifunctional agriculture. The results in Table 5 show that, although the absolute size of the employment in multifunctional agriculture is very small, the employment per unit of output is high, especially when compared to the employment/production rate in primary agriculture. A possible reason for this difference is that activities in multifunctional agriculture consist to a large extent of services, and many of these service oriented activities (e.g. health care) are known to have a high employment/production rate.

<<Table 5 around here>>

3.2 Data issues

Although input-output modelling has a solid base in economic theory, its foundations are mainly empirical. The validity and reliability of the outcomes is hence strongly dependent on the quality of the data. In this study, we encountered the problem of data-availibility. Data on regional expenditures are, as far as we know, not available. Even if one would be willing to invest in this, gathering data would be difficult, as these data are often not even registered at farm level. Expenditures and labour are not attributed to specific activities. Moreover, experts in this field indicate that farmers have incentives to systematically understate their income from multifunctional activities. It is in many cases a relatively small part of total farm

income[5], and farmers try to anticipate consequences in, for example, tax levies if this part of their income is (completely) revealed (Winkelmolen, 2009). We tried to circumvent these problems by using expert information of agricultural business consultants. These consultants have developed overviews of costs and benefits of multifunctional activities, to advise farmers who consider starting a multifunctional activity. They check their data with farmers who are already in business for some years. Although there are some issues with this information as well (the enormous divergence in size of an activity per farm for example), it is probably the most reliable information available.

There are clear indications that the average size of multifunctional activities differs over the country. For example, the average number of hectares per farm for which a subsidy is paid for green services, differs from 2.8 hectare in the province of Zeeland to 11.9 in the province of Drenthe. To some extent, these regional differences in capacity are built into the model. However, especially for tourism and on-farm sales there are no quantitative data on regional differences. For these activities no regional differences in average firm size are taken into account.

More detailed data would probably improve the results of the analysis, in the sense that for example regional differences could be accounted for even better. However, the analysis with the current datasets gives good indications of the impact of multifunctional agriculture.

4. Discussion

As stated before, input-output models are very useful in providing insights in the economic impact of an industry on the rest of the (regional) economy. However, it is of crucial importance that underlying factors are taken into account when interpreting the outcomes. The

[5] In 2008, 55% of the farms with any multifunctional activity in the Netherlands indicated that the contribution to the farm income of these activities was less than 10% of total farm income (CBS, 2009b).

results of the multiplier analysis as such do not provide any guidance to policy makers, if it is not clear what the reasons for these outcomes are.

The research in multifunctional agriculture is severely impaired by the lack of a consistent, widely acknowledged framework to indicate what the concept is supposed to comprise. Data and research outcomes are hardly (or not at all) comparable with other studies (see e.g. Huylenbroeck et al., 2007a). The empirical research would get a strong impulse if effort would be put in developing such a framework, which would be useful and helpful in comparing and manipulating existing datasets.

Moreover, new datasets should be developed. It is especially recommended that statistical bureaus make an additional breakdown in their work on the agricultural sector, to account for multifunctional activities. This will improve the reliability and level of detail of the data. In that way, the possibilities to distinguish the contribution of the multifunctional activities from the primary production of food and fibre are extended. That is of great value in order to shed light on the societal importance of multifunctional activities. Ideally, this should also include data on the employment effects of multifunctional agriculture. As this type of information is also very valuable to the European Union, it would be worthwhile to conduct a large comparative study in Europe on the importance of multifunctional agriculture in the various countries and regions.

Last but not least, we suggest that additional studies should be carried out to investigate the reasons for the regional differences. Better datasets will give more detailed insights in actual regional differences. However, already with the currently available data it is obvious that the participation in multifunctional activities by farmers in the Netherlands is not evenly spread over the country. Recent research with GIS tools clearly shows spatial concentrations (Roest et al., 2009: 135-141). A few studies are conducted that explain *why* some farmers develop multifunctional activities whereas others are not involved in

multifunctional agriculture. Aspects of importance include firm characteristics (structure and financial situation), personal characteristics of the farmer, and situational factors. The latter consists not only of institutional circumstances, but also spatial factors etc. (see e.g. Huylenbroeck et al., 2007a; Jongeneel et al., 2008). More knowledge on those factors is a very valuable addition to our findings. Together they explain in what type of regions multifunctional agriculture can be expected to have a relatively large impact on the regional economy. The combined knowledge can also be used to identify what type of policy measures can stimulate the development of multifunctional agriculture.

5. Conclusions

In this paper, we showed that the direct effects of multifunctional agriculture in the Netherlands are relatively small when compared to primary agriculture. In terms of output and employment, multifunctional agriculture is not particularly significant to the creation of economic growth and jobs. Furthermore, from the input-output analysis it follows that the indirect effects of multifunctional agriculture differ over Dutch regions. For a large part, this can be attributed to the fact that the composition of multifunctional agriculture also varies per region. The input-output analysis also showed that an increase in demand for *multifunctional* agriculture will increase the total gross production of the Dutch economy by more than the original increase. However, when the demand for *primary* agriculture increases, this increase in the Dutch total production will be higher. This is because in most cases, the backward multipliers values of multifunctional agriculture are lower than those for primary agriculture, which means that in general, multifunctional farmers purchase less from suppliers than monofunctional farmers. Moreover, our results showed that multifunctional agriculture generates relatively much employment per additional unit of output; that is, the

employment/production rate in multifunctional agriculture is higher than in primary agriculture.

Due to a lack of economic data on various elements of multifunctional agriculture, the results should not be generalised too strongly. Nevertheless, they still provide useful information. The multiplier values, for example, are a useful instrument to prioritize the most appropriate regions to stimulate investment in multifunctional activities, or to identify regions where bottlenecks exist. These values also help in identifying the interdependencies between sectors in a region. As such, the input-output model is a useful tool for policy makers to prioritize and justify investments.

Our analysis showed that the contribution of multifunctional agriculture to the Dutch economy is rather limited. However, this does not imply that it is not worthwhile to invest in multifunctional agriculture. Other empirical studies should be carried out to investigate its full social and economic impact. So, concerning further research, we should assess the costs and benefits of multifunctional agriculture for the society as a whole, and study what kind of means of agricultural policy are the most efficient to publicly manage and unambiguously enhance the development of multifunctional agriculture.

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Table 1. *Crucial elements in the various definitions of multifunctional agriculture.*

Publication (Author and year)	Crucial elements of definition
OECD, 1998	• Beyond food and fibre • Agricultural activity • Contribution to landscape, environment or socio-economic viability of rural areas
Ploeg et al., 2002	• Deepening (quality production, biological production, direct marketing) • Broadening (agrotourism, nature & landscape management) • Regrounding (income from outside the farm)
Bruins et al., 2004	• Beyond agriculture • Commercially exploitable and / or financially rewarded by society • Direct marketing • Nature management • Blue services (water management) • Agrotourism • Renewable energy (wind, biogas) • Green care • Storage (caravans etc.)
Huylenbroeck et al., 2007b	• Food safety • Animal welfare • Nature management • Agrotourism • Direct marketing • New crops
Verburg 2007 (and e.g. Venema et al., 2009)	• Green care (health care in an agricultural setting) • Regional products (proxied by direct marketing / on-farm sales) • Nature management • Agrotourism • Child care • Education

Table 2. *National output and employment in primary and multifunctional agriculture.*

Size agriculture 2007	**Turnover (mln €)**	**Turnover (%)**	**Employment (fte/year)**	**Employment (%)**
Agriculture (total)	27,859	100.00	212,000	100.00
• *Primary agriculture*	27,565	98.94	208,500	98.35
• *Multifunctional agriculture*	294	1.06	3,500	1.65
- Green care (including child care)	62	0.22		
- Tourism, recreation and education	91	0.33		
- On-farm sales	88	0.32		
- Green services	53	0.19		

Table 3. *Multipliers of multifunctional agriculture for three different sets of assumptions on leakages.*

	Flevo-land	Overig Zeeland	NO-N-Brabant	Zuid-Limburg
• Multiplier primary agriculture (incl. forestry, fisheries)	1.501	1.584	1.698	1.830
• Multiplier multifunctional agriculture:				
1. Without interest, (social) insurance, membership contributions, but including write-offs and maintenance of (im)movables; all purchases of goods for shops within own region	1.766	2.033	1.784	1.976
2. Without interest, (social) insurance, membership contributions, write-offs and maintenance of (im)movables; all purchases of goods for shops within own region	1.584	1.771	1.604	1.78
3. Without interest, (social) insurance, membership contributions, write-offs and maintenance of (im)movables; half of the purchases of goods for shops outside own region	1.438	1.596	1.457	1.553

Table 4. *Breakdown of the multiplier of multifunctional agriculture (MFA) per sector for the four regions (under the second set of assumptions as mentioned in Table 3).*

Breakdown multiplier MFA	Flevoland	Overig Zeeland	NO-N-Brabant	Zuid-Limburg
MFA	1.000081	1.000093	1.000075	1.000085
Agriculture/forestry	0.119864	0.139273	0.111573	0.159747
Mining of minerals	1.87E-05	0.007581	0.007906	0.01752
Industry	0.037777	0.048176	0.04988	0.06554
Energy/utilities	0.092878	0.16625	0.091894	0.114602
Construction	0.006337	0.009159	0.008755	0.009232
Commerce	0.158292	0.197763	0.152432	0.200968
Hotel and Catering	0.020309	0.019874	0.026487	0.016845
Transport	0.010243	0.01234	0.012562	0.017179
Financial institutes	0.010077	0.016386	0.016426	0.021092
Commercial services	0.095777	0.107496	0.091632	0.119469
Government	0.001388	0.001811	0.001418	0.001948
Education	0.004392	0.006392	0.004532	0.00446
Health care	0.001205	0.002059	0.001635	0.002886
Other services	0.025477	0.036832	0.026492	0.028526
Total multiplier	**1.584116**	**1.771484**	**1.603699**	**1.780099**

Table 5. *Employment created by the agricultural sector in the Netherlands. A distinction is made between primary agriculture and multifunctional agriculture (MFA).*

	Flevo-land	Overig Zeeland	NO-N-Brabant	Zuid-Limburg	Nether-lands
• *Primary agriculture:*					
- Employment (incl. forestry, fisheries) in ft years	6,600	4,800	10,500	2,500	208,500
- Employment/production primary agriculture (incl. forestry, fisheries) in (ft years/M€)	6.5	7.8	7.0	11.1	7.7
• *Multifunctional agriculture:*					
- Employment in ft years	76.6	197.1	211.2	125.8	3,494.2
- Employment/production (excl. green services) in ft years/M€	14.1	16.0	14.6	14.3	14.5
- Employment/production (incl. green services) in ft years/M€	11.6	14.7	13.3	11.7	11.9
- Number of jobs (ft years) generated by MFA in other sectors, at current size of MFA	24.9	71.6	65.4	61.9	
- Additional number of jobs (ft years) generated by MFA(both within and outside MFA) by an additional investment of 1M€ in MFA	15.4	18.6	18.8	17.5	
- Employment multiplier	1.325	1.267	1.416	1.492	

Figure 1. *The Netherlands, at a NUTS3 level, with the four selected regions indicated (1= Flevoland, 2 = Noordoost-Noord-Brabant, 3 = Zeeland, 4 = Zuid-Limburg). Source: CBS (2009a).*