Transaction costs for assessment of geo-information applications in agri-environmental policy

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SUMMARY
Geo-information and - products have been recognized as having potential for streamlining information exchange and information usage for agri-environmental policy. Efficiency gains are expected from the development of information infrastructures and the use of geo-information products. However, suitable methodologies for assessing the benefits of such efforts are lacking. This paper proposes transaction costs as a concept for economical assessment of geo-information use. The concept is demonstrated in the development of information infrastructures and the use of geo-information products in a case study concerning agri-environmental support schemes. We conclude that transaction costs have potential as an assessment framework which can be further elaborated on.

KEYWORDS: geo-information, agri-environmental policy, transaction costs

INTRODUCTION

Availability of and access to geo-information are crucial for the design, implementation and monitoring of agri-environmental schemes. Agri-environmental schemes demand an accurate administration of often location based activities and information exchange between different actors. Our premise is that efficiency gains are obtained by optimizing the information use in agri-environmental policy. Geo-information and - products have been recognized for having high potential by linking farm management systems and government systems for streamlining information exchange and information usage (Sorgdrager 2002).

Spatial data infrastructures (SDIs) aim to facilitate the collection, maintenance, dissemination, and use of spatial information. They allow the sharing of data, enabling users to save resources, time and effort when trying to acquire new datasets by avoiding duplication of expenses associated with maintenance of data and their integration with other datasets (Rajabifard, et al. 2002). SDI developments aim to support the access to and application of data products and services (Feeney 2003). Improved economic, social and environmental decision-making are principal objectives for these investment in SDI development. Research has been conducted to define the concept of an SDI and to analyse and evaluate their development (Rajabifard, et al. 2002a; Crompvoets, et al. 2004). However, to justify investments in SDI development evaluation also requires assessment of their economical impact.

In this paper we explore the possibility of applying the concept of transaction costs to make an economical assessment of the use of geo-information applications in agri-environmental policy. We briefly introduce a case study concerning agri-environmental support schemes where geo-information applications are being introduced and a data infrastructure is being developed to facilitate a more efficient administration.

We start the paper with a short introduction of the concepts transaction costs and information asymmetry. Next, the transaction costs in agri-environmental schemes are identified and the concept of transaction costs is used to explore possible impacts of geo-information applications.

TRANSACTION COSTS AND INFORMATION ASYMMETRY

New Institutional Economics (NIE) is the economic field dealing with institutional arrangements like agri-environmental schemes. A fundamental idea in NIE is that transaction cots exists and necessarily influence the structure of institutions and the specific economic choices people make (Williamson 2000). Transaction costs can be described as the costs to be incurred in order to organise and coordinate interaction between actors, or to run social and economic processes (Furubotn 1998). They are often arranged according to activities, i.e.: search and information costs, negotiating costs, decision-making costs, monitoring costs, maintenance costs, planning and evaluation costs. Transaction costs are an important factor for an efficient implementation of agri-environmental schemes. They account for a large proportion of the payments made under the agreements. Studies conducted in Northern England on agri-environmental management agreements found that the average percentages from the total budget devoted on transaction costs is around 20% (Falconer, et al. 2002; Falconer et al. 1999; Whitby 2000). However the variability in costs across the different management agreement types in existence is high. Groeneveld (2006) compared the Dutch policies to converse agro-biodiversity to those in England and found higher transaction costs in England, but also recognized more flexibility and a more targeted approach in England.

An important cause of transaction costs are information asymmetries. In economics, information asymmetry occurs when one party to a transaction has more or better information than the other party (Akerlof 1970). Information asymmetry models assume that at least one party to a transaction has relevant information whereas the other(s) do not. Application procedures and compliance monitoring of agri-environmental schemes require information about often location based activities. Farmers need to fulfil reporting requirements and governments collect data to check farmer compliance. In agri-environmental schemes the government has imperfect information about farmers' actual compliance with agreed requirements. Due to this asymmetry, farmers may feel tempted not to honour their conservation contracts (Hart, et al. 2005). This can seriously complicate the implementation of agri-environmental schemes making costly subsidy application procedures and compliance monitoring necessary. The use of geo-information applications for registering information and making better use of existing information gives possibilities to lower transaction costs caused by information asymmetry. Possibly, they also can diminish information asymmetry between farmer and government because of increased information availability.

TRANSACTION COSTS IN AGRI-ENVIRONMENTAL SCHEMES

Melman (2005) and Groeneveld (2004) studied the ecological - and cost-effectiveness of agri-environmental schemes. Our focus is on the implementation of those schemes and the related transaction costs. The meadow bird management scheme is an example of a scheme where transaction costs occur. In the meadow bird schemes voluntary participating farmers are required to follow a set of management prescriptions, e.g. postpone mowing dates and protection of broods and chicks during land works, aimed to protect meadow birds like lapwing and black tailed godwit. In return farmers are being compensated financially for any loss of income resulting from the required adaptations in farming operations.

Figure 1 shows the problem area of our example the meadow bird support scheme. Three subsystems or actors involved in the meadow bird management scheme have been identified (government, farm enterprises, potentially organized in co-operatives, and the environment) which are linked by directed flows of matter (solid black) and information (dotted grey). Based on research using environmental data

(e), the government (upper circle) designs the support scheme and determines the participation requirements for farmers. The defined subsidy scheme is communicated to the framers and opened for applications (a). Farmers can then decide to hand in an application (b). The government decides about the application and communicates the decision and management prescriptions to the farmer. The farmer needs to make adaptation in its farm management and is obligated the register the locations of nests on a map (c). The government checks the compliance of farmers with the subsidy requirements in the field (d).

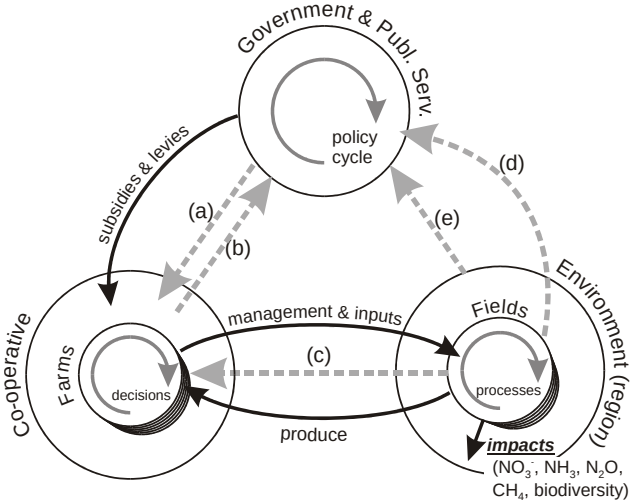

Figure 1: Information flows between actors involved in the meadow bird support scheme.

Analyzing the different information flows, the transaction costs can be divided into different types. In table 1 we define three groups of transaction costs: (1) policy design costs, e.g. research costs and consultation of stakeholders; (2) administration costs to run the scheme, e.g. communication costs, negotiation, making payments; (3) monitoring costs, e.g. field checks, check of reporting requirements and evaluation. Furthermore transaction costs in agri-environmental schemes can be divided into public transaction costs and private transaction costs and in variable costs, depending on the area or number of contracts and fixed costs. Table 1 gives an overview of different types of transaction costs.

Table 1: Categories of transaction costs in agri-environmental schemes (based on Groeneveld 2006; Falconer 1999; Falconer 2000).

Type	Costs	Variable with	Public/private
Policy design costs	Design of policy framework	-	Public
	Designation of area	Number of hectares	Public
	Definition requirements	Number of hectares	Public
Administrative costs	Information and promotion	Number of potential participants	Public
	Bargaining with participants	Number of potential participants	Both
	Administration	Number of contracts	Both
Monitoring cost	Monitoring of effects	Number of contracts	Both
	Compliance monitoring	Number of contracts	Both
	Policy evaluation	-	Public

Figure 2 shows the transaction costs as a proportion of the total budget for subsidy payment spend by the government implementing the scheme. Also a proportion of the subsidy payment to the farmer is compensation payment for his transaction costs. Using new geo-information applications and better use of available information gives possibilities to decrease the transaction costs proportion and increase the proportion dedicated to the actual compensation payments.

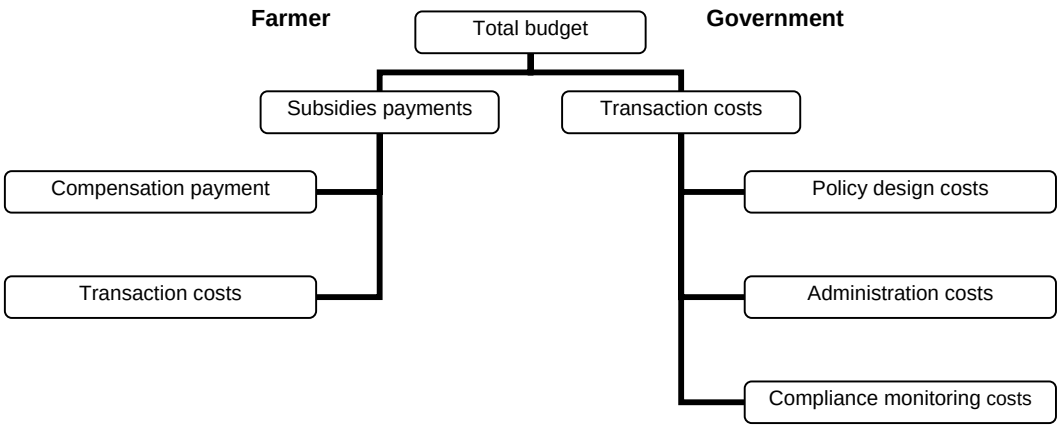

Figure 2: Transaction costs as a proportion of the total budget for subsidy payment.

IMPACT OF GEO-INFORMATION APPLICATIONS ON TRANSACTION COSTS

To make an assessment of the possible economical impact of the use of geo-information applications we analyse the introduction of an online application giving farmers the possibility applying for a management support scheme. Figure 3 is a screenshot of such an application which is currently being developed by the Dutch Ministry of Agriculture, Nature and Food Quality.

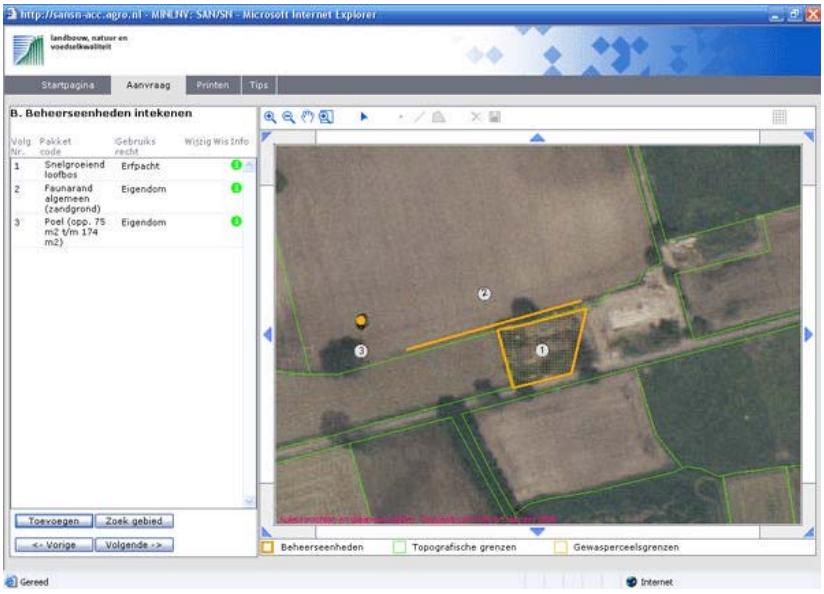

Figure 3: Screenshot of online application developed by the Dutch Ministry of Agriculture.

In our analysis we assume a fixed budget for agri-environmental schemes aiming at an efficient and effective implementation. Effective means maximize the number of meadow bird nests in protected areas by maximizing the number of hectares under the subsidy scheme. With the total budget being fixed this can be reached by maximizing the proportion of the budget available for compensation payments, which implies minimizing the proportion spent on transaction costs (see figure 2). The constraint used is that optimization is taking place within the framework of current policies. Minimizing transaction costs should not have negative impacts on the effectiveness of compliance monitoring, the accessibility of subsidy schemes for farmers, and the quality of research to design the regulations. To illustrate how the concept of transaction costs can be applied we compare hypothetically transaction costs incurred with the 'old' procedure using paper forms and maps with the 'new' procedure using the Internet applications.

In the 'old' system exchange of information is taking place by conventional mail. In the application procedure farmers need to delineate the fields they want to bring into the support scheme on a paper map and send it by mail. A governmental agency digitizes the paper maps and checks the eligibility of the

applications. The decision and further requirements are communicated via mail using paper maps. The farmers need those maps in their management and for registration of the information required by the ministry.
Recently, an online application, combined with an improved governmental data infrastructure was introduced. This 'new' system enables farmers to submit their subsidy application directly through an online service that performs several automated checks and directly delivers the digital format used by the governmental agency. Expected benefits of the 'new' system are a higher accuracy of submitted requests; easier processing of information; and higher accuracy of data in the system. Efficiency gains are expected at the governmental agency due to a decrease in labour costs. This is achieved by automated information processing and by the higher accuracy of data, which decrease the amount communication and actions required per application. However, setting up a reliable online application system requires investments in its development and changing the working processes of the governmental agency. The development of the geo-information application should lead to a decrease in transaction costs. Our proposed assessment of economical impacts can identify whether investments for further development of applications and automation of processes are beneficial to the total transaction costs of the subsidy programme.

To illustrate the approach we present a fictitious example in which the transaction costs of an 'old' and a 'new' procedure are compared. It is based on two assumptions:

1. Labour cost are assumed the dominant component of transaction costs in the 'old' system; this is represented by a fixed amount per application in figure 4 on the left side;
2. Investment costs are assumed to be the dominant transaction costs in the 'new' system; this is represented by linearly decreasing transaction costs per application in figure 4 on the right side.

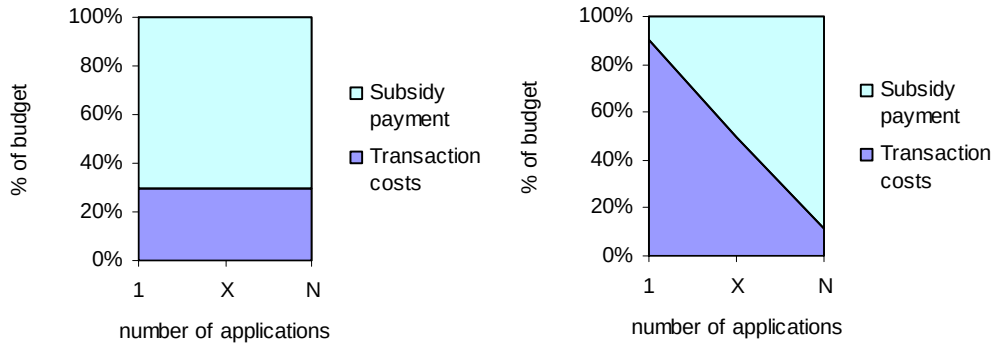

Figure 4: Proportion of transaction cost per application under the 'old' system (left) and the the 'new' system (right).

In figure 5 the transaction costs of the 'old' and 'new' procedure are compared. After point X (break-even) a linear decrease of transaction costs per application will lead to a higher proportion of the budget available for subsidy payments to farmers. The difference between the upper and lower edges of the triangle represents the reduction of transaction costs which can be used for subsidy payment. However, if there would be a slower decrease of transaction costs under the 'new' system (figure 4) and investment costs would not exceed savings in labour costs, then the geo-information application would cause an increase of transaction costs and the rational decision would be not to develop the application.

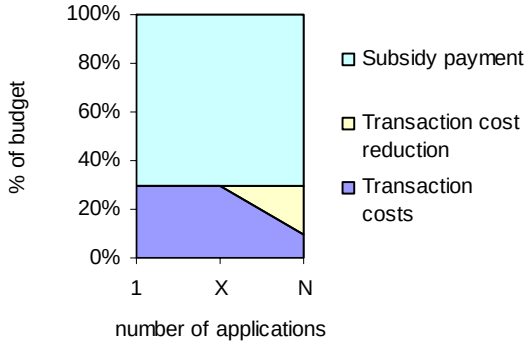

***Figure 5*:** Transaction cost reduction of the on-line application.

CONCLUSIONS AND FURTHER WORK

In this paper, transaction costs have been introduced as a concept to make an economical assessment of the use of geo-information applications in agri-environmental policy. We showed that transaction costs are potentially useful for analysing the economical impact of the use of geo-information applications. The proposed methodology is based on an analysis of efficiency gains of the development of information infrastructures and the use of geo-information products by measuring their impact on total transaction action costs of agri-environmental policy.

Transaction costs are an important factor in the implementation of agri-environmental schemes. Information asymmetry makes it difficult to come to an efficient implementation. Government and farmers try to eliminate their lack of information by acquisition of information which involves transaction costs. Using new geo-information applications and making better use of available information give possibilities to decrease the transaction costs, but the development of enabling infrastructure also requires investments. A hypothetical example showed that the concept of transaction costs can be used to assess the economical impact of geo-information application in agri-environmental policy. Furthermore, it can be used to define the critical point where investments are profitable.

Additional benefits of optimising the use geo-information were not taken into account in our analysis. For example, using more and better data can also have positive effects on the quality of policy design and improve management and decision making by farmers and authorities. Those benefits can be of significant importance in decision making but are outside the scope of the present work.

Using transaction costs for assessment of an optimal use of geo-information applications requires further study. In our on-going research we aim to quantify transaction costs and identify where geo-information applications are useful. Our objective is to optimize implementation of agri-environmental policy using geo-information applications. This optimization is also subject to further study by the first author. Possibilities to be explored are the use of geo-information application to decrease the costs of compliance monitoring within the current policy framework. Geo-information applications might also give possibilities of alternative policy designs lowering transaction costs, e.g. compliance checks based on farm management data or a regional approach based on aggregated data. The concept of transaction costs seems to be a suitable methodology for assessing the costs and benefits of such efforts.

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